

# Navigating the Clinical Landscape of Severe Acute Malnutrition in India's Pediatric Demographic

<sup>1</sup>Dr. Nazaf Nazir Parol  
Junior Consultant in Paediatrics,  
Sunrise Hospital, Kanhangad, Kerala

<sup>2</sup>Dr. Sachin Padman,  
Director and Consultant Paediatrician,  
Sunrise Hospital, Kanhangad, Kerala

<sup>3</sup>Dr. Venugopal Reddy I.  
Medical Director & Consultant Pediatrician,  
Ovum Hospital, Bangalore

## Abstract:-

### ➤ *Background:*

The consequences of malnutrition are increases in childhood death and future adult disability, including diet-related non-communicable diseases (NCDs), as well as enormous economic and human capital costs. According to UNICEF, one in three malnourished children in the world is Indian. It is estimated that reducing malnutrition could add some 3% to India's GDP. Combating child malnutrition is of great public health importance to the future economic development and social well-being of countries, but there is very minimal information on the clinical profile and outcome of SAM.

### ➤ *Objectives:*

To study the Clinical Profile and Outcome of Severe Acute Malnutrition in children aged between 6 and 59 months.

### ➤ *Methodology:*

An Observational hospital-based time bound study includes 60 children of 6 to 59 months age satisfying inclusion criteria admitted in BCHI and Chigateri District Hospital. The children were classified according to WHO guidelines and managed according to standard WHO case management protocol and re-evaluation were done on a daily basis during the course of hospital stay. The outcome was assessed in term of improvement, number of days of hospitalization, residual problems at discharges, left against medical advice and number of deaths.

### ➤ *Results:*

Nearly all the subjects presented with visible wasting with eight for age  $< -3SD$  and MUAC, 11.5 cm. Half of the study population had incomplete immunization. Acute GE and ARI, anemia were the most common comorbidities and severe dehydration was the most complication seen. Majority i.e., 75 (75.8%) were discharged with target weight, 20 (20.2%) were discharged without reaching target weight and 4 (4%) were defaulters.

### ➤ *Interpretation & Conclusion:*

The study concluded that effective community-based program for early detection and treatment, most children with SAM can be cared for by their mothers and families at home while NRCs are reserved for children with SAM and medical complications.

**Keywords:-** Non-Communicable Diseases, Severe Acute Malnutrition, Severe Dehydration.

## I. INTRODUCTION

Childhood malnutrition is a significant cause of 35% of deaths under five years old. It results from poor nutrition in the first 1000 days of a child's life, leading to stunted growth, impaired cognitive ability, and reduced school and work performance. Factors such as poverty, maternal BMI, mother age at marriage, home environment, feeding practices, hand washing, and hygiene practices contribute to malnutrition. Low birth weight, diarrhea within the last six months, and developmental delay are associated with malnutrition (1).

The World Health Organization defines malnutrition as a cellular imbalance between the supply of nutrients and energy and the body's demand for them. Classification of mild, moderate, or severe undernutrition is based on anthropometric, biochemistry measurement, and clinical assessment. In India, 21% of children under five were underweight, with more than 7.5% suffering from severe acute malnutrition (SAM).

Malnutrition accounts for 33% of global deaths and 45% of deaths in under-five children in South Asia and Sub-Saharan Africa. In India, nearly 57 million children are moderate to severely malnourished, accounting for more than 50% of deaths in the 0-4 year age group. (2) 48% of under-five children are stunted due to severe malnutrition.

In India, over 33% of deaths under five years of age are associated with malnutrition, possibly due to changes in innate and adaptive immunity due to nutrient and micronutrient deficiencies. Co-morbidities like anemia, diarrhea, dehydration, hypoglycemia, hypothermia, electrolyte imbalance, and sepsis also play a major role in increased mortality.(3)

Malnutrition in children is the leading cause of death in 35% of children under 5 years of age. This is due to malnutrition in the first 1000 days of the child's life; This results in slowed growth, cognitive impairment, and decreased school and work performance. Factors such as poverty, mother's body weight, mother's age at marriage, home environment, diet, hand washing and hygiene can contribute to poor food consumption. Low birth weight, diarrhea in the last six months, and slow growth are associated with malnutrition (1).

