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Original Article

Outcome of NRC Intervention in Treatment of Sam Children

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ABSTRACT

Background: Severe Acute Malnutrition (SAM) remains a major public health concern among children under five years of age, particularly in low-resource settings like Odisha, India. Nutritional Rehabilitation Centres (NRCs) provide standardized facility-based care for the management of SAM. This study aimed to evaluate the outcomes of the NRC intervention on the nutritional and clinical status of children with SAM.

Objectives: To assess the effectiveness of NRC-based management in improving anthropometric indicators and clinical status in SAM children and to evaluate post-discharge recovery over a six-month follow-up period.

Methods: A hospital-based prospective observational study was conducted at the Department of Pediatrics, SCB Medical College, Cuttack, from November 2023 to July 2024. A total of 100 SAM children aged 6 months to 5 years were enrolled using systematic random sampling. Baseline assessments included demographic, clinical, anthropometric, and laboratory evaluations. Participants were monitored during a 14-day NRC stay and followed up at 1, 2, and 6 months post-discharge. Data were analyzed using SPSS with a significance level set at $p < 0.05$.

Results: At admission, the mean weight, MUAC, and height were 6.06 ± 1.85 kg, 10.36 ± 1.16 cm, and 71.42 ± 10.04 cm, respectively. While inpatient gains in weight and MUAC were modest and statistically nonsignificant ($p > 0.05$), significant improvements were observed during follow-up. By 6 months, mean weight, MUAC, and height increased to 8.27 ± 1.56 kg, 11.21 ± 1.52 cm, and 74.10 ± 9.56 cm, respectively. Clinical symptoms, such as enema frequency, also showed marked improvement during the NRC stay.

Conclusion: NRC-based interventions are effective in initiating nutritional recovery and clinical stabilization in SAM children. Sustained improvements post-discharge highlight the importance of structured follow-up and community-based support. Strengthening NRCs and integrating them with community outreach can enhance long-term outcomes in managing childhood malnutrition.

Keywords*: Severe Acute Malnutrition, Nutritional Rehabilitation Centre, Anthropometry, MUAC, Weight Gain, Child Nutrition, Odisha.*

INTRODUCTION

Malnutrition remains a significant public health issue in many low- and middle-income countries, particularly among children under the age of five. Among the various forms of undernutrition, Severe Acute Malnutrition (SAM) is the most life-threatening, contributing to approximately 1 million child deaths annually worldwide [1]. SAM is defined by the World Health Organization (WHO) as a weight-for-height/length z-score below −3 standard deviations of the median WHO growth standards, a mid-upper arm circumference (MUAC) < 11.5 cm, or the presence of bilateral pitting edema [2].

In India, despite various nutritional programs, SAM continues to pose a serious challenge. According to the National Family Health Survey-5 (NFHS-5), 6.1% of children under five years of age in Odisha suffer from severe wasting, which reflects a critical level of acute malnutrition [3]. Malnourished children are highly susceptible to infections and developmental delays, which often result in poor health and long-term socio-economic consequences [4].

To address this challenge, the Government of India, in collaboration with UNICEF and other agencies, has established Nutritional Rehabilitation Centres (NRCs) across the country. These centers provide institutional care, including therapeutic feeding, medical treatment, and caregiver education, for the management of children with SAM [5]. NRCs aim not only at stabilizing the child's nutritional status but also at enabling long-term recovery through follow-up care and community involvement [6].

Previous studies have demonstrated that NRC-based interventions can lead to significant improvements in weight gain and MUAC among children with SAM [7,8]. However, there is a need for context-specific evaluations to assess the effectiveness and long-term impact of such interventions, particularly in high-burden states like Odisha, where socio-economic disparities and healthcare access further complicate child health outcomes [9].

This study was undertaken to evaluate the clinical and anthropometric outcomes of SAM children managed at the NRC of SCB Medical College and Hospital, Cuttack, and to observe their post-discharge progress over 6 months. The results aim to provide evidence-based insights to improve the management protocols and effectiveness of NRC-based interventions in Odisha.

MATERIALS AND METHODS

Study Design and Setting

This was a **hospital-based prospective observational study** conducted in the Department of Pediatrics at **SCB Medical College and Hospital, Cuttack**, Odisha. The study site features a dedicated Nutritional Rehabilitation Centre (NRC) that is responsible for managing children with **Severe Acute Malnutrition (SAM)**.

