Original Article

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Paediatrics Section

Clinicodemographic Profile, Risk Factors and Associated Co-morbidities in Children with Severe Acute Malnutrition: An Observational Study from a Tertiary Care Centre in Assam, India

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ABSTRACT

Introduction: Severe Acute Malnutrition (SAM) is a major cause of morbidity and mortality among children. Malnutrition during the early years of life can adversely affect overall growth, impair immunity, increase susceptibility to infections, delay development, and result in poor scholastic performance.

Aim: The present observational study was conducted to determine the clinical spectrum, sociodemographic profile, risk factors, and associated co-morbidities among children with SAM in a tertiary care centre in Assam, India.

Materials and Methods: The present hospital-based descriptive observational study was conducted at the Nutritional Rehabilitation Centre (NRC) of Tezpur Medical College and Hospital from September 2023 to August 2024. All children aged six months to five years admitted with SAM as per World Health Organisation (WHO) diagnostic criteria during the study period were included. After obtaining informed consent from parents or guardians, detailed sociodemographic and nutritional histories were recorded. Clinical features, associated co-morbidities, and relevant laboratory investigations were documented. Data were entered in a predesigned proforma and analysed using Microsoft Excel and Statistical Package for Social Sciences (SPSS) version 16. A p-value of <0.05 was considered statistically significant.

Results: Among the 65 children with SAM, 41 (63.07%) were males and 24 (36.9%) were females. Thirty-four children (52.3%) belonged to the 1-2-year age group. Of the total participants, 49 (75.4%) belonged to the lower socioeconomic strata, and 34 (52.3%) were residents of tea garden areas. Acute gastroenteritis was present in 21 (32.3%) children, acute respiratory infections in 18 (27.7%), moderate to severe anaemia in 15 (23.1%), delayed developmental milestones in 12 (18.5%), skin infections in 13 (20.0%), urinary tract infections in 11 (16.9%), seizure disorders in 8 (12.3%), culture-proven sepsis in 5 (7.7%), tuberculosis in 10 (15.4%), and vitamin A deficiency in 3 (4.6%) children.

Conclusion: Sociodemographic factors significantly influence the occurrence of malnutrition. Risk factors such as young age, poor literacy levels, and lack of awareness regarding nutrition contribute to malnutrition and its associated co-morbidities.

Keywords: Developmental delay, Gastroenteritis, Nutritional deficiency, Nutritional oedema, Wasting

INTRODUCTION

Malnutrition is a major public health concern affecting children in developing countries. SAM is defined as low weight-for-height (below -3 Z-scores of the median WHO growth standards), visible severe wasting, or the presence of nutritional oedema [1]. According to the American Society of Parenteral and Enteral Nutrition (ASPEN), paediatric malnutrition results from an imbalance between nutrient requirements and intake, leading to cumulative deficiencies of energy, protein, or micronutrients that adversely affect growth and development [2].

The SAM predominantly affects children in developing regions, where multiple interrelated factors contribute to its prevalence. Chronic poverty restricts access to nutritious food and healthcare services, while low educational levels hinder knowledge of appropriate nutrition and childcare practices. Poor hygiene increases the risk of infections, further worsening nutritional status due to impaired nutrient absorption. Additionally, food insecurity leads to inadequate intake of essential nutrients required for healthy growth and development [1].

Addressing SAM requires a multifaceted approach, including poverty alleviation, nutrition education, improved hygiene practices, food security, and access to healthcare services. Interventions such as breastfeeding promotion, dietary diversification, and therapeutic feeding programmes play crucial roles in preventing and managing SAM [3]. In India, malnutrition remains a significant challenge, affecting more than one-third of the paediatric population. The prevalence of underweight children in India is among the highest globally, nearly double that of sub-Saharan Africa [4]. Studying the clinical and sociodemographic profiles of malnourished children helps identify vulnerable populations and gaps in prevention strategies [3].

