


Research Article

A Cross-sectional Study on Effectiveness of Nutritional Interventions done in Nutritional Rehabilitation Centre at a Tertiary Care Hospital in Southern District of Odisha

Priti Pratyasha Dandpat¹, D Shobha Malini², Sasmita Kumari Bisoyi¹, Amita Patnaik¹, Sarojini Kesh¹, Durga Madhab Satapathy¹, Sithal Dalai^{*1}

Abstract

Introduction: Malnutrition remains a major public health issue, particularly among children under five, with over 5 million deaths annually. In India, 48% of children are underweight, surpassing rates in neighbouring countries. Programs like the Integrated Child Development Scheme and Nutritional Rehabilitation Centres (NRCs) aim to address this. This study evaluates an NRC in Odisha, focusing on care quality for children with Severe Acute Malnutrition (SAM), caregiver knowledge, and service provider feedback.

Methods: A cross-sectional study was conducted at an NRC over two months, focusing on children under 60 months with SAM. Data were collected through structured questionnaires and interviews.

Results: Bed occupancy rates were 87% in September and 83% in October 2023, with evident staff shortages. Despite perfect food preparation scores, hygiene gaps (e.g., lack of handwashing facilities) were noted. 97% of patients showed recovery, with an average weight gain of 11 ± 6 g/kg/day. However, only 8% of mothers received post-discharge family planning advice.

Conclusion: While the NRC showed positive treatment outcomes, issues like staff shortages, hygiene gaps, and insufficient maternal education need addressing. Targeted improvements in staffing, hygiene, and education are critical for better care and outcomes.

Keywords: Severe acute malnutrition, Underweight, Nutritional Rehabilitation Centre, SAM, NRC

Introduction

Malnutrition is a critical public health issue, particularly among children under the age of five. Globally, it is one of the leading causes of morbidity and mortality in this age group, with over 5 million child deaths attributed to undernutrition each year. In India, 48% of children are underweight, a rate significantly higher than in countries such as Bangladesh and Nepal, and almost double the rates seen in 26 sub-Saharan African nations, where the average stands at 25%[1]. According to the World Health Organization (WHO), malnutrition occurs when there is a cellular imbalance between nutrient intake and the body's demands for growth and maintenance[2]. Factors such as food scarcity, poverty, and traditional beliefs contribute to malnutrition in children, which is often reflected in growth failure[3]. India

Affiliation:

¹Maharaja Krushna Chandra Gajapati Medical College, Berhampur

²Jajati Keshari Medical College & Hospital (JKMCH), Jajpur

*Corresponding author:

Sithal Dalai, Maharaja Krushna Chandra Gajapati Medical College, Berhampur, India.

Citation: Priti Pratyasha, D Shobha Malini, Sasmita Kumari, Amita Patnaik, Sarojini Kesh, Durga Madhab, Sithal Dalai. A Cross-sectional Study on Effectiveness of Nutritional Interventions done in Nutritional Rehabilitation Centre at a Tertiary Care Hospital in Southern District of Odisha. *Fortune Journal of Health Sciences*. 7 (2024): 725-732.

Received: November 29, 2024

Accepted: December 09, 2024

Published: December 30, 2024

accounts for 8 million of the 19 million cases of severe acute malnutrition (SAM) globally[4] The National Family Health Survey (NFHS-5) recorded that 19.3% of Indian children are wasted, with 6.1% severely wasted[5]. In Odisha, the prevalence of wasting among children under five has decreased from 20.4% in NFHS-4 to 18.1% in NFHS-5, with 29.7% of children underweight. SAM is characterized by very low weight for height, visible severe wasting, or nutritional oedema, which increases the risk of death from common childhood diseases such as diarrhoea, measles, and pneumonia[6]. Severely wasted children are nine times more likely to die than well-nourished children[1]. Maternal health is closely linked to childhood malnutrition, with maternal factors like low BMI (<16 kg/m²) and short stature contributing to stunting and SAM in children[7]. To address malnutrition, India has implemented several programs, such as the Integrated Child Development Scheme (ICDS) and the establishment of Nutritional Rehabilitation Centres (NRCs) under the National Rural Health Mission (NRHM) [6,8]. NRCs provide therapeutic feeding and medical care for children with SAM, with government support for operational costs and infrastructure[9].