Study Period: The study was conducted over **nine months**, from **November 2023 to July 2024**.

Sample Size Estimation

Based on the prevalence of severely wasted children in Odisha (6.1%) as reported in the **NFHS-5 Odisha Fact Sheet**, the sample size was calculated using the following formula:

N=Z2·P·(1−P)L2N = \frac{{Z^2 \cdot P \cdot (1 - P)}}{{L^2}}N=L2Z2·P·(1−P)

Where:

- N = Required sample size
- P = Prevalence of SAM = 6.1%
- L = Allowable error = 5%
- Z = 1.96 (for 95% confidence level)

The calculated sample size was **89**. To account for a **10% non-response rate**, the final sample size was rounded to **100 participants**.

Sampling Method

Systematic random sampling was employed to enroll eligible participants admitted to the NRC during the study period.

Inclusion Criteria

4. Children aged **6 months to 5 years** diagnosed with SAM as per **WHO criteria**.
5. Children admitted to the NRC.
6. Caregivers providing **written informed consent** for participation.

Exclusion Criteria

- Children with **severe comorbidities or chronic illnesses** (e.g., congenital heart disease, chronic renal failure).
- Children **previously admitted to NRCs** during the study period.

Methodology

After enrollment, each participant underwent a detailed **baseline assessment**, including:

- **Demographic details** and medical history
- **Anthropometric measurements**: weight, height/length, and **mid-upper arm circumference (MUAC)**
- **Laboratory investigations**: complete blood count (CBC), serum electrolytes

Participants were monitored **daily** during their stay at the NRC for nutritional progress and clinical status. Specific parameters recorded included:

- **Weight gain and MUAC improvements**
- **Clinical response to therapeutic feeding regimens**
- **Medical care and counseling** as per national protocols for SAM management

Post-discharge, participants were followed up for a **period of 6 months** through scheduled **home visits**. During follow-up, the child's nutritional status, anthropometric parameters, incidence of **relapse**, and any complications were documented.

Data Collection Tools

- A **pre-designed, semi-structured questionnaire** to collect socio-demographic and clinical data
- Anthropometric tools for weight, height/length, and MUAC measurements
- Standardized forms for **laboratory results** and **follow-up data**

Statistical Analysis

Data were compiled in **Microsoft Excel (Version 16)** and analyzed using **SPSS software**. A **p-value < 0.05** was considered statistically significant. The following statistical methods were applied:

1. **Descriptive Statistics**: Mean, standard deviation, median, and interquartile range (IQR) for continuous variables; frequency and percentages for categorical variables.
2. **Comparative Analysis**:
   - **Independent t-test** or **Mann-Whitney U test** for continuous variables
   - **Chi-square test** or **Fisher's exact test** for categorical variables
3. **Nutritional Outcomes**:
   - Changes in **weight**, **height**, and **MUAC** from baseline to follow-up were analyzed using **repeated measures ANOVA**.
4. **Morbidity and Mortality Analysis**:
   - Incidences compared using **Chi-square** or **Fisher's exact test**
5. **Recovery Time and Relapse Rate**:
   - Evaluated using **Kaplan-Meier survival analysis** and **log-rank test**

Ethical Considerations

The study protocol was reviewed and approved by the **Institutional Ethics Committee** of SCB Medical College & Hospital, Cuttack. **Informed written consent** was obtained from the caregivers of all participants. Data confidentiality and participant safety were maintained throughout the study per ethical standards outlined in the **Declaration of Helsinki**.

RESULTS AND OBSERVATIONS;

Table 1: Socio-demographic profile of the study participants

Characteristics	**Overall (N=100)**
Age (Months)	
Mean (SD)	18.56 (14.90)
Sex	
Female	38 (38.0%)
Male	62 (62.0%)
Socio-economic status	
Lower	44 (44.0%)
Lower Middle	15 (15.0%)
Upper Lower	33 (33.0%)
Upper Middle	8 (8.0%)

Table 2: Baseline characteristics of the patient at the time of admission

Characteristics	**Overall (N=100)**
Height (cm)	
Mean (SD)	71.42 (10.04)
Weight (Kg)	
Mean (SD)	6.06 (1.85)
MUAC (cm)	
Mean (SD)	10.36 (1.16)
Enema	
0	70 (70.0%)
+	12 (12.0%)
++	10 (10.0%)
+++	8 (8.0%)

