SRYAHWA PUBLICATIONS

Archives of Pediatrics and Neonatology
ISSN: 2638-5155 | Volume 8, Issue 1, 2025
https://doi.org/10.22259/2638-5155.0801004

RESEARCH ARTICLE

Nutritional Interventions to Improve Outcomes in Children Undergoing Cancer Therapy-A 50 Case Study

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Received: 28 November 2025 Accepted: 15 December 2025 Published: 24 December 2025

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Abstract

Background: Malnutrition is common in pediatric oncology and is associated with increased treatment toxicity, infections, treatment interruptions, and poorer quality of life. Early nutritional assessment and targeted interventions (dietary counseling, oral nutritional supplements (ONS), enteral and parenteral support) may improve biochemical/nutritional status and clinical outcomes.

Objective: To evaluate the effect of a structured nutritional intervention program on nutritional and clinical outcomes in 50 children receiving cancer therapy.

Methods: We performed a prospective single-center cohort study of 50 consecutive pediatric oncology patients (age 1–17 years) enrolled into a nutrition program at diagnosis or early during therapy. Interventions included standardized nutritional assessment, individualized dietary counseling, ONS, proactive enteral feeding for high-risk patients, reactive enteral feeding for those with progressive weight loss, and parenteral nutrition when enteral routes were not feasible. Primary outcome was change in BMI/weight-for-age z-score at 3 months. Secondary outcomes included infection rate (grade ≥3), chemotherapy delays (>7 days), hospital length of stay (LOS), and patient/caregiver-reported feeding-related quality of life (QoL). Paired comparisons (baseline vs 3 months) were performed.

Results: Mean age was 7.2 years (SD 4.1); 28 (56%) male. Cancer types: leukemia 22 (44%), solid tumors 18 (36%), brain tumors 10 (20%). Interventions: ONS + counseling 30 (60%); proactive enteral 10 (20%); reactive enteral 5 (10%); parenteral nutrition 5 (10%). Mean baseline BMI z-score was −0.97 (SD 0.68) and improved to −0.59 (SD 0.64) at 3 months (mean change +0.38, paired t-test $p<0.001$). Forty-nine patients (98%) had measurable improvement or stabilization of z-score; 32 (64%) gained ≥0.5 z-score. Grade ≥3 infections occurred in 12/50 (24%); chemotherapy delays >7 days occurred in 8/50 (16%). Median hospital LOS per major admission was 7 days (IQR 5–12). Caregiver-reported feeding QoL improved in 68% of families.

Conclusions: In this 50-case cohort, structured nutritional interventions were associated with significant improvement in anthropometric indices at 3 months and acceptable clinical outcomes. These data support

Citation: Sajeda Sultana, Nilufar Akhtar Banu Choudhury, Md. Abdul Wohab, *et al.* Nutritional Interventions to Improve Outcomes in Children Undergoing Cancer Therapy-A 50 Case Study. Archives of Pediatrics and Neonatology. 2025; 8(1):17-21.

early, proactive nutritional support as an integral part of pediatric oncology care. Larger, controlled trials are needed to confirm impact on long-term survival and event-free outcomes.

Keywords: Pediatric Oncology, Nutrition, Enteral Feeding, Oral Nutritional Supplements, Malnutrition, Supportive Care.

1. Introduction

Malnutrition both undernutrition and specific nutrient deficiencies—is a frequent and clinically important problem among children receiving therapy for cancer. Nutrition status at diagnosis and during treatment influences tolerance to chemotherapy and radiotherapy, infection risk, wound healing, and overall quality of life. Several observational studies and reviews report malnutrition prevalence ranging widely depending on cancer type, socioeconomic setting, and measurement method, but the clinical signal is consistent: poorer nutritional status is associated with worse treatment tolerance and outcomes. [1–4] Mechanisms linking cancer treatment and nutritional deterioration are multifactorial: reduced oral intake due to nausea, mucositis, taste changes and anorexia; increased metabolic demands related to tumor and treatment; treatment-related gastrointestinal losses; and psychosocial factors such as food aversion and care-giver stress. [5–7] Early identification using standardized screening tools and timely interventions can mitigate weight loss, maintain lean body mass, and reduce complications. [8–10] Nutrition interventions in pediatric oncology usually fall into a spectrum from dietary counseling and oral nutritional supplements (ONS) to enteral tube feeding (nasogastric or gastrostomy) and parenteral nutrition (PN) when enteral routes are insufficient or contraindicated. Evidence supports benefit from ONS and enteral nutrition in preventing or reversing weight loss during therapy, and proactive (preemptive) enteral feeding in some high-risk populations has been associated with better maintenance of growth and fewer prolonged weight losses than reactive approaches. [11–14] International guidelines recommend routine nutritional screening, early dietitian involvement, and escalation to enteral/parental support when oral intake is inadequate despite counseling and ONS.[15,16] Despite guideline recommendations, implementation varies widely—especially in low- and middle-income settings where resource constraints and cultural factors may limit adoption.[17] Recent consensus and review articles continue to emphasize standardized pathways, early involvement of a pediatric oncology dietitian, and pragmatic interventions (ONS, enteral protocols) as feasible, effective measures to improve short-term nutritional outcomes. [18–20] This study reports outcomes from a single-center prospective cohort of 50 pediatric oncology patients enrolled in a structured nutritional program combining assessment, counseling, ONS, and enteral/parenteral support when indicated. We aimed to measure the program's effect on anthropometry (BMI/weight z-score) at 3 months and describe secondary clinical outcomes including infection rates, chemotherapy interruptions, hospital LOS, and caregiver-reported feeding QoL.

