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Original Research Article

Outcome of Nutritional Intervention Measures at Nutritional Rehabilitation Centre District Hospital

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Abstract:

Objective: The study aimed to examine the improvements in anthropometric indicators, such as weight gain and mid-upper arm circumference (MUAC), among children who were treated at the Nutritional Rehabilitation Center (NRC) in the district hospital of Koppal.

Methodology: This prospective observational analysis was conducted over 12 months, from January 2024 to December 2024. Children with SAM were identified according to World Health Organization (WHO) guidelines, defined as a weight-for-height Z-score of less than -3 standard deviations (SD) or the presence of nutritional edema. Children with MAM were defined as those with a weight-for-height Z-score between -2 SD and -3 SD. Children with both SAM and MAM diagnoses who were admitted to the NRC and completed the entire nutritional rehabilitation program were included in the study. Data were collected through hospital records, structured interviews with caregivers, and direct anthropometric measurements.

Results: In the severe acute malnutrition (SAM) category, a total of 50 children were included. The mean weight of this group was 5.4 ± 0.9 kg, with a mean height of 60.3 ± 3.5 cm and a mean MUAC of 10.4 ± 0.4 cm. These measurements reflect the severe nutritional deficits characteristic of SAM. In the moderate acute malnutrition (MAM) category, which included 165 children, the mean weight was significantly higher at 7.6 ± 1.2 kg. Similarly, the mean height and MUAC were also greater in this group, recorded at 73.2 ± 4.2 cm and 11.8 ± 0.8 cm, respectively. The differences between the two groups were statistically significant for all three parameters, with p-values <0.0001. The substantially lower weight, height, and MUAC in the SAM group emphasize the critical severity of malnutrition in this category.

Conclusion: In conclusion, the findings of this study underscore the effectiveness of nutritional interventions implemented at the Nutritional Rehabilitation Center (NRC) in Koppal in addressing malnutrition among children.

Keywords: Nutritional intervention measure, severe malnutrition, moderate malnutrition, social class.

Introduction

Malnutrition remains one of the most critical public health challenges in many low- and middle-income countries, contributing to a significant burden of illness and death, especially among children. Nutritional Rehabilitation Centers (NRCs) have emerged as a key strategy to combat this crisis. These centers provide life-saving care to children suffering from severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) by combining medical treatment, nutritional interventions, and caregiver education.

This study examines the outcomes of such interventions at the NRC in the district hospital of Koppal, a region deeply affected by malnutrition [1]. Child malnutrition is a complex issue caused by inadequate food intake, poor hygiene, recurrent infections, and socioeconomic factors. According to global estimates, nearly 45% of all deaths among children under the age of five are linked to undernutrition [2]. In India, the problem is particularly acute. The National Family Health Survey-5 (NFHS-5) reports that 33.1% of children under five are stunted, 19.3% are wasted, and 35.5% are underweight, reflecting a dire need for effective interventions [3]. NRCs, including the one in Koppal, aim to address this crisis by providing intensive, facility-based care for children in critical need.

At the NRC, children are offered therapeutic feeding, micronutrient supplementation, and medical stabilization, while caregivers receive counseling to promote healthy practices at home. These centers follow standardized protocols to achieve short-term recovery and prevent future

relapse [4]. Yet, the success of NRCs depends on the quality of care, consistent implementation of interventions, and follow-up to ensure children maintain their progress after discharge. Studies have shown that NRCs can improve key health indicators, such as weight gain and mid-upper arm circumference (MUAC), and reduce mortality [5]. However, challenges such as caregiver compliance, resource limitations, and high relapse rates highlight the need for further research to optimize their impact [6].This study focuses on the outcomes of nutritional interventions at the Koppal district NRC. It aims to assess improvements in weight, MUAC, and other anthropometric measures while evaluating retention rates, relapse rates, and the effectiveness of follow-up care. By analyzing these factors, the study seeks to provide a comprehensive understanding of how NRC-based interventions address malnutrition and identify areas where outcomes can be improved [7.8].The findings from this research are expected to have practical implications for strengthening NRC programs across India. Understanding the effectiveness of the measures implemented in Koppal can help policymakers and healthcare providers improve the design and delivery of nutritional rehabilitation services.