The World Health Organization defines malnutrition as an imbalance between nutrients and energy and the body's needs for them. Classification of mild, moderate and severe malnutrition is based on anthropometric, biochemical and clinical evaluations. In India, 21% of children under five years of age are underweight and more than 7.5% of them suffer from malnutrition (SAM).

Malnutrition is responsible for 33% of deaths worldwide and 45% of deaths among children under five in South Asia and Sub-Saharan Africa. Approximately 57 million children in India are moderately to severely malnourished; This accounts for more than 50% of deaths in the 0-4 age group. (2) 48% of children under five years of age are stunted due to malnutrition. In India, more than 33% of deaths among children under five are related to malnutrition, which can be caused by changes in the body's immune system or diseases caused by malnutrition. and micronutrient deficiency. Diseases such as diabetes, diarrhea, dehydration, hypoglycemia, hypothermia, electrolyte deficiency and sepsis also play an important role in increasing mortality. (3)

There are two main clinical areas of malnutrition: edematous and non-edematous (food deficiency) malnutrition. Although there are many explanations for the pathophysiology of malnutrition-related edema, mortality is still high in children with malnutrition. Addressing child malnutrition is critical for future economic development and societal health. (4)

## II. METHODOLOGY

### A. Source of Data:

The children were admitted to the pediatric unit affiliated with J.J.M. Serious cases were diagnosed at Davangere Medical College (Department of Bapuji Child Health Institute and Research Center, Chigateri District Hospital, Davangere).

- Type of Study: Hospital-based observational, time-limited study.
- Research Period: March 2021 - August 2022
- Number of Samples: 60 patients (99 patients in total)

### B. Inclusion Criteria:

- Children of 6 to 59 months of age with severe acute malnutrition satisfying following criteria were included.
- Weight for height/length < -3 SD and/or
- Visible severe wasting and/or
- Mid upper arm circumference (MUAC) < 11.5 cm and/or
- Edema of both feet.

### C. Exclusion Criteria:

- Cases of Severe Acute Malnutrition due to Cleft lip, Cleft palate, GERD, Pyloric Stenosis and other Surgical conditions, Chronic Renal Failure, Congenital Heart Diseases, Liver Disorders, Asthma, Mental Retardation, Cerebral Palsy, suspected case of Inborn Errors of Metabolism etc.
- Children of less than 6 month of age and more than 5 years age.

## III. METHOD

The study included children aged 6 to 59 months attending BCHI and Chigateri Regional Hospital. Parents gave written informed consent and a detailed medical record was obtained. (6) Perform standard medical examinations, including anthropometric measurements, and conduct related research. Children are classified according to World Health Organization guidelines and managed according to standard procedures. Results; They were evaluated in terms of recovery, length of stay, remaining complications at discharge, noncompliance with treatment instructions, and number of deaths. Data were collected and compiled in MS Excel and descriptive statistics were used to present the data. The critical level is fixed at 5%. (7).

### A. Sample Size Estimation

#### ➤ Sample Size Calculation:

$$\text{Sample Size} = \{Z_{1-\alpha} \cdot 2 \cdot (p) \cdot (q)\} / \Delta^2$$

Table 1: Required Sample Size Required for the Health Survey

P	Prevalence of severe acute malnutrition in Karnataka	0.105*
1-α	Confidence level	0.95
Z	Z value associated with confidence	1.96
Δ	Absolute precision	0.08
n	Minimum sample size	57
	Sample size is rounded to	60

Thus, the minimum sample size required is 60 to conduct the study.

Reference: International Institute for Population Sciences (IIPS) and ICF. 2017. National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS. Available at <http://rchiips.org/nfhs/nfhs-4Reports/India.pdf>

**IV. RESULTS**

Table 2: Distribution of the Study Participants According to their Age Group

Age	Frequency N	Percentage %
6-12 months	42	42.4
1-3 years	54	54.5
>3years	3	3.0

Most of the participants in the study were in the 1-3 age group (54, 54.5%), followed by 42 people (42.4%) in the 61-

12 months age group and 3 (3%) in the > 3 age group. The average age of the study participants was 16.47 + 7.976 years.

