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SUPPLEMENT ARTICLE

The importance of enteral nutrition to prevent or treat undernutrition in children undergoing treatment for cancer

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Abstract

Nutrition therapy is a therapeutic approach to treating medical conditions and symptoms via diet, which can be done by oral, enteral or parenteral routes. It is desirable to include nutritional interventions as a standard of care in pediatric cancer units (PCUs) at all levels of care. The interventions are dependent on available resources and personnel across all clinical settings. Enteral nutrition is easy, inexpensive, uses the gastrointestinal tract, maintains gut mucosal integrity, and allows for individualized nutritional strategies. This narrative review describes enteral nutritional interventions for children undergoing cancer treatment and is aimed at PCUs of all levels of care located in a low- and middle-income country.

KEYWORDS
intervention, malignancy, NG feeds, supplementation

1 | INTRODUCTION

Nutrition therapy is a therapeutic approach to treating medical conditions and symptoms through the use of oral interventions or advanced practices such as enteral nutrition (EN) or parenteral nutrition (PN). It is estimated that nearly 50% of children with cancer who live in low- and middle-income countries (LMICs) are undernourished at diagnosis,[1,2] the prevalence being less than 10% in high-income countries[3,4] The use of EN is often necessary among children undergoing treatment for cancer due to a high prevalence of undernutrition that may be present at diagnosis or occur during cancer therapy (refer to Case Presentation: Box 1). To address malnutrition in pediatric oncology, it is essential to include nutrition therapy and interventions as a standard of care for all patients. It is now established that malnutrition is a modifiable prognostic factor. To achieve desirable outcomes, nutritional therapy should be applied universally in pediatric cancer units (PCU) at all levels of care. Selected interventions will depend on available resources and personnel across all clinical settings. The primary objectives of nutritional intervention are to promote growth and development while also ensuring the maintenance or recovery of body stores, minimization of wasting/morbidities, improving outcomes, and supporting a good quality of life.[5,6] In most PCUs in LMICs, access to PN is limited, and oversight of PN by trained personnel is often not available. Moreover, the disadvantages of utilizing PN have been well established.[7,8] This is pronounced with our improved understanding of the protective role of the microbiome during and after cancer care.[5] Thus, whenever clinically feasible, it is recommended to utilize the gastrointestinal tract with EN to confer the benefits of maintaining mucosal gut integrity and a colonized gastrointestinal tract, with the desire of reducing the risk of infections. Several clinical studies have documented the safety of EN even in the setting of

Abbreviations: ABVD, adriamycin, bleomycin, vinblastine, and dacarbazine; ALL, acute lymphoblastic leukemia; ASPEN, American Society for Parental and Enteral Nutrition; BMI, body mass index; EN, enteral nutrition; HIC, high-income country; LMIC, low- and middle-income country; MUAC, mid upper arm circumference; NG, nasogastric; PCU, pediatric cancer unit; PEG, percutaneous endoscopic gastrostomy; PN, parenteral nutrition; PODC, pediatric oncology in developing countries; RUTF, ready-to-use therapeutic foods; SAM, severe acute malnutrition; SIOP, International Society of Paediatric Oncology; SMP, skimmed milk powder; WHO, World Health Organization.

severe neutropenia, thrombocytopenia, and mucositis.[8-10] However, adequate clinical support, training, and access to supplies are essential items for the delivery of EN. To this end, several efforts are under way to ensure PCUs have optimal capacity, training, and supplies for the delivery of enteral nutritional support throughout the spectrum of cancer care.[11,12] Workshops on nutrition in pediatric oncology in LMICs, training of dietitians and medical personnel, formulating guidelines for assessment and interventions are a few steps taken by The Nutrition Working Group of the International Society of Paediatric Oncology (SIOP), Committee on Pediatric Oncology in Developing Countries (PODC), and the International Initiative for Pediatrics and Nutrition (IIPAN) at the Columbia University Irving Medical Center to improve nutritional care in children with cancer. This narrative review describes enteral nutritional interventions in children undergoing cancer treatment and is aimed at all PCUs, independent of capacity level. PN will not be discussed in this review.

2 | NUTRITION ALGORITHMS

There is great variation in the clinical practice, timing and type of nutritional therapy, and access to nutritional services and supplies in the provision of nutritional care among children with cancer.[13,14] Validated, adaptable algorithms are clinically useful tools that provide a structure for the delivery of nutritional therapy and serve as a guide for clinicians whose primary practice is not in pediatric oncology. Moreover, algorithms enable health professionals in PCUs to incorporate nutritional intervention and support into every patient's standard of care by approaching care with a uniform guiding principle.