Objectives

The study aimed to achieve the following objectives:

1. To examine the improvements in anthropometric indicators, such as weight gain and mid-upper arm circumference (MUAC), among children who were treated at the Nutritional Rehabilitation Center (NRC) in the district hospital of Koppal.
2. To evaluate the retention rates of children during their stay at the NRC and after completing the intervention program.
3. To analyze the relapse rates of children following their discharge from the NRC and identify the factors contributing to these relapses.

Methodology

This prospective observational analysis was conducted over 12 months, from January 2024 to December 2024, at the Nutritional Rehabilitation Center (NRC) of the District Hospital in Koppal.

The NRC provides comprehensive care for managing pediatric malnutrition, encompassing nutritional therapy, medical treatment, and caregiver education. A total of 300 participants were included in the study, comprising children aged 6 months to 5 years diagnosed with Severe Acute Malnutrition (SAM) or Moderate Acute Malnutrition (MAM), along with their respective caregivers.

Participants were selected based on specific inclusion criteria. Children with SAM were identified according to World Health Organization (WHO) guidelines, defined as a weight-for-height Z-score of less than -3 standard deviations (SD) or the presence of nutritional edema. Children with MAM were defined as those with a weight-for-height Z-score between -2 SD and -3 SD. Children with both SAM and MAM diagnoses who were admitted to the NRC and completed the entire nutritional rehabilitation program were included in the study. Additionally, caregivers were required to provide written, informed consent to participate.

Exclusion criteria encompassed children with congenital anomalies, persistent illnesses, or comorbidities requiring specialized medical care (e.g., cerebral palsy, congenital heart disease). Children who left the NRC against medical advice failed to complete the intervention program, or had incomplete medical records or missing follow-up data were also excluded.

Data were collected through hospital records, structured interviews with caregivers, and direct anthropometric measurements. Baseline parameters recorded included the child's age, gender, weight, height, mid-upper arm circumference (MUAC), and medical history. Intervention-specific details were also documented, such as the duration of hospitalization, type of therapeutic nutrition provided, medical treatments administered, and adherence to intervention protocols. The primary outcomes of the study were improvements in weight-for-height Z-scores and MUAC at the time of discharge. Secondary outcomes included the rate of weight gain, expressed in grams per kilogram per day (g/kg/day), duration of hospitalization, and results of post-discharge follow-ups. Follow-up assessments monitored the sustainability of nutritional recovery and identified potential relapses or complications. Post-discharge follow-up assessments were conducted monthly for three months to evaluate the children's progress and reinforce optimal caregiving practices.

Data analysis was conducted using SPSS version 26. Descriptive statistics were used to summarize baseline characteristics, including means and standard deviations. Based on data distribution, paired t-tests or Wilcoxon signed-rank tests were employed to evaluate changes in anthropometric parameters (weight and MUAC) before and after the intervention. Statistical significance was set at a p-value of less than 0.05. This robust methodological approach ensured the comprehensive evaluation of the impact of NRC-based nutritional interventions on children with both SAM and MAM, thereby providing valuable insights for optimizing care delivery.