This study aims to evaluate the operational efficiency of a Nutritional Rehabilitation Centre (NRC) in a southern district of Odisha. The focus is on assessing the effectiveness of nutritional interventions for children with Severe Acute Malnutrition (SAM) and understanding the perspectives of both caregivers and service providers. Key objectives include evaluating the quality of care provided to SAM children, analysing caregivers' knowledge and practices related to feeding and hygiene, and gathering feedback from service providers on care delivery. The study also assesses the infrastructure and operational functionality of the NRC, to propose recommendations for improvement.

Methods

The study was funded under the Short-Term Studentship Program (STS) conducted by the Indian Council of Medical Research (ICMR ID: 2023-00051-protocol available on

website)[10]. This was a cross-sectional mixed method study design, conducted at the Nutritional Rehabilitation Centre (NRC) under the District Head quarter Hospital (DHH), Berhampur over three months (October to December 2023). The sample consisted of children under 60 months of age admitted with Severe Acute Malnutrition (SAM) based on Indian association of Paediatrics criteria [Weight/height or Weight/length < -3 Z score, using the WHO Growth Charts; OR Presence of visible severe wasting; OR Presence of bipedal oedema of nutritional origin; OR mid- upper arm circumference (MUAC) < 115 mm][11]. Participants included children whose mothers provided informed consent. Children whose caretakers did not consent or who were admitted only for follow-up care were excluded from the study. Data were gathered over two months using structured questionnaires designed from literature and National Health Mission (NHM) guidelines[6]. Open-ended interviews were conducted with both caregivers and service providers. The interviews assessed caregivers' knowledge and practices regarding nutrition, feeding, and hygiene, while service providers were questioned about service delivery and operational challenges at the NRC.

Quantitative data were analysed using SPSS-V17 (SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc.), DATAtab (DATAtab Team (2023). DATAtab: Online Statistics Calculator. DATAtab e.U. Graz, Austria. URL <https://datatab.net/>) and MS Excel. Qualitative data analysed manually, followed a grounded theory approach. Themes and subthemes were created based on initial interviews that further modified with subsequent interviews.

Result

The study was conducted in one (DHH) out of Three Nutritional Rehabilitation Centres (NRCs) of Ganjam District, Odisha, India over three months as per the Short-Term Scholarship criteria of ICMR. Data collection involved three primary methods: direct observation, completion of checklists, and interviews with staff and mothers.

Table 1: Types of observation checklists and important components

Observation checklists	Major Components
Staff available	Paediatrician, Nutrition counsellor, Care takers, Cooks
External and internal environment of the Hospital	Hygiene, play area, utilization of space etc
Monitoring Food Preparation[6]	Ingredients available, proper storage, Hygiene, Preparation of food, feeding of the child
Monitoring Ward Procedures.[6]	Feeding, warming, weighing, Providing treatment, Ward environment
Monitoring Hygiene[6]	Hand washing, mother's cleanliness, bedding and laundry, General maintenance, Dishwashing, Toys

(Observation checklists available in the booklet of the monitoring guidelines for the facility-based care of SAM child by the National Health Mission (NHM))[6]