Infections are a major cause of morbidity among children with SAM. Conditions such as gastroenteritis, respiratory tract infections, malaria, measles, and tuberculosis account for most illnesses in severely malnourished children. Co-morbidities associated with SAM significantly contribute to mortality [5]. Although several studies have been conducted in different parts of India [4,6-8], data from this region remain limited. Therefore, the present study aimed to assess the clinicodemographic profile, risk factors, and co-morbidities associated with SAM among children in Assam.

MATERIALS AND METHODS

The present hospital-based observational study was conducted in the Department of Paediatrics at Tezpur Medical College and Hospital (TMCH) in Tezpur, Assam, India, over a one-year period from September 2023 to August 2024. Institutional ethical approval

was obtained (IEC SL No. 074/2023/TMCH dated 09/09/2023). Written informed consent was secured from parents or guardians, and participant confidentiality was maintained throughout the study.

Inclusion criteria: All children aged six months to five years diagnosed with SAM according to WHO criteria and admitted to the NRC during the study period were included.

Exclusion criteria: Children below six months of age and those with secondary causes of malnutrition, such as chronic liver disease, kidney disease, and congenital heart disease, were excluded.

Sample size calculation: All children attending the Outpatient Department and emergency services during the study period were screened for malnutrition. Seventy children aged six months to five years met the criteria for SAM. Five children with secondary causes of malnutrition were excluded. The remaining 65 children admitted to the NRC were included in the study.

Study Procedure

After obtaining informed consent from the parents or guardians, clinical features at the time of admission, relevant examination findings, provisional clinical diagnosis, associated co-morbidities, and pertinent laboratory investigations were recorded. Significant past medical history, birth history, and a detailed dietary history including breastfeeding and complementary feeding practices were documented.

Caregivers' knowledge regarding infant and child feeding practices was assessed using ten simple questions related to breastfeeding and complementary feeding. Correct responses to at least six out of ten questions were considered indicative of good knowledge.

Sociodemographic details such as the child's age and sex, parental education level, family income, and socioeconomic status were recorded. Socioeconomic status was determined using the modified Kuppuswamy scale [9]. Information regarding the child's immunisation status was also collected. All data were obtained through interviews conducted with the mother or primary caregiver in a comfortable and private environment.

All children underwent standard anthropometric assessments. Body weight was measured with minimal clothing during daylight hours in accordance with WHO 2006 growth chart recommendations [10]. Height was measured using a stadiometer, and recumbent length was measured using an infantometer, with values plotted on WHO growth charts. Mid-Upper Arm Circumference (MUAC) was measured using a UNICEF MUAC tape at the midpoint between the acromion and olecranon of the upper arm. A MUAC of <11.5 cm was considered indicative of SAM [1]. Head circumference was measured using a non-stretchable measuring tape placed around the occipital prominence and frontal eminence, and values were compared with WHO reference charts. Laboratory investigations were performed to identify infections and other relevant clinical conditions.

STATISTICAL ANALYSIS

Data were recorded in a predesigned proforma and analysed using Microsoft Excel and SPSS version 16. The Chi-square test was used for categorical variables. A p-value of <0.05 was considered statistically significant.

RESULTS

Among the 65 children with SAM, 41 (63.07%) were males. The majority, 51 children (78.46%), belonged to the age group of one to five years, while 14 (21.53%) were between six months and one year of age. A total of 49 children (75.4%) belonged to the lower socioeconomic strata. The per capita monthly income of 36 families (55.4%) ranged between Rs. 8,000 and 14,000, 21 families (32.3%) between Rs. 6,000 and 8,000, and 8 families (12.3%) exceeded Rs. 14,000 [Table/Fig-1].