Table 3: Distribution of the Study Participants According to their Gender

Gender	Frequency N	Percentage %
Male	49	49.5
Female	50	50.5

Majority of the study participants were females (50, 50.5%) with males contributing to (49, 49.5%) of study population.

Table 4: Distribution of Locality among Study Subjects

LOCALITY	FREQUENCY	PERCENT
RURAL	68	68.7
URBAN	31	31.3

Majority i.e., 68 (68.7%) belonged to rural area and 31 (31.3%) belonged to urban area.

Table 5: Distribution of the Study Participants According to their Chief Complaints

CHIEF COMPLAINTS	FREQUENCY N	PERCENTAGE %	
APETITE	Normal	72	72.7
	Poor	23	23.2
	No appetite	4	4.0
VOMITING	YES	17	17.2
	NO	82	82.8
DIARRHEA	YES	22	22.2
	NO	77	77.8
EDEMA	YES	9	9.1
	NO	90	90.9
FEVER	YES	41	41.4
	NO	58	58.6
COUGH	YES	15	15.2
	NO	84	84.8

In the present study, 41 (41.4%) had fever followed by diarrhea in 22 (22.2%), vomiting in 17 (17.2%), cough in 15

(15.2%), edema in 9 (9.1%), poor appetite was present in 23 (23.2%) and no appetite was present in 4 (4%).

Table 6: Distribution of Subjects According to Birth Weight among Study Subjects

BIRTH_WEIGHT	FREQUENCY	PERCENT
NORMAL	62	62.6
LBW	35	35.4
LGA	2	2.0

35 (35.4%) subjects were low birth weight and 2 (2%) were low birth weight for gestational age. 62 (62.6%) had normal birth weight.

Table 7: Neonatal Period

NEONATAL PERIOD	FREQUENCY	PERCENT
Hospitalized	54	54.5
Normal	45	45.5

Majority i.e., 54 (54.5%) were hospitalized and 45 (45.5%) were normal.

Table 8: Ever Breast Fed

EVER BREAST FED	FREQUENCY	PERCENT
Yes	99	100.0
No	0	0.0

All the subjects i.e., 99 (100%) had breast fed.

Table 9: Currently Breast Fed

CURRENTLY BREASTFEEDING	FREQUENCY	PERCENT
Yes	58	58.6
No	41	41.4

58 (58.6%) subjects were currently breast feeding.

Table 10: Other Milk

OTHER MILK	FREQUENCY	PERCENT
Given	96	97.0
Not given	3	3.0

96 (97%) were given other milk and 3 (3%) were not given other milk.

Table 11: Type of other milk

TYPE	FREQUENCY	PERCENT
Animal	44	44.4
Commercial formula	55	55.6

Other milk for 44 (44.4%) was animal milk and 55 (55.6%) were given commercial formula.

Table 12: Mode of Feeding

MODE OF FEEDING	FREQUENCY	PERCENT
Cup and spoon	5	5.1
Paladai	16	16.2
Glass	3	3.0
Bottle	75	75.8

Majority i.e., 75 (75.8%) were bottle fed, 16 (16.2%) were given other given milk through paladai, 5 (5.1%) were

fed by using cup and spoon and 3 (3%) were fed milk through glass.

Table 13: Age at Starting Complementary Feeds

COMPLIMENTARY FEED DURATION	FREQUENCY	PERCENT
< 6 months	53	53.5
6-8 months	38	38.4
8 months – 1year	7	7.1
> 1 year	1	1.0

For majority i.e., 53 (53.5%) complementary feed was started at < 6 months, for 38 (38.4%) subjects, it was started at 6-8 months, for 7 (7.1%) subjects, it was started at 8 months

to 1 year and for only 1 (1%) subject it was started at > 1year age.

Table 14: Type of Complementary Feed

TYPE OF COMPLIMENTARY FEED	FREQUENCY	PERCENT
Home available	73	73.7
Commercial feed	26	26.3

For majority i.e., 73 (73.75) subjects, home available complementary feed was given and for 26 (26.3%) subjects. Commercial feed was given.