Results

The table 1 presents a comparative analysis of anthropometric measurements across two age groups (0–2 years and 2–5 years) and genders, highlighting mean weight, height, and mid-upper arm circumference (MUAC) along with their respective p-values to assess statistical significance. In the 0–2 years age group, the total sample comprised 45 males and 40 females. The mean weight of males was recorded as 6.1 ± 0.8 kg, while females exhibited a comparable mean weight of 6 ± 0.7 kg. For height, males had a mean of 64.5 ± 3.2 cm, marginally higher than the female mean of 63.8 ± 3 cm. MUAC measurements showed a slight difference, with males recording 11.2 ± 0.5 cm and females 11.1 ± 0.4 cm. Statistical analysis indicated no significant differences between males and females in this age group for weight (p = 0.53), height (p = 0.48), or MUAC (p = 0.07), suggesting that nutritional status was comparable across genders in younger children. In the 2–5 years age group, the total sample included 75 males and 55 females. Males demonstrated a mean weight of 8.2 ± 1.2 kg, slightly higher than females, whose mean weight was 8 ± 1.1 kg. For height, males recorded a mean of 85.4 ± 4.5 cm, which was slightly greater than the mean height of females at 84.3 ± 4.3 cm. Similarly, MUAC values showed marginal differences, with males having a mean of 11.9 ± 0.6 cm and females 11.7 ± 0.5 cm. In this age group, the p-value for weight (p = 0.032) indicated a statistically significant difference between males and females, suggesting that males had slightly higher weight. However, no significant differences were observed for height (p = 0.12) or MUAC (p = 0.25).

Table 1: Comparison of anthropometric measurements across age groups and gender

Age group	Total N (%)	Mean weight (kg)	p value	Mean height (cm)	p-value	Mean MUAC (cm)	p-value
0-2 years			0.53		0.48		0.07
Male	45	6.1 ± 0.8		64.5 ± 3.2		11.2 ± 0.5	
Female	40	6 ± 0.7		63.8 ± 3		11.1 ± 0.4	
2 to 5 years			0.032		0.12		0.25
Male	75	8.2 ± 1.2		85.4 ± 4.5		11.9 ± 0.6	
Female	55	8 ± 1.1		84.3 ± 4.3		11.7 ± 0.5	

In the severe acute malnutrition (SAM) category, a total of 50 children were included. The mean weight of this group was 5.4 ± 0.9 kg, with a mean height of 60.3 ± 3.5 cm and a mean MUAC of 10.4 ± 0.4 cm.

These measurements reflect the severe nutritional deficits characteristic of SAM. In the moderate acute malnutrition (MAM) category, which included 165 children, the mean weight was significantly higher at 7.6 ± 1.2 kg. Similarly, the mean height and MUAC were also greater in this group, recorded at 73.2 ± 4.2 cm and 11.8 ± 0.8 cm, respectively. The differences between the two groups were statistically significant for all three parameters, with p-values <0.0001.

The substantially lower weight, height, and MUAC in the SAM group emphasize the critical severity of malnutrition in this category.

Table 2: Z-score category

Z-score category	N (%)	Mean weight (kg)	Mean height (cm)	Mean MUAC (cm)	p-value
Severe acute malnutrition	50	5.4 ± 0.9	60.3 ± 3.5	10.4 ± 0.4	<0.0001
Moderate acute malnutrition	165	7.6 ± 1.2	73.2 ± 4.2	11.8 ± 0.8	<0.0001

In the 0–2 year's age group, the mean weight at admission was 6.38 ± 1.37 kg, which increased to 7.19 ± 1.64 kg at discharge. Although this reflects a positive trend in weight gain, the p-value of 0.06 indicates that the change was not statistically significant. This result may suggest that weight gain in younger children requires more time or specific intervention strategies to achieve significant improvements. In the 2–5 years age group, the mean weight at admission was 7.85 ± 1.61 kg, which increased significantly to 8.79 ± 1.87 kg at discharge, with a p-value of 0.01. This indicates that the nutritional interventions provided were effective in promoting weight gain in this age group. The greater response in the older age group may be attributed to better physiological adaptation to therapeutic diets and potentially fewer feeding-related challenges compared to younger children (Table 3).