2. Methods

2.1 Study Design and Setting

Prospective single-center cohort study conducted at Department of Paediatric Haematology & Oncology, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh from January to December 2024. Written informed consent was obtained from parents/guardians; assent from children when age-appropriate.

2.2 Participants

Consecutive pediatric oncology patients (age 1–17 years) newly diagnosed or early in treatment who were referred to the nutrition service and enrolled in the nutritional program were included. Exclusion criteria: end-stage disease with comfort care only, preexisting chronic conditions severely affecting growth (e.g., cystic fibrosis unrelated to cancer), or refusal of nutritional interventions.

2.3 Nutritional Program and Interventions

All patients received:

- Baseline nutritional assessment by a pediatric dietitian: anthropometry (weight, height, BMI, weight-for-age and BMI z-scores using WHO/CDC standards), dietary history, and screening for risk factors.
- Individualized dietary counseling (targeted energy/protein prescriptions).
- ONS when oral intake inadequate or to supplement energy/protein needs.
- Escalation criteria:
- *Proactive enteral feeding:* for patients at high risk of deterioration (e.g., brain tumors at diagnosis expected mucositis or dysphagia; anticipated prolonged therapy with poor intake), a nasogastric or gastrostomy tube was placed early.

- *Reactive enteral feeding:* for patients with sustained weight loss (>5% body weight or >0.5 z-score decline) despite ONS.
- *Parenteral nutrition:* used when enteral route not feasible or insufficient.
- Multidisciplinary follow-up visits occurred weekly during inpatient stays and at 2–4 week intervals outpatient. Caregiver education and psychosocial support were provided.

2.4 Outcomes and Follow-Up

Primary outcome: change in BMI/weight-for-age z-score between baseline and 3 months. Secondary outcomes: incidence of grade ≥3 infections during the 3-month period, chemotherapy delays >7 days due to toxicity or clinical complications, median hospital LOS per admission, and caregiver-reported feeding QoL (simple Likert-type questionnaire: improved/same/worse).

2.5 Statistical Analysis

Descriptive statistics summarized cohort characteristics. Paired t-test compared baseline and 3-month z-scores. Proportions presented for categorical outcomes. Significance threshold $p<0.05$. Analyses performed using standard statistical software.

3. Results

3.1 Cohort Characteristics

Fifty patients were enrolled. Mean age 7.2 years (SD 4.1); 28 (56%) male. Diagnoses: leukemia 22 (44%), solid tumors 18 (36%), brain tumors 10 (20%). Intervention distribution: ONS + counseling 30 (60%), proactive enteral 10 (20%), reactive enteral 5 (10%), parenteral nutrition 5 (10%). Baseline mean BMI/weight z-score = −0.97 (SD 0.68).

3.1.1 Primary Outcome

Mean z-score improved from −0.97 to −0.59 at 3 months (mean change +0.38; paired t-test $p<0.001$). Forty-nine patients (98%) had stabilization or improvement of z-score; 32 (64%) improved by ≥0.5 z-score.

3.1.2 Secondary Outcomes

- Grade ≥3 infections: 12/50 (24%) during the 3-month period.
- Chemotherapy delays >7 days: 8/50 (16%).
- Median hospital LOS per major admission: 7 days (IQR 5–12).
- Caregiver-reported feeding QoL improved in 34/50 families (68%), unchanged in 12 (24%), worse in 4 (8%).

3.2 Subgroup Observations

- Patients receiving proactive enteral feeding (n=10) showed larger mean z-score gains (mean change ≈ +0.54) than those receiving ONS alone (mean change ≈ +0.28).
- Parenteral nutrition recipients (n=5) had rapid correction of biochemical markers (albumin/prealbumin) but required longer inpatient stays for central access management.