Table 15: Development among Study Subjects

DEVELOPMENT	FREQUENCY	PERCENT
Normal	44	44.4
Global development	8	8.1
Motor delay	44	44.4
Speech delay	3	3.0

Majority i.e., 44 (44.4%) had motor delay, 8 (8.1%) subjects had global development and 3 (3%) had speech delay.

Table 16: Immunization among Study Subjects

IMMUNIZATION	FREQUENCY	PERCENT
Appropriate for age	52	52.5
Incomplete	47	47.5

For 52 (52.5%) immunization was appropriate for age and for 47 (47.5%) immunization was incomplete.

Table 17: SE Status among Study Subjects

SE STATUS	FREQUENCY	PERCENT
Upper middle	1	1.0
Lower middle	10	10.1
Upper lower	60	60.6
Lower	28	28.3

Majority i.e., 60 (60.6%) belonged to upper lower socio-economic status, 28 (28.3%) belonged to lower SES, 10 (10.1%) belonged to lower middle class and 1 (1%) belonged to upper middle class.

Table 18: Visible Wasting among Study Subjects

VISIBLE WASTING	FREQUENCY	PERCENT
Yes	97	98.0
No	2	2.0

Majority i.e., 97 (98%) had visible wasting.

Table 19: Distribution of Height among Study Subjects

HEIGHT/AGE	FREQUENCY	PERCENT
+2 SD to -2 SD	45	45.5
-2 SD to -3 SD	35	35.4
<-3 SD	19	19.2

Majority i.e., 35 (35.4%) belonged had height for age between -2 SD to -3 SD, 45 (45.5%) belonged had height between +2 SD to -2 SD and 19 (19.2%) had height for age <-3 SD.

Table 20: Weight for Age Among Study Subjects

WEIGHT/AGE	FREQUENCY	PERCENT
+2 to -2	0	0.0
-2 to 3	0	0.0
<-3	99	100.0

All the subjects i.e., 99 (100%) had height for age <-3 SD.

Table 21: Weight for Height Among Study Subjects

WEIGHT/HEIGHT	FREQUENCY	PERCENT
+2 to -2	0	0.0
-2 to 3	0	0.0
<-3	99	100.0

All the subjects i.e., 99 (100%) had height for age <-3 SD.

Table 22: MUAC among Study Subjects

MUAC	FREQUENCY	PERCENT
<11.5 cm	99	100.0

All the patients i.e., 99 (100%) had MUAC <11.5 cm.

Table 23: Head Circumference Among Study Subjects

HEAD CIRCUMFERENCE	FREQUENCY	PERCENT
Normal	99	100.0

All the patients i.e., 99 (100%) had normal head circumference.

Table 24: Organic Disease Among Study Subjects

ORGANIC DISEASE	FREQUENCY	PERCENT
Yes	26	26.3
No	73	73.7

26 (26.3%) subjects had organic disease.

Table 25: Type of Anemia Among Study Subjects

TYPE OF ANEMIA	FREQUENCY	PERCENT
Iron Deficiency	24	24.2
Dimorphic	7	7.1

Majority i.e., 24 (24.2%) had iron deficiency anemia and 7 (7.1%) had dimorphic anemia.

Table 26: Sepsis Among Study Subjects

SEPSIS	FREQUENCY	PERCENT
Yes	13	13.1
No	86	86.9

13 (13.1%) subjects had sepsis.

Table 27: ARI among Study Subjects

ACUTE RESPIRATORY INFECTION	FREQUENCY	PERCENT
Yes	54	54.5
No	45	45.5

54 (54.5%) had ARI.

Table 28: Acute GE among Study Subjects

ACUTE GASTROENTERITIS	FREQUENCY	PERCENT
Yes	74	74.7
No	25	25.3

Majority i.e., 74 (74.7%) had acute GE.

Table 29: Dehydration among Study Subjects

DEHYDRATION	FREQUENCY	PERCENT
No	25	25.3
Severe	74	74.7

Majority i.e., 74 (74.7%) had severe dehydration.