Varaibles	Male	Female
Age (year)		
<1	8 (12.3%)	6 (9.2%)
1-2	23 (35.3%)	11 (16.9%)
2-5	10 (15.4%)	7 (10.8%)
Total	41 (63%)	24 (37%)
Clinical features at presentation	**Number**	**Percentage**
Not gaining weight	22	33.8
Oedema	10	15.45
Skin lesion	13	20.0
GI symptom (Diaarhoea, vomiting)	21	32.3
Loss of appetite	55	84.6
Pneumonia	18	27.7
Delayed milestone	12	18.5
Heart disease	3	4.6
Sepsis	5	7.7
Socioeconomic factors		
Upper	4	6.2
Upper middle	12	18.5
Lower middle	32	49.2
Upper lower	10	15.4
Lower	7	10.8
Per capita income		
6000-8000 Rs	21	32.3
8000-14000 Rs	36	55.4
>14000 Rs	8	12.3

[Table/Fig-1]: Age, sex and socioeconomic distribution.
GI: Gastrointestinal

Thirty-four children (52.3%) belonged to the tea garden population. Bottle feeding was reported in 24 children (36.9%), and 30 parents (46.2%) demonstrated poor knowledge regarding complementary feeding and healthy food habits. Regarding immunisation status, 52 children (80.0%) were fully immunised, 9 (13.8%) were partially immunised, and 4 (6.2%) were unimmunised. A past history of diarrhoea was present in 21 children (32.3%), while 15 children (23.1%) had previous hospital admissions for pneumonia [Table/Fig-2].

Parameters	Number	Percentage
Education level of parents		
Literate	35	53.8%
Illiterate	30	16.2%
Resident of Tea garden	34	52.3%
Birth history		
Low birth weight	21	32.3%
Normal weight at birth	44	67.7%
Preterm birth	28	43.1%
Term	37	56.9%
Mode of feeding		
Exclusive breast feeding	41	63.1%
H/O bottle feeding	24	36.9%
Poor knowledge of feeding	30	46.2%
Immunisation		
Complete till date	52	80.0%
Partial	9	13.8%
Unimmunised	4	6.2%

Past h/o diarrhoea	21	32.3%
Past h/o Pneumonia	15	23.1%

[Table/Fig-2]: Risk factors for SAM.

At admission, dehydration was observed in 17 children (26.2%), hypothermia in 8 (12.3%), and hypoglycaemia in 5 (7.7%) [Table/Fig-3].

Complications	Number	Percentage
Dehydration	17	26.16%
Hypoglycaemia	5	7.7%
Hypothermia	8	12.3%
Others	5	7.7%
No complications	30	46.15%

[Table/Fig-3]: Distribution of study population according to complications.

Regarding co-morbidities, acute gastroenteritis was present in 21 children (32.3%), pneumonia in 18 (27.7%), moderate to severe anaemia in 15 (23.1%), delayed developmental milestones in 12 (18.5%), skin infections in 13 (20.0%), urinary tract infections in 11 (16.7%), seizure disorders in 8 (12.3%), culture-proven sepsis in 5 (7.7%), tuberculosis in 10 (15.4%), and vitamin A deficiency in 3 (4.6%).

No co-morbidity showed a statistically significant association with age groups (all p-values>0.05) [Table/Fig-4].

Co-morbidities	Total no. of patients	6-12 months	1-2 years	2-5 years	Chi-sq	p-value
Acute gastroenteritis	21 (32.3%)	4 (6.1%)	5 (7.6%)	12 (18.46%)	0.256	0.880
Pneumonia	18 (27.7%)	5 (7.6%)	3 (4.6%)	10 (15.3%)	2.146	0.342
Anaemia	15 (23.1%)	4 (6.1%)	2 (3.1%)	9 (13.8%)	1.954	0.376
Delayed milestones	12 (18.5%)	1 (1.5%)	3 (4.6%)	8 (12.3%)	0.802	0.670
Skin infections	13 (20.0%)	2 (3.1%)	3 (4.6%)	6 (9.2%)	0.666	0.717
Urinary infections	11 (16.9%)	0	2 (3.1%)	9 (13.8%)	3.196	0.202
Sepsis	5 (7.7%)	2 (3.1%)	0	3 (4.6%)	2.876	0.237
Seizure disorder	8 (12.3%)	0	2 (3.1%)	6 (9.2%)	1.866	0.393
Tuberculosis	10 (15.4%)	0	2 (3.1%)	8 (12.3%)	2.664	0.264
Vitamin A deficiency	3 (4.6%)	0	0	3 (4.6%)	-	-

[Table/Fig-4]: Age wise distribution of co-morbidities.