The direct observation (**Table 1**) focused on infrastructure, admission procedures, ward management, hygiene, food preparation, and mother-child interactions. The NRC, a 10-bed facility adjacent to the Obstetric Unit, was observed to have an underutilized outdoor area that could serve as a play space but was overgrown and had stagnant water. The centre should operate with one In-charge (senior paediatric specialist), four ANMs, three caretaker-cum-cooks, and one nutritionist-counsellor, who should manage tasks such as patient intake, record maintenance, and food distribution. However, only three staffs (nutritionist, cook, ANM-one each) are assigned per shift, which is insufficient to meet demand, especially during peak seasons and in case of staff going on leave. The bed occupancy rates were high, at 87% for September and 83% for October 2023 (secondary data). The preparation and feeding procedures scored a perfect 100% (14/14), but staff noted that food portions are occasionally reduced when ingredients are less than required. Mothers are encouraged to persist in feeding their children leftover food by engaging them in play. Hygiene practices were largely in line with guidelines, but notable gaps included the lack of handwashing facilities and soap for mothers, who had to use the bathroom taps and their own soap. Additionally, toys for sensory stimulation were scarce, with only a few old toys available. Despite regular cleaning, the floors were often damp, with food particles and children's urine sometimes present. The survey collected comprehensive data from patients and staff, including sociodemographic information and anthropometric measurements during hospitalization and follow-up. A total of 38 cases were studied, with 25 patients attending the 1st follow-up and 3 attending the 4th follow-up. The average age of mothers was 25±3 years, with each having 2±1 children.

Table 2: Socio-demographic characteristics of the beneficiaries

Variables	Categories	Count	Percentage
Gender of child	Female	25	66%
	Male	13	34%
Education of mother	Illiterate	9	24%
	Primary school	12	32%
	Secondary school and above	17	45%
Number of Living child	1	10	26%
	2	23	61%
	3	5	13%
Caste	General	14	37%
	OBC	1	3%
	SC	14	37%
	ST	9	24%
Residence	Urban	4	11%

	Rural	34	90%
SES (Using Modified Kuppuswamy Scale)	Lower	9	24%
	Lower middle	10	26%
	Upper lower	19	50%
Referred by	NRC Staff	1	3%
	OPD	7	18%
	RBSK	30	79%
Transport to NRC	Accompanied by healthcare worker	31	82%
	Private arrangement	7	18%

Out of those admitted to the NRC, 66% (25) were female children, 45% (17) had mothers with formal education, 61% (23) had mothers with two living children, 90% (34) came from rural areas, and 50% (19) were from an upper-lower socioeconomic background (**Table 2**). Most children 79% (30) were referred by RBSK team and 82% (31) were accompanied by a health worker to NRC. A significant association was found between mother's education and family social status ($\chi^2 = 9.72, p = 0.045$).

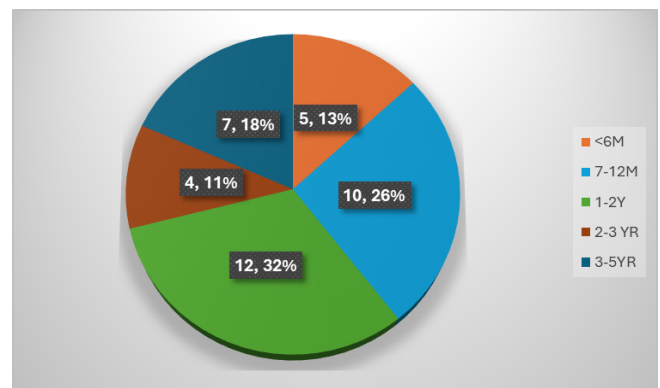


Figure 1: Age distribution of SAM children admitted to NRC

Most children admitted (**Figure 1**) were aged 1–2 years (32%, 12), followed by those aged 7 months to 1 year (26%, 10).

Table 3 reveals that the majority of admitted children are second born (58%), with nearly all fully immunized (97%). Additionally, most mothers took IFA only in the last six months of pregnancy (63%). Exclusive breastfeeding was practiced by 82% (31) of mothers for less than six months, while 58% (22) introduced complementary feeding after 6 months. Significant number of mothers with history of IFA intake for 6 months before delivery were able to exclusive breastfed till 6month ($\chi^2 = 10.122, df=4, p=0.038$). Irregular IFA intake and discontinuation of IFA post childbirth was also an important finding.