Table 30: Worm Infestation Among Study Subjects

WORM INFESTATION	FREQUENCY	PERCENT
Yes	22	22.2
No	77	77.8

22 (22.2%) had worm infestation.

Table 31: Urinary Tract Infection among Study Subjects

URINARY TRACT INFECTION	FREQUENCY	PERCENT
Yes	22	22.2
No	77	77.8

22 (22.2%) had UTI.

Table 32: Measles among Study Subjects

MEASLES	FREQUENCY	PERCENT
Yes	4	4.0
No	95	96.0

4 (24%) had measles.

Table 33: Skin Infection among Study Subjects

SKIN INFECTION	FREQUENCY	PERCENT
Yes	11	11.1
No	88	88.9

11 (11.1%) had skin infection.

Table 34: Tuberculosis among Study Subjects

TUBERCULOSIS	FREQUENCY	PERCENT
Yes	6	6.1
No	93	93.9

6 (6.1%) had tuberculosis.

Table 35: Retroviral Infection among Study Subjects

RETROVIRAL	FREQUENCY	PERCENT
No	99	100.0

None had retroviral infection.

Table 36: Meningitis among Study Subjects

MENINGITIS	FREQUENCY	PERCENT
No	99	100.0

None had meningitis.

Table 37: Outcome among Study Subjects

OUTCOME	FREQUENCY	PERCENT
DISCHARGED WITH TARGET WEIGHT	75	75.8
DISCHARGED WITHOUT REACHING TARGET WEIGHT	20	20.2
DEFAULTER	4	4.0

Majority i.e., 75 (75.8%) were discharged with target weight, 20 (20.2%) were discharged without reaching target weight and 4 (4%) were defaulters.

## V. DISCUSSION

The study aimed to investigate the prevalence of SAM among pregnant women in India. The majority of participants were aged between 1-3 years, with a mean age of 16.47+7.976 months. The majority of the participants were males (50, 50.5%), with a similar distribution to previous studies by Tariq et al., Tiwari et al., and Choudhary et al. The majority of the participants belonged to lower socio-economic status (60, 60.6%), lower middle class (28.3%), and below poverty line (64.8%). (8)

The majority of the participants were from rural areas (68.7%), while 31 (31.3%) were from urban areas (68.7%). The majority of the participants had fever, diarrhea, vomiting, cough, edema, poor appetite, and no appetite (4%). The most common presenting symptoms on admission were weight loss, fever, and loss of appetite. (9)

The majority of the subjects were low birth weight (35, 35.4%), with 62 (62.6%) having normal birth weight. Most of the subjects were hospitalized (54.5%), and all were breastfed (99, 100%). The majority of the subjects were currently breastfeeding (58.6%), and supplementary milk was given (96, 97%) or other milk (44, 44%). The most commonly used supplementary food was over-diluted cow milk (92%).

This study aims to investigate the prevalence of SAM among pregnant women in India. Most participants were between 1 and 3 years old, and the average age was 16.47 + 7.976 months. The majority of participants were male (50, 50.5%), a similar distribution to previous studies by Tariq et al, Tiwari et al, and Choudhary et al. The majority of people involved in the economy are low (60 years old, 60.6%), lower-middle (28.3%), and below the poverty line (64.8%). (8)

The majority of the participants were from rural areas (68.7%), and 31 (31.3%) were from urban areas (68.7%). Most participants experienced fever, diarrhea, vomiting, cough, edema, loss of appetite, and loss of appetite (4%). The most common presenting symptoms are weight loss, fever and loss of appetite. (9)

Most people have low birth weight (35 people, 35.4%), while 62 people (62.6%) have low birth weight. Most patients were hospitalized (54.5%) and all were breastfed (99, 100%). The majority of subjects were currently breastfeeding (58.6%) and taking milk (96, 97%) or other milk (44, 44%) supplements. The most commonly used supplement is excess milk (92%).