There are a few published algorithms incorporating nutritional assessment to determine the appropriate intervention in children with cancer. Some are complex and aimed at institutions with sufficient resources; others are simplified and adapted to recognize institutional limitations.[15-18] The Nutrition Working Group of SIOP, PODC has developed a nutrition algorithm to facilitate the timely delivery of nutritional intervention and offer a standardized approach for the provision of nutrition therapy to children with cancer in LMICs (Appendix A).[19,20] Its adaptive nature makes the algorithm accessible to PCUs globally, since substitutions can be made according to institutional capacity and resources.

3 | INTERVENTION

1. If a patient is adequately nourished, does not lose weight, and is consuming at least 50% of the recommended nutrient intake, general nutrition counseling alone may suffice.[17,20-22]
2. Oral supplements are indicated if the patient has a moderate evaluated nutritional risk or if he or she is unable to meet needs orally through a healthy diet alone.
3. EN is indicated when energy and nutrient requirements are not met by daily food intake or oral supplements in a patient with a functional gut. The main indications for use of EN include (i) severely wasted patients, (ii) those meeting less than 60% of their

Box 1. Rehabilitation of a child with advanced malignancy with underlying severe acute malnutrition (SAM)

A 13-year-old male from a low socioeconomic family presented with fever for a period of one year. He had a swelling in the right supraclavicular region, which had been increasing in size for the same duration. He had lost weight, was unable to walk, and had also developed visual impairment. Examination revealed an emaciated child with a weight of 19 kg (−3 Z score), height of 132 cm (−3 Z score), BMI for age 10.9 (−3 Z score) and a mid-upper arm circumference (MUAC) of 12.6 cm (−3 Z score). Clinical evidence of vitamin A and D deficiency was also observed in the form of poor vision and rickets. He had bulky lymphadenopathy in the right cervical and axillary areas. The albumin was 2.6 g/dL. Further investigations revealed a diagnosis of Hodgkin lymphoma stage IIIB. The plan was to administer the ABVD (adriamycin, bleomycin, vinblastine, and dacarbazine) regimen of chemotherapy.

In view of his emaciated state, it was challenging to administer chemotherapy as he was at significant risk for treatment-related toxicity; therefore, his therapy was initially withheld. He was started on enteral nutrition (nasogastric tube) as per the WHO SAM protocol guidelines with micronutrient supplementation. The feeds were tailored to provide 1450 calories and 54 g of protein. The calories and proteins were increased gradually at weekly intervals. After about two weeks, weight gain was observed (19.4 kg, MUAC 12.6 cm). The nasogastric feeds were enhanced (Table 1) and he was discharged from hospital. After about one month, he advanced to oral intake. The child had a sweet tooth, and his mother was advised regarding homemade fortified calorie dense foods to his liking. At six weeks, with enteral and oral feeds there was an increase in weight (22.5 kg) and MUAC ($13.2_{\text{this is 13.7}}$ cm).

As his oral intake was meeting his needs, his NG tube was removed. He continued to meet recommendations through oral intake, and at two months after diagnosis he had gained 6.2 kg. He was continued on a home-based diet, with micronutrient supplements (zinc, calcium, and vitamin D). At three months, his weight had increased to 27.8 kg, and the MUAC was 15.9 cm.

At one month after presentation to the oncology clinic, the ABVD regimen for his Hodgkin lymphoma was initiated. The first cycle was administered at 50% doses. As he had improved his anthropometry, the doses of the second cycle were increased to 75%. Subsequently, full doses were administered. He tolerated his chemotherapy well. The patient completed chemotherapy and has been well for two years since completion of chemotherapy. Diligence toward nutritional rehabilitation was instrumental in the management of this patient.

TABLE 1 Chronological anthropometry and dietary intake of illustrated case

Time from diagnosis		Week 2	Week 4	Week 6	Week 8	Week 12
Weight (kg)	19 (−3Z)	19.4	21.3	22.5	25.2	27.8
Height (cm)	132	132	133	133	134	134
BMI	10.9 (−3Z)		11.7	12.3	13.8	15.1
MUAC	12.6 (−3Z)	12.6	13.2	13.7	15.3	15.9
Feeding		NG	NG + oral	NG + oral	Oral	Oral
Calories (Kcal/kg)		76	90	95	110	115
Proteins (g/kg)		2.5	2.8	2.9	3.2	3.2
				NG removed		

estimated nutritional requirements orally for more than five consecutive days, (iii) presenting with over 5% weight loss since diagnosis, (iv) a decrease of > 10% in the mid upper arm circumference (MUAC) since diagnosis.[6,8,21]

4. Parenteral nutrition (PN) is the preferred method of delivering nutrition when EN is impossible, inadequate, or clinically contraindicated, such as in children with intestinal obstruction or paralytic ileus, intractable vomiting or diarrhea, acute hemorrhage, severe pancreatitis, necrotizing enterocolitis, radiation enteritis, chronic ileus, severe adhesions, short bowel syndrome, peritoneal carcinomatosis, or the occurrence of chylous ascites after surgery for abdominal tumors. Generally, when the period of no or minimal EN is anticipated to be longer than five to seven days, most children will benefit from PN.[5,6,8]