Table 3: Personal history of the Children and their mothers

Variables	Categories	Count	Percentage
Birth order of the admitted child	1	14	37%
	2	22	58%
	3	2	5%
Immunization status of the child	partial	1	3%
	full	37	97%
Breastfeeding history	Not breastfed	2	5%
	*EBF <6 month	31	82%
	*EBF for >6 month	5	13%
Started complementary feeding	before 6 months	16	42%
	after 6month	22	58%
History of IFA intake by mother during last pregnancy	Infrequently	7	18%
	Only 6 months before delivery	24	63%
	6 months before and after delivery	7	18%

*Exclusive breast feeding-EBF

Table 4: The Relationship Between Exclusive Breastfeeding and Child Z Scores Upon Admission

Breastfeeding status	Z score			
	<-3		<-4	
	Count	row%	Count	row%
Not breastfed	0	0.00%	2	100.00%
*EBF <6 month	23	74.20%	8	25.80%
*EBF for >6 month	5	100.00%	0	0.00%

*Exclusive breast feeding-EBF

The **Table 4** shows a significant positive association between the longer duration of breastfeeding and better z-scores at admission was noted ($\chi^2 = 7.39, p = 0.025$).

During the admission (**Figure 2**), medical history assessments focused on the child’s primary symptom, often neglecting standard pre-admission guidelines. For example, children with ARI were routinely questioned about cough and recent food intake, but broader history topics, such as diet and breastfeeding, were covered in fewer than 70% of cases. The duration of stay was not significantly associated with the presenting clinical complains.

Exit indicators provide information about the proportion of patients completing the treatment successfully or not successfully (recovered, defaulter, death). They are calculated as a percentage of the total number of exits (discharges) during the reporting month. Exit indicators in **Table 5** shows 97% of patients completing treatment and no deaths. Only 3% of patients were defaulters, well within the acceptable 15% threshold. Patients showed weight gain averaging 11 ± 6 g/kg/day, which exceeds the minimum standard of 8 g/kg/day. The mother of the defaulting female child disclosed

that she abstained from taking vitamin and iron tablets during pregnancy due to cultural beliefs that they could induce abortion. She departed the center prematurely, citing a social event in their village. The admitted child was the third-born, aged 8 months, with two older siblings alive. The mean weight, length, and MUAC at admission were 6.9 ± 2.5 kg, 75.6 ± 14 cm, and 10.2 ± 4.2 cm, respectively.

Table 5: Outcome (Exit) indicators[6]

Indicators	Observed value	Acceptable	Alarming
Recovery rate (total recovered/total exit) (%)	97%	>75%	50%
Non recovery rate (non-recovered/total exit) (%)	0%		
Defaulter rate (total default/total exit) (%)	3%	<15%	>15%
Death/case fatality rate (total death/total exit) (%)	0%	<10%	>15%
Average daily weight gain (g/kg/day)	11 ± 6	>8 g/kg/day	<8 g/kg/day
Average length of stay (mean \pm SD)	<3week	<4 week	>6 week

Table 6: Relation of Weight gain to Duration of stay in the facility

Duration of stay (days)	Good (≥ 10)		Moderate ($5 - < 10$)	
	Count	Column %	Count	Column %
<7	0	0%	0	0%
>14	19	91%	9	100%
Jul-14	2	10%	0	0%