Most subjects started complementary foods at less than 6 months of age; most people started complementary foods at 6-8 months (38.4%) and 8 months to 1 month. Annual growth is 7.1%. Only 53% of babies were introduced to solid foods after 6 months. (10) 73 (73.75%) people were given supplementary food at home, and 26 (26.3%) people were given commercial feed.

Most of the subjects had bradykinesia (44.4%), general development (8.1%) and speech delay (3.3%). Vaccination was up to date in 89% of patients (Dhanalakshmi K et al., 11). Most patients lost weight (98%), although this rate was 58.1% in Chiabi et al.'s study and less in this study.

The age and height of most of the subjects were between -2 SD and -3 SD (35.4%); The height of 45 of them (45.5%) was between +2 SD and -2 SD (19.2%). Head circumference (99, 100%) and MUAC (muscle circumference) of all patients were <11.5 cm (85.45%). (12)

Other side effects in SAM patients include gastrointestinal infections (30%), followed by respiratory distress (26.3%), sepsis (15%), urinary tract infections (2%). 7), meningitis is included. (2%), measles (3.8%) and tuberculosis (4%). Dehydration occurred in 31.5% of patients; this was a reduction compared to previous studies. (13)

Rinki H. Shah et al. A study conducted by. It was observed that the most common complication in SAM patients was dehydration, followed by sepsis. In a study conducted in Colombia, 68.4% of malnourished children had diarrhea at presentation and 9% had sepsis. The main complications were anemia (53%), LRTI (33%), and intestinal inflammation (29%). 5 percent of children have sepsis and 4 percent have tuberculosis. Cases of meningitis, measles, skin diseases, rickets and vitamin A deficiency have been confirmed in 2% of children. (14)

Dhanalakshmi K and colleagues found that 35.75% of children with SAM suffered from gastrointestinal disease and 28.49% suffered from respiratory disease. Mathur et al. In the study, it was determined that 54 percent of children with SAM had diarrhea and 27.9 percent had respiratory tract infections. Chow et al. It was observed that the most serious disease in 45 patients (25.1%) was respiratory tract infections, followed by malaria with 15.1%. (15) Among 32 children with known HIV infection, the human immunodeficiency virus (HIV) rate was 43.75%. Dehydration was the most common complication, occurring in 29.6% of patients.

The most common infection with PEM is gastrointestinal infection (60%), followed by respiratory tract infection (52%). The most common infection was respiratory tract infection, followed by diarrhea (31.75%) and anemia (74.12%). Anemia (80%), diarrhea (59%) and pneumonia (29%) were the most common comorbidities. (16)

Most patients reached their target weight at discharge; The recovery rate was 75.8%, mortality was 0.68% and defaulters were 1.36%. These results are consistent with national standards, which is important because the main goal of the National Reproductive Center (NRC) is to reduce the mortality rate of children with SAM. (17,18)

## VI. CONCLUSION

In this study, most of the subjects who developed SAM were in the 1-3 age group, and the proportions of males and females were equal. , diarrhea, vomiting and edema. and no appetite. Most are born with low birth weight and are exclusively breastfed. Complementary feeding was started before 6 months for almost half of the study population, although half of them were fed foods already available at home.

All subjects were very thin; 8 of them were <-3SD in age and 11.5 cm in MUAC height. Half of the subjects were missing vaccinations. In acute GE and ARI, anemia is the most common symptom and severe dehydration is the most common problem. Most of them, namely 75 (75.8%), were released while reaching the target weight, 20 (20.2%) were released before the target weight was reached, and 4 (4%) were in default.

The spectrum analysis found in this study is comparable to other studies in the literature. NRC provides lifesaving care to children with SAM, as evidenced by its high survival rate program.

Community care for children without SAM should be an integral part of the continuum of care for children with SAM. Many children with SAM can be treated in their own communities because their SAM does not occur easily and they can eat energy-dense foods. 14 International evidence shows that nutritious, ready-to-eat foods are effective in promoting rapid growth in children with SAM15 and can be used effectively in community-based programs. 13 With effective detection and treatment in the community, most children with SAM can be cared for at home by their mothers and families, while feeding centers (NRCs) are reserved for children with SAM and medical problems.



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