Table 3: Clinical characteristics of the study participants at NRC during their hospital stay

Characteristics	**Day-7 (N=100)**	**Day-14 (N=100)**
Height (cm)		
Mean (SD)	71.42 (10.04)	71.43 (10.05)
Weight (Kg)		

Mean (SD)	6.06 (1.85)	6.27 (1.80)
MUAC (cm)		
Mean (SD)	10.36 (1.16)	10.36 (1.16)
Enema		
0	70 (70.0%)	92 (92.0%)
+	12 (12.0%)	4 (4.0%)
++	10 (10.0%)	4 (4.0%)
+++	8 (8.0%)	0 (0.0%)

Table 4: Summary of the effect of NRC treatment on the anthropometric outcome of the study participants

Characteristics	**Day-0**	**Day-7**	**Day-14**	**P value**
Height (cm)				1.00
Mean (SD)	71.42 (10.04)	71.43 (10.05)	71.45 (10.01)	
Weight (Kg)				
Mean (SD)	6.06 (1.85)	6.27 (1.80)	6.58 (1.82)	0.13
MUAC (cm)				
Mean (SD)	10.36 (1.16)	10.36 (1.16)	10.40 (1.17)	0.95

Table 5: Summary of the effect of NRC treatment on the anthropometric outcome during their post-discharge follow-up period of the study participants

Characteristics	**1 month (N=93)**	**2 months (N=80)**	**6 months (N=20)**
Height (cm)			
Mean (SD)	71.25 (10.15)	72.22 (10.31)	74.10 (9.56)
Weight (Kg)			
Mean (SD)	6.87 (1.84)	7.43 (1.85)	8.27 (1.56)
MUAC (cm)			
Mean (SD)	10.36 (1.30)	10.49 (1.30)	11.21 (1.52)

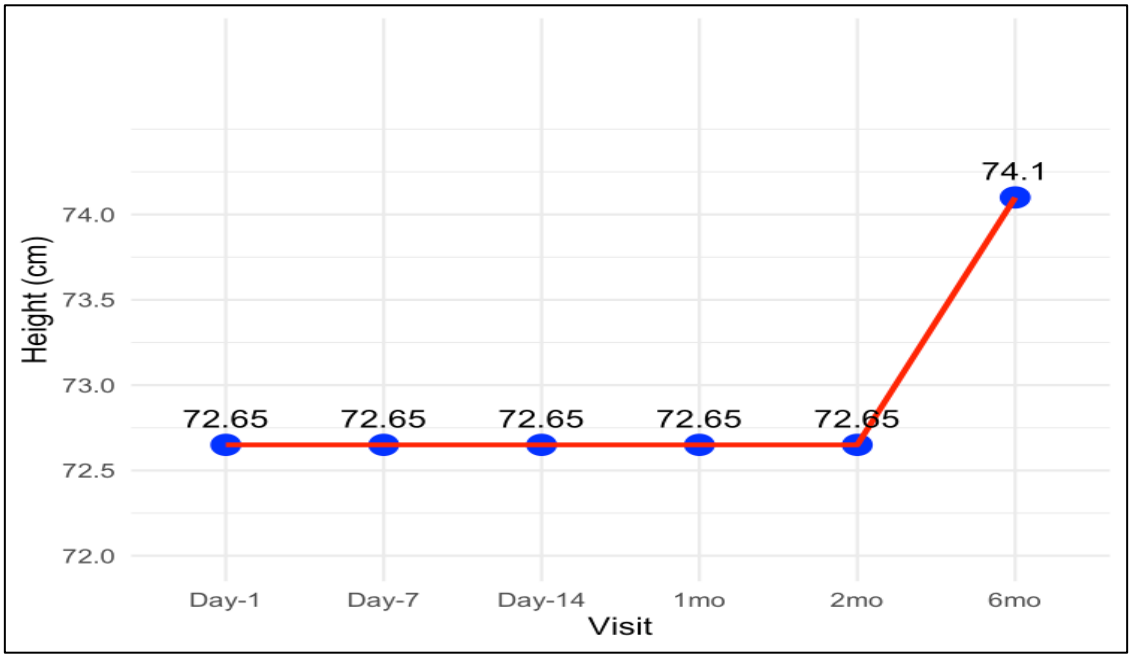

Figure 1: Measurement of Height of the study participants from the day of admission to 6 months follow-up