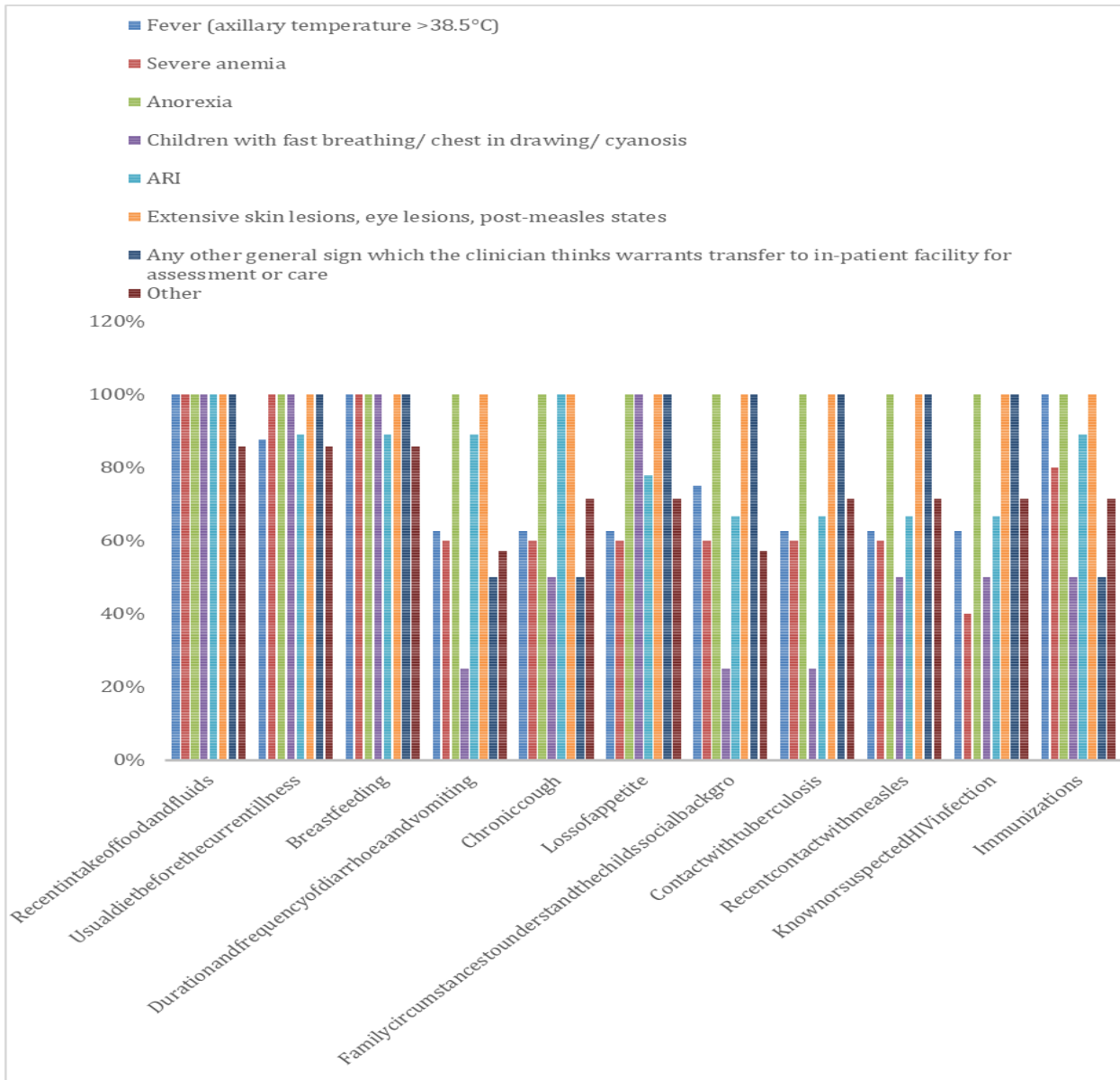


Figure 2: Comparison of history taken with the presenting complain during admission[6]

Statistically significant weight gain (Table 6) was associated with longer stays ($p = 0.0015$), and MUAC improved steadily from admission to follow-up.

