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Original Research Article

Etiological Factors, Clinical Presentation, and Outcomes among Children with Severe Acute Malnutrition (SAM): A Retrospective Study

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Abstract:

Background: Severe acute malnutrition (SAM) remains a critical public health issue in India, contributing to high morbidity and mortality among children under five. Multiple socio-demographic, nutritional, and health-related factors influence its occurrence and outcomes.

Aim: To assess etiological factors, clinical presentation, and treatment outcomes among children with SAM admitted to a pediatric ward in Muzaffarpur, Bihar.

Methodology: A retrospective observational study was conducted over eight months, reviewing hospital records of 70 children aged 6–60 months meeting WHO criteria for SAM. Data on demographics, feeding practices, birth weight, comorbidities, hospital stay, and outcomes were analyzed using descriptive statistics.

Results: Most children were aged 1–2 years (45.7%) with female predominance (60%) and lower socio-economic background (42.9%). Exclusive breastfeeding for ≥6 months was observed in 57.1%, while early complementary feeding (<6 months) occurred in 54.3%. Low birth weight was noted in 40% of cases. Common comorbidities included acute respiratory infections (57.1%) and anemia (42.9%). Recovery rate was 71.4%, with 21.4% leaving against medical advice and 7.1% mortality. Hospital stay was predominantly 7–15 days (54.3%).

Conclusion: SAM in children is closely linked to socio-economic disadvantages, suboptimal feeding practices, and comorbidities. Hospital-based management yields favorable recovery, but early intervention, nutritional support, and monitoring are essential to reduce mortality and improve outcomes.

Keywords: Severe acute malnutrition, children, etiological factors, clinical presentation, treatment outcomes, Muzaffarpur.

Introduction

Malnutrition is also known as the silent crisis in India as it is widespread but less known in its effect on child health and development. The concept of malnutrition, broadly speaking, is the relationship between nutrient intake, which may be due to either insufficient intake, absorption, or loss of nutrients; but in some contexts, it can also be said to be over nutrition [1]. Malnutrition has been a burning issue of public health concern among children especially in developing nations such as India where it has been a major source of morbidity and mortality. It has been estimated that the level of malnutrition is around 15.8 percent in India, and there is an urgent necessity to develop specific interventions [2] to resolve the problem.

Severe acute malnutrition (SAM) is a clinical entity on its own in the continuum of malnutrition among children. Contrary to severe underweight or stunting, SAM is a medico social condition that is characterized by acute nutritional deficiencies and high mortality and long-term morbidity risks. A combination of socio-environmental and biological factors usually causes SAM in children. Factors that are usually contributory are failure to breastfeed exclusively, complementary feeding introduced late, feeds that are of low nutritional value or diluted, frequent enteric and respiratory infections, ignorance on the part of the parents, and poverty [3]. The SAM prevalence suggests that its popularity in children is 1-2 percent in developing and least developed

nations, which is the global indicator of its high public health importance [4]. SAM children die about 9 times more often than their healthy counterparts, which is evidence of the life-threatening nature of the condition [5].

SAM remains a significant health issue in India. According to the National Family Health Survey-4 (NFHS-4), SAM afflicts almost 8.1 million children aged below five years or 6.4 percent of children. The effects of SAM are not limited to instant death, as they lead to greater vulnerability to infection, poor physical development, slow cognitive development, and low productivity in the long run. This emphasizes the importance of early diagnosis, proper treatment and nutritional recovery of the suffering children.

SAM prevalence shows a great level of geographical variation in India. States like Madhya Pradesh have higher rates of prevalence (55%), but other states like Kerala have lower rates (27%) [6]. A rather complicated interdependence of socio-economic, cultural and health-related factors determine this heterogeneity. The uneven distribution of SAM in the country is caused by poverty, food insecurity, gender inequities, limited access to health facilities and endemic diseases [7] among others. These differences highlight the need to conduct region specific research to guide localized approaches to public health.

Treatment of SAM in hospitals, especially under the Nutritional Rehabilitation Centers (NRCs) has yielded mixed results in various states. The recovery rates are reported to be 37.1 to 65 percent and this indicates variations in the implementation of the programs, the infrastructure of health care and patient compliance [8]. In Maharashtra as an example, more than 600,000 children are facing the problem of malnutrition out of which about 450,000 children are SAM-eligible. Standardized criteria of SAM diagnosis in children aged 660 months are given by World Health Organization (WHO) and they include weight-height less than -3 standard deviations, observable severe wasting, a mid-upper arm circumference (MUAC) under 11.5 cm, and bilateral pedal edema. These criteria are used as the basis of early detection and proper clinical treatment.