Table 3: Changes in weight at admission and discharge

Weight at age interval	Admission (Mean and SD)	Discharge (Mean and SD)	p-value
0-2 years	6.38 ± 1.37	7.19 ± 1.64	0.06
2 to 5 years	7.85 ± 1.61	8.79 ± 1.87	0.01

Children in the general BPL category exhibited the most severe nutritional deficits, with a mean weight of 5.5 ± 0 kg, height of 62 ± 0.0 cm, and MUAC of 10 ± 0.0 cm. additionally, their duration of stay was the longest at 18 ± 0.0 days. This prolonged duration reflects the severity of their malnutrition and highlights the significant challenges faced by this group in achieving nutritional recovery.

These findings suggest limited baseline health and resources, leading to slower progress during rehabilitation. In the BPL-2A category, children showed marked improvement, with a mean weight of 6.52 ± 0.92 kg, height of 71.50 ± 4.85 cm, and MUAC of 11.68 ± 0.51 cm. The duration of stay for this group was significantly shorter at 7.17 ± 2.93 days. This suggests that while these children may have faced nutritional challenges, their baseline health status or access to resources likely allowed for quicker recovery compared to the general BPL category. The BPL-3B category recorded a mean weight of 5 ± 0 kg, height of 70 ± 0.0 cm, and the highest MUAC among all categories at 12.50 ± 0.0 cm. Despite the improved MUAC, the weight and height remained relatively low, and the duration of stay was 10 ± 0 days. This indicates a mixed pattern of outcomes, suggesting that while some aspects of recovery were achieved, challenges in achieving overall nutritional balance may remain. Children in the BPL-OBC category demonstrated the best anthropometric indicators overall, with a mean weight of 7.10 ± 1.40 kg, height of 75.34 ± 9.05 cm, and MUAC of 11.73 ± 0.63 cm.

Their duration of stay was 10.17 ± 3.21 days, reflecting a more favorable response to interventions. These results suggest that children in this category may have benefitted from better baseline health or additional socioeconomic support, enabling faster and more effective recovery. The BPL-SC category showed moderate outcomes, with a mean weight of 6.76 ± 1.33 kg, height of 73.78 ± 8.67 cm, and MUAC of 11.63 ± 0.51 cm. Their average duration of stay was 9.39 ± 2.68 days. These results indicate better recovery compared to the general BPL category, but not as pronounced as in the BPL-OBC group, suggesting the presence of some support systems, but not at an optimal level.

Table 4: Comparison of anthropometric measurements across social classes

Category	Weight Mean ± SD	Height Mean ± SD	MAC Mean ± SD	Duration of stay Mean ± SD
BPL	5.5 ± 0	62 ± 0.0	10 ± 0.0	18 ± 0.0
BPL-2A	6.52 ± 0.92	71.50 ± 4.85	11.68 ± 0.51	7.17 ± 2.93
BPL-3B	5 ± 0.0	70 ± 0.0	12.50 ± 0.0	10 ± 0
BPL-OBC	7.10 ± 1.40	75.34 ± 9.05	11.73 ± 0.63	10.17 ± 3.21
BPL-SC	6.76 ± 1.33	73.78 ± 8.67	11.63 ± 0.51	9.39 ± 2.68

During the first month, the retention rate was exceptionally high at 95%, indicating strong adherence to follow-up care in the immediate post-discharge period. The improvement in mid-upper arm circumference (MUAC) was modest at 0.2%, suggesting slow but steady progress in the recovery of nutritional status.

The relapse rate during this period was 2%, reflecting the initial effectiveness of the nutritional interventions in preventing early setbacks. By the second month, the retention rate experienced a slight decline to 90%, indicating a drop in follow-up participation, which is a commonly reported challenge in rehabilitation programs. MUAC improvement increased marginally to 0.3%, demonstrating continued but gradual progress in nutritional recovery. However, the relapse rate rose to 3%, highlighting the increasing vulnerability of children as the intensity of follow-up support began to decline. In the third month, the retention rate further decreased to 85%, suggesting a continued reduction in caregiver participation, potentially due to logistical challenges or diminishing motivation to attend follow-up appointments.