Table 1. *Baseline demographics and intervention distribution (n = 50)*

Variable	Value
Mean age (years)	7.2 ± 4.1
Male sex	28 (56%)
Diagnosis	Leukemia 22 (44%); Solid tumor 18 (36%); Brain tumor 10 (20%)
Baseline mean weight/BMI z-score	−0.97 ± 0.68
Intervention type	ONS + counseling 30 (60%); Proactive enteral 10 (20%); Reactive enteral 5 (10%); Parenteral 5 (10%)

Table 2. *Key outcomes at 3 months*

Outcome	Value
Mean z-score at 3 months	−0.59 ± 0.64
Mean change in z-score	+0.38 ($p<0.001$)
Patients with ≥0.5 z-score gain	32 (64%)
Grade ≥3 infections	12 (24%)
Chemotherapy delays >7 days	8 (16%)
Median hospital LOS per admission (days)	7 (IQR 5–12)
Caregiver feeding QoL improved	34 (68%)

4. Discussion

This prospective cohort of 50 pediatric oncology patients demonstrates that an integrated nutritional program—combining early assessment, individualized counseling, ONS, and appropriately timed enteral/parenteral support—was associated with statistically and clinically meaningful improvements in anthropometric status at 3 months. Mean BMI/weight z-score rose by +0.38 SD ($p<0.001$), and nearly two-thirds of patients achieved a gain of ≥0.5 z-score. These improvements occurred alongside acceptable rates of serious infection (24%) and chemotherapy delays (16%), and caregiver-reported improvements in feeding QoL in the majority of families. Our findings align with prior literature indicating benefit from nutritional interventions in children receiving cancer therapy. Studies of ONS and enteral feeding have reported prevention of treatment-related weight loss and improved nutritional indices, particularly when interventions are started early or proactively in high-risk patients.[11–14] The ESPEN and related guidelines recommend screening, early dietetic input, and escalation to enteral nutrition when ONS/counseling fail—recommendations our program operationalized.[15,16] One notable observation is the apparent greater magnitude of anthropometric improvement among patients receiving proactive enteral feeding compared with ONS alone, consistent with previously reported advantages of proactive tube feeding for select high-risk groups (e.g., patients with anticipated dysphagia or prolonged mucositis).[12,13] Proactive placement may prevent the cascade of sustained weight loss, treatment interruptions, and deconditioning that can follow delayed nutritional support. However, enteral feeding requires multidisciplinary planning, and acceptability (caregiver/patient refusal) can be a barrier; in our cohort some families initially declined tube placement and later accepted when weight loss progressed. Infection rates and chemotherapy delays in our cohort are within ranges reported in pediatric oncology cohorts with active nutritional support, though cross-study comparisons are limited by differing case-mix and infection definitions. Some studies have suggested that better nutritional status reduces infectious complications, likely via preserved immune competence and mucosal integrity; however, evidence is still evolving and confounded by disease severity and treatment intensity. [4,5,11,18-20] This study has limitations. It is a single-center, non-randomized cohort without a concurrent control group, which limits causal inference. Selection bias is possible—patients referred to the nutrition service may differ systematically from those not referred. The follow-up period reported here (3 months) is relatively short; longer follow-up is needed to assess sustained growth, event-free survival, and long-term functional outcomes. We did not perform body composition measures (e.g., bioelectrical impedance, DXA) for all patients, so changes in lean mass versus fat mass cannot be distinguished from BMI/z-score changes alone. Despite these limitations, the pragmatic design reflects real-world implementation of nutrition support in a pediatric oncology service. Key practical lessons include: (1) routine screening and early dietitian involvement are feasible and yield measurable short-term benefits; (2) ONS are effective first-line measures for many patients; (3) clear criteria and pathways for timely escalation to enteral feeding improve outcomes, particularly when applied proactively in high-risk subgroups; and (4) caregiver education and psychosocial support increase adherence and QoL. Future work should evaluate standardized nutritional algorithms in randomized or matched-controlled designs, include objective lean mass measures, cost-effectiveness analyses, and long-term oncologic outcomes (EFS/OS). Multicenter collaboration will help clarify effects across diverse healthcare settings and cancer types.

5. Conclusion

A structured nutritional program that provides early assessment, counseling, ONS, and timely enteral/parenteral escalation was associated with significant short-term improvements in anthropometry and caregiver-reported feeding QoL in this 50-patient pediatric oncology cohort. Implementation of standardized nutritional pathways should be considered an essential component of supportive cancer care for children. Controlled studies are recommended to confirm impact on long-term clinical endpoints.

Acknowledgements

We thank the pediatric dietetics team, nursing staff, patients and families who participated.

Funding

[Specify funding or write “No external funding.”]

Conflicts of Interest

Authors declare no conflicts of interest.

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