There was consistent increase in mean Length, MUAC and Weight of the children over the study cycle since admission till 4th follow up (Figure 3). Till the time of discharge, the mother's counselling about further family planning, awareness regarding danger signs requiring immediate follow up and information regarding the special medications for the child were only 8% (3), 3% (1) and 37% (14) respectively. Inquiry into specific problems about the past diet 47% (18), foods available at home that can be used 74% (28) and counselling on the medications to be continued at home 63% (24) were

also below satisfaction level. Mother's perception showed no statistically significant association with socio-demographic variables such as mother's education, socio-economic status, area of residence, etc.

The qualitative findings gathered from interviews with both mothers and staff at the NRC highlighted several challenges and experiences (Table 7). Institutionally, the staff discussed issues such as early discharge without proper follow-up and bed shortages, particularly during peak months. "We have to bring in extra mattresses, and mothers sleep on the floor with their children," shared the nutritionist. Financial assistance to mothers was consistent, with Rs. 100/day provided during their stay, but no compensation was

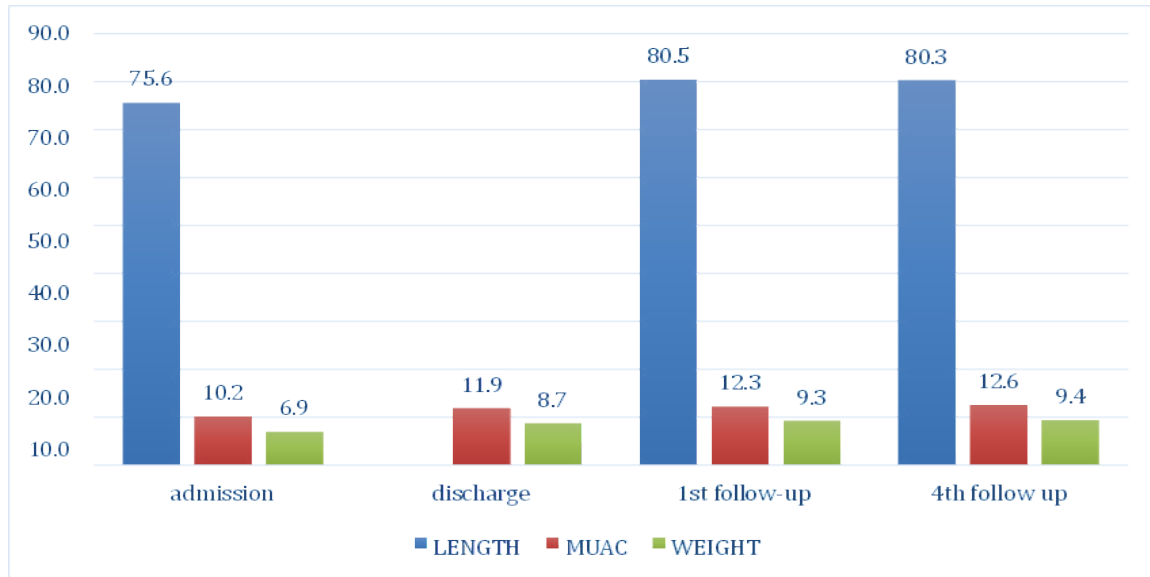


Figure 3: Change in the mean value of various anthropometric measurements over the study period

Table 7: Themes and subthemes emerged from the qualitative data

Serial number	Themes	Sub themes
a	Institutional Data (Interview with the Counsellor cum Nutritionist)	<ol style="list-style-type: none"> 1. Early discharge 2. Bed shortage 3. Financial assistance 4. Cognitive and sensory development 5. Counselling
b	Food Preparation (Interview of Cook cum Attendant)	<ol style="list-style-type: none"> 1. Role overlap 2. Diets 3. Food preparation and recipes 4. Feeding time 5. Staff shortage
c	Patient satisfaction (mother's interview)	<ol style="list-style-type: none"> 1. Maternal health and nutrition <ul style="list-style-type: none"> Challenges in Breastfeeding Lack of Prenatal Care and Nutrition 2. Child Health and Well-being <ul style="list-style-type: none"> Growth development issue Pre-existing health conditions Feeding difficulties Successful treatment 3. Health system and accessibility <ul style="list-style-type: none"> Hygiene Communication barrier due to illiteracy