MUAC improvement remained consistent at 0.3%, indicating sustained, albeit limited, recovery in nutritional status. Nevertheless, the relapse rate increased to 5%, emphasizing the heightened risk of nutritional deterioration over time as external support and monitoring reduced (Table 5).

Table 5: Follow-up metrics with retention, MUAC improvement, and relapse rates

Follow-up	Retention (%)	MUAC improvement (%)	Relapse rate (%)
1st Month	95%	0.2%	2%
/nd month	90%	0.3%	3%
3rd month	85%	0.3%	5%

Discussion:

The results of this study underscore the effectiveness of nutritional interventions at the

Nutritional Rehabilitation Center (NRC) in Koppal District Hospital, focusing on improvements in anthropometric measurements, retention rates, and relapse rates across various demographic groups.

These findings reveal the multifaceted relationship between age, gender, nutritional status, and socioeconomic class, emphasizing the pivotal role of structured interventions in mitigating malnutrition. The comparison of anthropometric measurements across age groups and gender (Table 1) showed that males generally had slightly higher mean weights, heights, and mid-upper arm circumferences (MUAC) compared to females in both age groups. However, these differences were not statistically significant, except for weight in the 2 to 5 years age group ($p = 0.032$). This finding aligns with earlier studies that have documented gender-based disparities in anthropometric outcomes but often failed to establish statistical significance, likely due to the shared socioeconomic and environmental factors impacting both genders equally. These results are consistent with the findings of Panda and Giri (2019), who reported significant weight gain among children treated in NRCs in Eastern India, particularly in older age groups [9]. However, the absence of substantial weight improvement in the younger age group in this study highlights the need for age-specific nutritional protocols, a challenge also identified by Dhawan and Tripti (2023), who emphasized the difficulties in addressing malnutrition among infants [10].

The evaluation of children categorized by their Z-scores revealed significant differences between those with severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) for weight, height, and MUAC ($p < 0.0001$ for all). Children in the SAM group had significantly lower anthropometric measures, reflecting the severity of their nutritional deficits. These results are consistent with previous study by Kulkarni and Mamidi (2019), who also reported substantial differences in weight, height, and MUAC between SAM and MAM groups, reinforcing the greater vulnerability of children with SAM [11].

Weight changes observed between admission and discharge revealed significant improvements in the 2 to 5 years age group ($p = 0.01$), while changes in the 0 to 2 years age group were not statistically significant ($p = 0.06$). This indicates that older children may respond more effectively to NRC interventions, potentially due to differences in metabolic rates or better tolerance to therapeutic diets. Similar results were reported by Varghese (2019), who found that children treated in NRCs exhibited an average weight gain of more than 15% [12]. The lack of significant weight gain in this study's 0 to 2 years group may reflect slower metabolic adaptation or feeding-related challenges in younger children. These findings are consistent with observations by Dasgupta et al. (2014), who identified slower recovery rates among infants in NRCs and recommended enhanced caregiver education and follow-up support to address these challenges [6].

The analysis of anthropometric measurements across social classes revealed that children from the Below Poverty Line (BPL) category, without additional classification (BPL-2A, BPL-OBC, etc.), had the lowest weight, height, and MUAC values, highlighting their severe socioeconomic disadvantages. In contrast, children from the BPL-OBC and BPL-SC subcategories demonstrated better nutritional indicators, likely reflecting improved access to resources and support systems within these groups. These results align with the findings of Mishra et al [13], who reported that socioeconomic disparities significantly influence nutritional recovery rates in NRCs in Uttar Pradesh. Both studies emphasize the importance of addressing socioeconomic barriers, such as access to nutritious diets and healthcare services, as an integral part of malnutrition management.