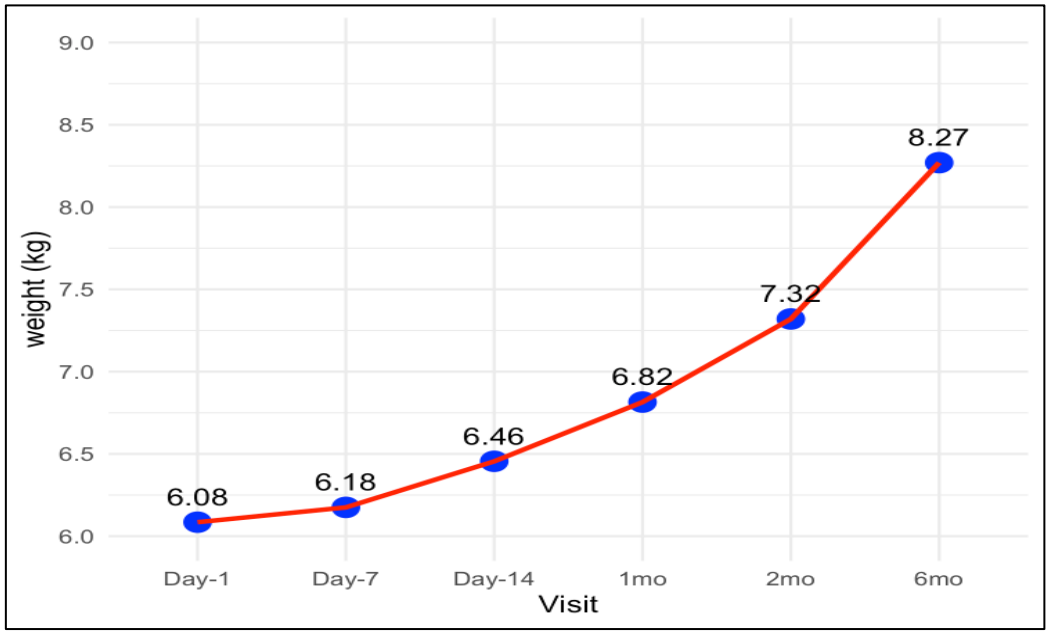

Figure 2: Measurement of weight of the study participants from the day of admission to 6 months follow-up

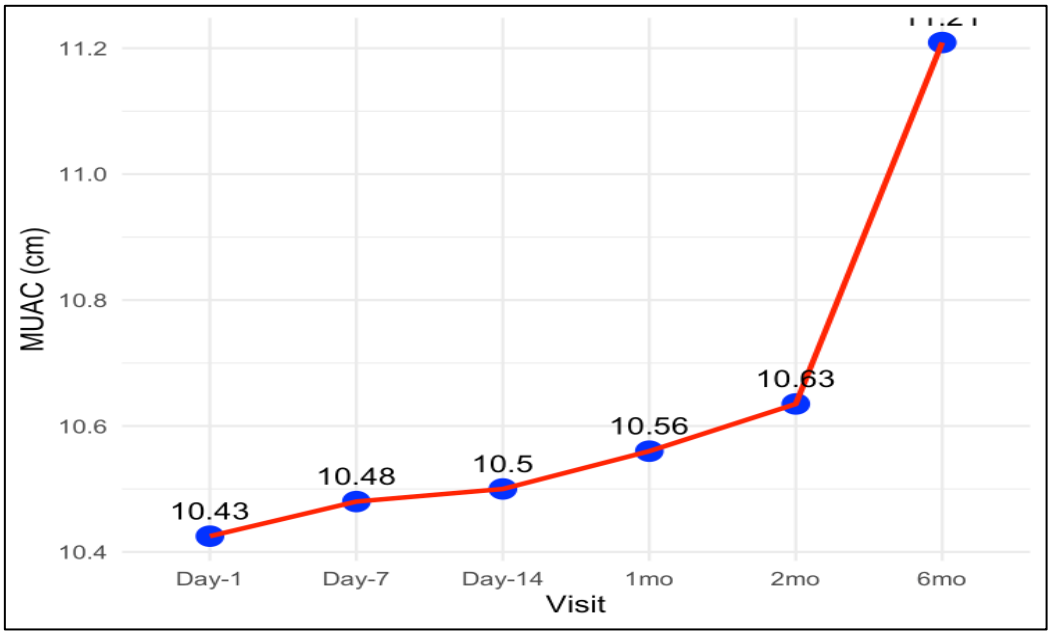

Figure 3: Measurement of MUAC of the study participants from the day of admission to 6 months follow-up