given if the child was discharged early without a 15% weight gain. Concerns about insufficient play stations were raised by the nutritionist: "We've brought it up, but no real action has been taken." Food preparation faced staff shortages, with attendants doubling as cooks and working without breaks. "We prepare F-100 and other meals, but we're short on hands," the attendant explained. Feeding times and meal quality were maintained, but the staff shortage caused strain. From

the mothers' perspectives, they expressed concerns about their children's health, with one saying, "My baby doesn't show any growth or strength." Another mother mentioned difficulties with feeding, explaining, "At home, my child wasn't eating properly, and the same continued here." While some noted improvements, such as reduced vomiting, others shared dissatisfaction with the overall care: "My child's health worsened, and we had to take him to another doctor."

Hygiene was another concern, with one mother stating, "We were not provided with soap for handwashing, so I had to buy my own." Overall, while most mothers found the services adequate, they identified areas requiring improvement, particularly in staff availability, hygiene, and post-discharge care support.

Discussion

The study utilized various methods of data collection, including observations, informal discussions, questionnaires, and in-depth interviews, to triangulate data and mitigate biases arising from its limited duration and sample size. Findings revealed that while facility infrastructure adhered to established protocols, areas requiring improvement included adequate bedding, hygiene materials, and child-friendly environments. Despite sufficient space, the external surroundings lacked stimulation, adversely affecting children's cognitive development, an aspect often overlooked in prior studies[1,12–14]. Demographically, most patients came from marginalized communities, with a significant correlation between maternal education and family social status. Notably, 61% of patients belonged to Scheduled Castes and Tribes, echoing previous findings on early childhood malnutrition in such populations[3,13]. The study found that higher IFA intake during pregnancy was linked to better breastfeeding outcome not explored much previously. History taking during admission was not satisfactory with missing clues to important indicators like breastfeeding, immunization history etc. This has not been explored in previous studies[4,13–15].

Regarding clinical outcomes, the discharge criteria for infants and children were stringently followed, with an impressive 87% achieving targeted weight gain (>15%) upon discharge, surpassing recovery rates reported in prior literature[13]. Counselling on further family planning, awareness of danger signs, different playing methods for child's neuro cognitive and sensory-motor development were not much touch upon unlike the study by Tandon et al. that reported 3/4th of participant receiving the same[1,2]. Weight gain was positively associated with the duration of stay in the facility, but the duration of stay was not significantly associated with the presenting clinical complaints. The absence of follow-up arrangements in case of early discharge from the center and staff shortages further complicated care delivery, underlining the need for qualitative explorative studies on patient satisfaction, which remain under-researched [13–15]. The study's generalizability is limited by its single-centre scope and brief duration, highlighting the need for additional research in varied settings to confirm these results and address existing gaps. Interviews with relevant program managers and administrative staff could not be conducted due to lack of consent. However, a key strength of this study is

its comprehensive assessment including the observation and interviews, and future research should take a broad approach, examining all aspects of the centre rather than focusing solely on exit indicators.

Conclusion

The comprehensive assessment of the Nutritional Rehabilitation Centre (NRC) shed light on both its strengths and areas for enhancement. Notably, the meticulous record-keeping, proficient food preparation, and positive treatment outcomes underscored the facility's competence. However, operational challenges such as inadequate discharge follow-up, seasonal bed shortages, and financial assistance discrepancies were identified, emphasizing the need for administrative improvements. Moreover, qualitative insights revealed concerns regarding hygiene, staff shortages, and maternal education gaps, calling for targeted interventions to enhance overall care quality. Addressing these issues, including bolstering staff numbers, improving hygiene infrastructure, and providing tailored maternal education, can significantly elevate the facility's effectiveness and ensure better outcomes for both mothers and children.