	Parameters (%)								
Study	Male (%)	Female (%)	Age group (1-2 year) (%)	Lower economic strata (%)	Immun-isation Status (full) %	Complication D=dehydration P=Pneumonia S=Sepsis (%)	Anaemia (%)	TB (%)	Diarrhoea (%)
Present study (Assam, 2024; N=65)	63.03	36.67	52.2	75.4	80.0	D=26 P=28 S=8	23.1	15.4	32.3
Banga D et al., [3] (Uganda, 2020; N=338)	61.5	38.4	52.9	76.6	52.3	D=37.8 P=36.9 S=6.8	18	5	21.5
Sing S et al., [7] (Rajasthan, 2020; N=84)	51.19	48.81	46.43	100	27.38	D=26.2, P=21.4	31	2.4	34.5
Kumar R et al., [8] (Rewa, 2014; N=104)	48.1	51.9	30.7	75	42.3	P=27.9, S=9.6	88.3	22	54
Kumar S et al., [14] (Jharkhand, 2025; N=132)	51	49	52	77.27	82.57	P=25.8, S=3.78	74.3	4.5	42.42
Baskaran VM et al., [15] (Tamilnadu, 2018; N=200)	46.5	53.5	58.5	91.5	59.5	P=44.5, S=13	27	1	57.5

[Table/Fig-5]: Comparison of present study with different studies [3,7,8,14,15].

DISCUSSION

The SAM is characterised by severe wasting and/or bilateral pitting oedema [1]. Malnutrition, particularly undernutrition, remains a major public health problem among children under five years of age worldwide [11]. It continues to be a leading cause of morbidity and premature mortality in developing countries [12]. In the present study, SAM was more common among male children, consistent with previous reports [3,6,13,14]. The highest prevalence was observed in the 1-2-year age group, similar to findings from other studies [3,7,14,15]. A comparison of the present findings with previous studies is shown in [Table/Fig-5] [3,7,8,14,15].

A high prevalence of SAM was observed among the tea garden population and among children of illiterate mothers. The tea garden community constitutes nearly one-fifth of Assam's population and faces numerous challenges, including poor living conditions, overcrowding, illiteracy, and unhygienic environments, which contribute to malnutrition and communicable diseases [13].

Most children in this study belonged to lower socioeconomic and low-income families, consistent with earlier research [Table/Fig-1,2] [3,7,14,15]. A higher proportion of children were fully immunised (80%) compared to some previous studies [3,7,15]. Common complications at admission included dehydration, hypoglycaemia, and hypothermia, which aligned with findings from other studies [Table/Fig-3] [3,7,16].

Acute gastroenteritis and acute respiratory infections were the most frequent co-morbidities, followed by anaemia and skin infections. These findings were consistent with previous reports [3,7,8,14,15]. Moderate to severe anaemia was observed in 23.1% of cases, lower than in some other studies [8]. Anaemia in children with SAM may result from iron deficiency, folate and vitamin B12 deficiencies, infections, parasitic infestations, and chronic disease [16].

Tuberculosis was detected in 15.4% of children, similar to earlier studies [8]. Delayed developmental milestones were noted in 18.5% of cases, highlighting the critical role of nutrition in child growth and development [17]. Other co-morbidities such as seizure disorders, sepsis, and vitamin A deficiency occurred in smaller proportions. No significant age-related differences in co-morbidities were observed.

Limitation(s)

The present study was conducted at a single centre with a relatively small sample size of 65 children. Therefore, the findings may not be generalisable to the broader population. Larger multicentre studies are recommended to obtain more representative and robust data.

CONCLUSION(S)

Sociodemographic factors play a crucial role in the occurrence of malnutrition. Risk factors such as young age, low literacy levels, and lack of awareness regarding appropriate nutrition significantly contribute to SAM and its associated co-morbidities. Early identification and timely management of comorbid conditions are essential to interrupt the malnutrition disease, malnutrition cycle and promote effective rehabilitation. Understanding the sociodemographic profile of affected populations enables targeted interventions to reduce the burden of malnutrition.

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