Muzaffarpur, which is a part of the state of Bihar, is an area with significant socio-economic problems and prevalence of childhood malnutrition. Because it was a state, malnutrition prevalence in Bihar has always been above-average in national surveys, thus, it is a significant location to conduct clinical research on the topic of SAM. Knowledge on the clinical profile, etiological factors, and management outcomes of children who are admitted into the pediatric wards in Muzaffarpur can be important in understanding the issues unique to the region and the targeted interventions.

Since SAM is very burdened and serious, there is an urgent need to assess the clinical features and the management outcomes of children with SAM. This research does not only inform clinical practice but also serves to expand the broader public health strategies that can be used to decrease the morbidity and mortality associated with malnutrition. This was the aim of the present study, to evaluate the clinico-etiological profile, treatment outcomes, and prevention of SAM children on a pediatric ward in Muzaffarpur, Bihar, India. This research will offer evidence that may be used to inform better nutritional rehabilitation guidelines and the policy action at local and national levels by examining retrospective data, hospital records.

Methodology

Study Design: This study was a retrospective observational study conducted to assess the etiological factors, clinical presentation, and outcomes among children diagnosed with Severe Acute Malnutrition (SAM). The retrospective nature of the study allowed for the evaluation of previously recorded hospital data without direct patient interaction.

Study Area: The study was carried out in the Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

Study Duration: The study was conducted over a period of eight months from March 2025 to October 2025.

Sample Size: A total of 70 children diagnosed with Severe Acute Malnutrition were included in the study. The sample size was determined based on the number of eligible cases admitted during the study period.

Study Population: The study population consisted of children aged between 6 months and 60 months who were admitted to the pediatric department and fulfilled the World Health Organization (WHO) criteria for Severe Acute Malnutrition. These children represented varying clinical presentations and socioeconomic backgrounds.

Data Collection: Data were collected retrospectively from hospital medical records using a structured data collection format. Information obtained included demographic details such as age and sex, admission criteria, feeding practices, immunization status, anthropometric measurements, clinical features, associated medical complications, laboratory findings, epidemiological and etiological factors, duration of hospital stay, and treatment outcomes including discharge, discharge against medical advice, referral, readmission, and mortality.

Inclusion Criteria

- Children aged 6–60 months
- Diagnosed with SAM as per WHO criteria, which include:

- Weight-for-height < -3 SD
- Mid Upper Arm Circumference (MUAC) < 11.5 cm
- Presence of bilateral pitting edema
- Visible severe wasting

Exclusion Criteria

- Children with surgical causes of malnutrition, such as short bowel syndrome
- Incomplete or missing medical records
- Children with chronic conditions not primarily related to nutritional deficiency

Procedure: The procedure involved reviewing medical records of children admitted with SAM during the study period. Eligible cases were identified based on predefined inclusion and exclusion criteria. Anthropometric and clinical parameters were verified according to WHO standards. The required data were systematically extracted and recorded in a structured format for further analysis.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. The results were tabulated and interpreted to draw meaningful conclusions."

Result

Table 1 presents the socio-demographic profile, immunization status, and maternal age of 70 children. Most children were aged 1–2 years (32, 45.7%), followed by 3–5 years (20, 28.6%) and 6–12 months (18, 25.7%). Females (42, 60%) outnumbered males (28, 40%). Regarding socio-economic status, 30 children (42.9%) belonged to the lower class, 20 (28.6%) to lower middle, 12 (17.1%) to lower upper, and 8 (11.4%) to upper class. Immunization coverage was incomplete, with only 10 children (14.3%) fully immunized, 55 (78.6%) partially immunized, and 5 (7.1%) non-immunized. Maternal age was predominantly 21–30 years (40, 57.1%), followed by >30 years (18, 25.7%) and <20 years (12, 17.1%). This table highlights a majority of young children, female predominance, lower socio-economic status, and suboptimal immunization coverage.

Table 1: Socio-demographic profile, immunization status and maternal age (N = 70)

Socio-demographic data	Frequency	Percentage (%)
Age group		
6 to 12 months	18	25.7
1 to 2 years	32	45.7
3 to 5 years	20	28.6
Gender		
Male	28	40
Female	42	60
Socio-economic status		
Lower	30	42.9
Lower middle	20	28.6
Lower upper	12	17.1
Upper	8	11.4
Immunization status		
Completed	10	14.3
Partially immunized	55	78.6
Non-immunized	5	7.1
Maternal age (years)		
<20	12	17.1
21 to 30	40	57.1
>30	18	25.7

Table 2 shows the duration of exclusive breastfeeding among 70 patients. Exclusive breastfeeding was practiced for more than 6 months in 40 patients (57.1%), while 30 patients (42.9%) received exclusive breastfeeding for less than 6 months. This indicates that slightly more than half of the study population adhered to the recommended duration of exclusive breastfeeding.