Acknowledgement

We would like to express our gratitude to the district administration and NRC staff for permitting us to carry out the study. Our heartfelt thanks also go to the parents and children for their patience and cooperation during the physical exams and interviews. Finally, we are grateful to ICMR for the scholarship program that provided undergraduate students with the opportunity to conduct research and gain valuable firsthand experience.

Source of funding:

Short-Term Studentship Program (STS) conducted by the Indian Council of Medical Research (ICMR ID: 2023-00051)

Conflicts of Interest

The authors declare that they have no conflict of interest.

References

1. Tandon M, Quereishi J, Prasanna R, Tamboli AF, Panda B. Performance of Nutrition Rehabilitation Centers: A Case Study from Chhattisgarh, India. *Int J Prev Med* 10 (2019): 66.
2. Panda M, Nanda S, Murmu M, Giri R, Debi L. Evaluation of the outcome indicators of a Nutritional Rehabilitation Center in Eastern India. Published online 2019 (2024).
3. Rastogi S, Maheshwari C, Raghav SK, Muzammil K. A prospective observational study to evaluate the efficacy of facility-based management in malnourished children at

- NRC, district Meerut. *J Family Med Prim Care* 7 (2018): 1341.
4. Hurlihal S, Vidya G, Varalakshmi R. Clinicoepidemiological profile of severe acute malnutrition children admitted to the nutritional rehabilitation center of a tertiary care center in Davangere: A retrospective study. *Indian Journal of Health Sciences and Biomedical Research (KLEU)* 16 (2023): 256.
 5. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5), 2019-21: India. 2021 (2024).
 6. Ministry of Health and Family Welfare Government of India. *Participant Manual for Facility Based Care of Severe Acute Malnutrition*. NRHM; 2013 (2024).
 7. Choedon T, Dinachandra K, Sethi V, Kumar P. Screening and Management of Maternal Malnutrition in Nutritional Rehabilitation Centers as a Routine Service: A Feasibility Study in Kalawati Saran Children Hospital, New Delhi. *Indian J Community Med* 46 (2021): 241.
 8. Verma DK, Varghese A, Agarwal M, Singh VK, Chandrakanta C. Outcome of Nutritional Rehabilitation Centre based care for children with Severe Acute Malnutrition in Uttar Pradesh, India: Cross sectional Study. *International Journal of Health and Allied Sciences* 11 (2022).
 9. THE MINISTER OF HEALTH AND FAMILY WELFARE. Digital Sansad. Published online (2023).
 10. Short-Term Studentship (STS) | Indian Council of Medical Research | Government of India. Accessed October 30 (2024).
 11. Consensus Statement of the Indian Academy of Pediatrics on Integrated Management of Severe Acute Malnutrition.
 12. Bhanat NJ, Mall A. Effect of nutritional intervention on anthropometric measurements of malnourished children at Nutritional Rehabilitation Center, Civil Hospital Ahmedabad under “Mission Balam Sukham” scheme. *J Family Med Prim Care* 11 (2022): 696.
 13. Katole A, Naik G, Kujur A, Kumar M. Performance appraisal of nutritional rehabilitation centers in central India: A retrospective facility-based descriptive study. *Indian Journal of Community Medicine* 47 (2022): 272-276.
 14. Bande B, Agrawal Varshney G, Gupta S, Agrawal A, Sethia SS, Verma P. Socio-Economic Factors, Feeding Behavior and Hygiene of Children Admitted to the Nutritional Rehabilitation Center at a Secondary Care Hospital. *Caspian Journal of Pediatrics* 8 (2022): 624-632.
 15. Austin D, Prakash A. Connecting the Dots in Nutritional Rehabilitation: A Qualitative Study on ICT and Community Based Care. Published online August 22 (2021).