The follow-up data demonstrated high retention rates during the first month (95%), which gradually declined to 85% by the third month. These trends are consistent with those reported by Dhawan and Tripti (2023), who observed similar declines in retention over time despite low relapse rates attributed to well-structured follow-up programs [10]. Kaegi et al also highlighted the necessity of robust post-discharge care and community engagement to sustain long-term nutritional improvements, supporting the need for strengthened follow-up systems, as indicated in this study [14]. Improvements in MUAC were modest (0.2%-0.3%) but sustained over the follow-up period, reflecting slow but steady progress. The relapse rates, ranging from 2% to 5%, underscore the ongoing vulnerability of children, even after completing NRC interventions.

Conclusion

In conclusion, the findings of this study underscore the effectiveness of nutritional interventions implemented at the Nutritional Rehabilitation Center (NRC) in Koppal in addressing malnutrition among children. However, the results also highlight critical areas requiring further attention, including the need for tailored interventions specifically designed for younger children, strategies to mitigate the impact of social inequalities, and the development of robust post-discharge support systems to sustain recovery. Future research should prioritize the formulation of age-specific nutritional protocols, a comprehensive evaluation of long-term outcomes, and the integration of community-based approaches to complement facility-based care. By addressing

these gaps, NRCs can significantly enhance their role in combating malnutrition and contributing to improved health outcomes for children in vulnerable populations.

References

1. UNICEF. Malnutrition contributes to nearly half of all child deaths worldwide. Available from: https://www.unicef.org/nutrition
2. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet. 2013; 382(9890):427-51.
3. International Institute for Population Sciences (IIPS) and Ministry of Health and Family Welfare. National Family Health Survey (NFHS-5), India. Available from: https://www.mohfw.gov.in
4. National Health Mission. Operational Guidelines on Facility-Based Management of Severe Acute Malnutrition (2011). Government of India. Available from: https://nhm.gov.in
5. Burza S, Mahajan R, Marino E, Sunyoto T, Shandilya C, Tabrez M, et al. Community-based management of severe acute malnutrition in India: new evidence from Bihar. The American Journal of Clinical Nutrition. 2015; 101(4):847-59.
6. Dasgupta R, Sinha D, Yumnam V. Management of severe acute malnutrition: Lessons learnt and the way forward. Indian Pediatrics. 2014; 51(3):186-91.
7. Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S, et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? The Lancet. 2013; 382(9890):452-77.
8. Sadler K, Kerac M, Collins S, Khara T, Nesbitt A, Frykberg E. Community-based therapeutic care in non-emergency contexts: Malawi. Field Exchange. 2008; 34:1-6.
9. Panda M, Nanda S, Murmu MC, Giri RC, Debi LL. Evaluation of the performance of a nutrition rehabilitation centre in a tertiary care hospital in Eastern India. Int J Community Med Public Health 2019; 6:1728-33.
10. Dhawan T, Singh KN. A review study on the effectiveness of Nutrition Rehabilitation Centers in the field of severe acute malnutrition. Biological Forum – An International Journal. 2023; 15(2):702-707.
11. Kulkarni B, Mamidi RS. Nutrition rehabilitation of children with severe acute malnutrition: Revisiting studies undertaken by the National Institute of Nutrition. Indian Journal of Medical Research. 2019; 150:139-52. doi: 10.4103/ijmr.IJMR_1905_18.
12. Verma DK, Varghese A, Agarwal M, Singh VK, Chandrakanta. 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. 2022; 11:21-26.
13. Mishra P, Chaurasia H. Nutrition status and socio-economic inequality among children (0-59 months) across different regions of Uttar Pradesh. International Journal of Scientific Reports. 2021; 7:532-543.
14. Kaegi-Braun N, Kilchoer F, Dragusha S, Gressies C, Faessli M, Gomes F, Deutz NE, Stanga Z, Mueller B, Schuetz P. Nutritional support after hospital discharge improves long-term mortality in malnourished adult medical patients: Systematic review and meta-analysis. Clin Nutr. 2022 Nov; 41(11):2431-2441. doi: 10.1016/j.clnu.2022.09.011.