Table 2: Duration of exclusive breastfeeding (N = 70)

Exclusive breastfeeding	No. of patients	Percentage (%)
Less than 6 months	30	42.9
More than 6 months	40	57.1
Total	70	100

Table 3 summarizes complementary feeding practices among 70 patients. The age of starting complementary feeding was less than 6 months in 38 patients (54.3%), between 6–12 months in 22 patients (31.4%), and after 12 months in 10 patients (14.3%). Regarding the method of feeding, 32 patients (45.7%) were bottle-fed, 20 (28.6%) were fed using a katori spoon, and 18 (25.7%) used both methods. The types of complementary foods included diluted cow's milk in 50 patients (71.4%) and mashed biscuits in 20 patients (28.6%). Overall, early initiation and bottle feeding were common practices, with diluted cow's milk being the predominant complementary food.

Table 3: Complementary feeding practices (N = 70)		
Complementary feeding	**No. of patients**	**Percentage (%)**
Age of starting complementary feeding		
Less than 6 months	38	54.3
6 to 12 months	22	31.4
More than 12 months	10	14.3
Method of feeding		
Katori spoon	20	28.6
Bottle feeding	32	45.7
Both	18	25.7
Complementary feeding given		
Diluted cow milk	50	71.4
Mashed biscuits	20	28.6

Table 4 presents the birth weight distribution among 70 patients. Low birth weight (<2.5 kg) was observed in 28 patients (40%), while 42 patients (60%) had a birth weight of ≥2.5 kg. This indicates that the majority of neonates had a normal birth weight, though a substantial proportion were low birth weight.

Table 4: Birth weight distribution (N = 70)		
Birth weight	**No. of patients**	**Percentage (%)**
<2.5 kg	28	40
≥2.5 kg	42	60
Total	70	100

Table 5 shows the distribution of comorbidities among 70 patients. Acute respiratory infections were the most common, affecting 40 patients (57.1%), followed by anemia in 30 patients (42.9%). Acute gastroenteritis was present in 18 patients (25.7%), while tuberculosis affected 6 patients (8.6%). Other comorbid conditions were reported in 10 patients (14.3%). This indicates that respiratory and hematological conditions were the predominant comorbidities in the study population.

Table 5: Associated comorbidities (N = 70)		
Comorbidities	**No. of patients**	**Percentage (%)**
Acute respiratory infection	40	57.1
Acute gastroenteritis	18	25.7
Anemia	30	42.9
Tuberculosis	6	8.6
Others	10	14.3

Table 6 summarizes the treatment outcomes of 70 patients. The majority, 50 patients (71.4%), recovered successfully. A notable proportion, 15 patients (21.4%), were defaulters who left against medical advice (LAMA). There were 5 deaths (7.1%) during the study period. Overall, the table indicates a high recovery rate, though a significant number of patients discontinued treatment prematurely.

Table 6: Treatment outcomes (N = 70)		
Outcome	**No. of patients**	**Percentage (%)**
Recovered	50	71.4
Defaulter (LAMA)	15	21.4
Death	5	7.1
Total	70	100

Table 7 presents the duration of hospital stay among 70 patients. The majority of patients, 38 (54.3%), stayed between 7 and 15 days. Shorter stays of less than 7 days were observed in 18 patients (25.7%), while 14 patients (20%) had prolonged hospitalizations exceeding 15 days. This indicates that most patients required a moderate hospital stay of 1–2 weeks, with fewer experiencing very short or extended admissions.

Table 7: Duration of hospital stay (N = 70)		
Duration of stay	**No. of patients**	**Percentage (%)**
<7 days	18	25.7
7–15 days	38	54.3
>15 days	14	20
Total	70	100

Discussion

The current research indicates that children under 1-2 years with severe acute malnutrition (SAM) made the highest percentage (45.7%), then children under 6-12 months (25.7%), then 3-5 years (28.6%). It is also compatible with the age distribution by Kumar et al. (2014) [9] and Choudhary et al. (2015) [10] who found that most hospitalized SAM patients were younger than two years of age and that the first two years of life is a crucial growth phase and nutritional risk period. This period is characterized by a high rate of growth, and the nutrient demands are high, and any disequilibrium in the intake or losses due to diseases may easily lead to malnutrition. Curiously, our research revealed a somewhat greater proportion of children between the ages of 3 and 5 years in comparison with certain previous studies, indicating that in this group, nutritional deficiency remains not eliminated after infancy, perhaps because of a delay in prevention or socio-economic limitations (Goyal and Agarwal, 2015) [6]."

The gender distribution was predominantly female (60%) to male (40%), the same as Sharma et al. (2019) [11] and Shah et al. (2014) [12] (female preponderance in cases of SAM in community-based studies). On the other hand, male admissions have been found to be higher in certain hospital-based research in Northern India, possibly due to gender-specific health-seeking behavior, where male children are given priority in the care of patriarchal societies (Nagar et al., 2016) [13]. The difference between studies can signal the cultural differences and access to health care in the regions.