DISCUSSION

This study evaluated the effectiveness of facility-based nutritional rehabilitation provided at the Nutritional Rehabilitation Centre (NRC) of SCB Medical College, Cuttack, in children diagnosed with Severe Acute Malnutrition (SAM). The primary focus was on anthropometric recovery, clinical improvement, and long-term follow-up outcomes over a six-month period.

At admission, the mean weight, MUAC, and height of study participants were 6.06 kg, 10.36 cm, and 71.42 cm, respectively. These findings fall well below the WHO-defined thresholds for SAM [1]. The baseline nutritional and socio-demographic profile revealed that a majority (62%) of the enrolled children were males, with most belonging to lower (44%) or upper-lower (33%) socioeconomic strata—corroborating existing literature that links poverty and food insecurity with malnutrition [2,3].

Inpatient Intervention Outcomes:

During the NRC stay, significant improvements in clinical symptoms were noted, particularly in enema grading, which showed a reduction from 30% at baseline to 8% by Day 14, and complete resolution (+/++/+++) by the second week.

This improvement aligns with findings from Singh et al., where standardized treatment protocols led to the resolution of gastrointestinal symptoms and edema in malnourished children [4].

While **weight gain was observed from 6.06 kg (Day 0) to 6.58 kg (Day 14)**, the change was not statistically significant ($p = 0.13$), possibly due to the short observational window and inter-individual variability in appetite and comorbidities. Studies have noted that weight gain often becomes significant after the initial stabilization phase when children respond to therapeutic feeds [5]. Similarly, MUAC showed minimal change during the two-week NRC stay (mean 10.36 cm to 10.40 cm), consistent with earlier studies that suggest MUAC is a relatively **stable indicator** in short-term interventions [6].

Post-Discharge Outcomes:
A notable and progressive improvement in anthropometric outcomes was observed during follow-up: weight increased to 8.27 kg and MUAC to 11.21 cm at 6 months. This post-discharge gain is indicative of **effective community follow-up**, ongoing nutritional supplementation, and caregiver education, as advocated by national guidelines [7]. The height gain from 71.25 cm to 74.10 cm at six months, although modest, reflects ongoing linear growth—a process known to be delayed in children recovering from SAM [8].

These observations are consistent with similar findings by Bhandari et al., who reported better long-term outcomes in SAM children who received continuous support and monitoring after discharge from NRCs [9]. The progressive catch-up growth observed in our study also supports WHO's recommendation that **post-discharge follow-up is critical** for sustained recovery [10].

Strengths and Limitations:
A key strength of this study was the longitudinal follow-up design, which allowed the evaluation of both short-term and extended recovery outcomes. However, the reduction in sample size during follow-up (from 100 at baseline to 20 at 6 months) may have limited the statistical power to detect differences. Other limitations include the lack of a control group and unmeasured confounders such as maternal education, dietary diversity, and household food security.

Despite these limitations, the study provides important insights into the impact of NRC-based interventions in Odisha, where SAM prevalence remains high. The findings underscore the **importance of early identification, protocol-based management, and structured follow-up**, which collectively contribute to improved recovery and reduced relapse.

CONCLUSION

This prospective observational study highlights the effectiveness of facility-based management of Severe Acute Malnutrition (SAM) at the Nutritional Rehabilitation Centre (NRC) of SCB Medical College, Cuttack. Short-term inpatient care led to clinical stabilization and modest improvements in weight and MUAC, while continued nutritional and caregiver support during follow-up significantly enhanced recovery over six months. The progressive gains in anthropometric parameters post-discharge underscore the importance of structured community follow-up and parental counseling in sustaining recovery and preventing relapse. These findings reaffirm the critical role of NRCs in the holistic management of SAM and emphasize the need for strengthening post-discharge surveillance and integration with community-based programs to ensure long-term nutritional rehabilitation in vulnerable pediatric populations.

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