Socio-economic background of our sample showed that 42.9 percent were of lower class and 28.6 percent were of lower-middle class. These results were similar to those obtained by Goyal and Agarwal (2015) [6] and Mishra et al. (2014) [7] that found poverty to be an important factor in malnutrition, influencing food supply, healthy diets, and medical services. On the other hand, a reduced proportion of children in high socio-economic status was affected, which confirms the fact that SAM is less common in well-to-do households.

The coverage of immunization was poor with 14.3 percent of the population being fully immunized, 78.6 percent partially immunized and 7.1 percent not immunized. The same trends were mentioned by Najar et al. (2021) [14] and Choudhary et al. (2015) [10], who reported incomplete immunization as a risk factor related to frequent infections worsening malnutrition. The fact that our population has very low levels of complete immunization can be attributed to socio-economic causes and it can also be due to the fact that programs of public health outreach are lacking, which supports the necessity of integrated programs of nutrition and immunization.

A higher number of children (57.1 percent) were found to have a period of exclusive breastfeeding of more than six months; 42.9 percent were found to be breastfed below six months. This is widely in line with the research by Najar et al. (2021) [14], in which 58 percent of children used the exclusive breastfeeding of the first six months or longer. Complementary feeding was also introduced early in their lives as 54.3% were fed complementary foods before the age of six months. In studies done by Patil et al. (2020) [15] and Gamit et al. (2021) [16], premature complementary feeding is also reported as a cause of malnutrition because of inadequate nutrient uptake and high risk of infections. In our cohort, bottle feeding was the most common (45.7%), which is in accordance with Patil et al. (2020) [15], yet is a little bit higher than Choudhary et al. (2015) [10] and indicates that bottle feeding can still be one of the practices despite the potential risks of contamination and diarrheal disease.

The analysis of birth weight showed that 60 percent of children were found to have weight that exceeds 2.5 kg at birth, 40 percent of children were found to have low birth weight (<2.5 kg). According to Gamit et al. (2021) [16], the results were similar as low birth weight was associated with the higher susceptibility to SAM because of the impaired immunity and nutrient reserves. This brings out the intergenerational cycle of malnutrition where maternal nutrition may be insufficient, especially in resource-limited environments.

The comorbidities were high as acute respiratory infections were present in 57.1, anemia in 42.9, acute gastroenteritis in 25.7, and tuberculosis in 8.6%. This fact confirms previous reports by Ahmad et al. (2020) [17] and Panigrahi et al. (2018) [18], who suggest that infectious morbidities are the cause and effect of malnutrition. The prevalence of respiratory infections in our research was a little higher than used in the study of Panigrahi et al. (2018) [18], perhaps because of differences in the prevalence of the disease in the region or the time of the year when the study was conducted.

The results of the treatment showed a 71.4% recovery rate, 21.4% defaulters, and deaths of 7.1, which are in agreement with Ahmad et al. (2020) [17] and Panigrahi et al. (2018) [18], whose recovery rates were 70-75% with a mortality of less than 10%. The duration of stay in the hospital was mainly 7-15 days (54.3%), similar to Nagar et al. (2016) [13], which means that under the condition of standardized management guidelines in nutrition rehabilitation centres, even with serious comorbidities, it is possible to attain positive results in children.

In general, the research supports the etiological factors and outcomes that have been recorded in the past in SAM. The similarities in the presented studies indicate consistent age, socio-economic determinant, feeding practices, and comorbidity patterns, whereas differences in the gender distribution, hospital stay, and immunization coverage suggest the impact of regional, cultural, and health care delivery disparities. To alleviate these inequalities, specific interventions such as maternal education, breastfeeding promotion, complementary feeding at the right time, immunization, and early detection of infections is important to enhance the results among children with SAM.

Conclusion

The research paper emphasizes that a combination of socio-demographic, nutritional, and health-related factors determine the case of severe acute malnutrition (SAM) among the children. Most of the children with the disease were of lower socio-economic status and were partially immunized with the maternal age majorly being in the young to middle adult age range. The feeding habits were found to be suboptimal exclusive breastfeeding and early or inappropriate supplementary feeding, which in most cases was diluted cow milk or bottle feeding. Among these children, low birth weight and comorbidities, including acute respiratory infections, anemia and gastroenteritis were also commonly observed. Irrespective of their condition severity, majority of the children had favorable course of recovery when they were under hospital-based care, yet a significant proportion defaulted or died of illness, which highlights the need to implement early intervention, adequate nutritional care, and surveillance to enhance the outcome in this vulnerable group of children.

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