4 | NUTRITION COUNSELING

The first step toward nutritional support usually begins with nutritional counseling. This can be provided in a group format or individually. The use of supporting material, such as booklets, guidelines, and illustrated information, is encouraged, especially in places with limited personnel and when time with the patient needs to be optimized. Dietary counseling should consider the child's tastes, eating habits, symptoms, as well as expected toxicities from the planned therapy. It is important to counsel the family with regard to the nutrients required by the child to ensure nutritional adequacy, particularly in regions where micronutrient deficiencies are endemic. Ideally, nutritional education should be provided on a consistent basis to all patients and families throughout the cancer continuum. In units with limited resources, as defined by SIOP-PODC,[1] general nutritional education focused on food safety should be provided by nurses or other health care providers, and individualized counseling delivered by the dietitian can be limited to the high-risk patients. Ideally, the dietitian should have pediatric oncology training.[1,5]

5 | ORAL NUTRITION

In low nutritional risk patients (children who are adequately nourished, have nonmetastatic malignancy, and those not receiving intensive therapy), one needs to ensure an adequate oral diet. The requirements of patients with cancer correspond to those of the general population of the same age and sex. It is important to recognize that most children with cancer are not hypermetabolic, requiring excess nutrient intake.[8,23] The dietetic advice has to be tailored to face the periods of intense anorexia, changing tastes, and access/availability of food.

If necessary, dietary intake can be complemented with commercial supplements, energy dense foods, or ready-to-use therapeutic foods (RUTF), depending on local availability. This is more effective at promoting weight gain and usually easily accessible. Adding nutrient-dense regional foods and homemade supplements should be encouraged since they are inexpensive, available, less processed, and usually culturally easier for children to consume than commercial formulas.[24] In LMICs, a major barrier to the delivery of oral supplementation is the reliance on families to purchase the nutritional supplements, especially in the outpatient setting.[14] Cultures across the globe have traditional food items that are nutrient dense. Advising and using a home-based energy-rich easily-available diet, which provides adequate nutrition at home, can reduce morbidity, mortality, and abandonment of cancer therapy in LMICs. For example, popular energy-dense foods made at home in India include (i) jaggery and peanut bars (providing 650 calories and 16 g of protein in 100 g) and (ii) Davangere mix containing groundnuts, grams, cereals, and jaggery (providing 400 calories and 15 g of protein in 100 g of the mix). Commercial oral supplements are developed to provide energy- and nutrient-dense solutions as ready-to-drink liquids. Semisolids or powders can be prepared as drinks or added to drinks and foods.[25] These supplements can be very helpful in promoting nutritional intake, especially flavorless ones that can be added to a greater variety of foods. However, industrialized supplements have the disadvantage of expense, availability, and acceptance.

Appetite stimulants may augment oral dietary intake, although evidence supporting their use has not been consistently demonstrated.[26-29] Corticosteroids increase appetite in many patients, with modest effects on weight gain; however, there is a disproportionate increase in fat accrual and an increased risk of adrenal suppression. The role of cyproheptadine hydrochloride, an antiserotonin agent, has been evaluated for weight gain due to the lack of adrenal suppression; however, no randomized clinical trials have been performed in pediatric oncology. Additional research evaluating

the effect of appetite stimulants on body composition is needed prior to recommendation for inclusion into clinical care.

6 | FOOD SAFETY

Variations in diet recommendations for neutropenia have been demonstrated in some retrospective studies and multicenter surveys in a high-income country (HIC) setting; however, no studies have been published in an LMIC setting.[10,30,31] These recommendations are primarily an effort to reduce the risk of infections in immunocompromised individuals. Fruits and raw vegetables, an important source of vitamins and minerals, are invariably restricted. The use of restrictive neutropenic diets has not been proven to be superior to regular diets that adhere to safe food handling guidelines.[10,31-35] It is also reiterated that further restriction of diet with little scientific support may represent an unnecessary burden for patients who are already compromised in maintaining adequate oral intake.[36,37]

There is little evidence that infections in children with cancer arise from their food; however, these data are limited to the HIC setting. As most infections in children with neutropenia are caused by endogenous pathogens rather than by food,[32,38] safe and hygienic food handling is recommended rather than infection prophylaxis from neutropenic diets. In the LMIC setting, the neutropenic diet is essentially centered on food safety as often the source of water and hygiene may be inadequate (as in cut fruit sold on the roadside). Patient literacy plays a role in food safety and requires inclusion while counseling.[39]

The efficacy of this approach in reducing food-borne infections has yet to be tested in a randomized, controlled trial. Cultural, regional, and socioeconomic differences should be considered when educating about food safety, especially in LMICs. One approach may be for the PCUs to analyze the characteristics of its population and to build recommendations based on those of the U.S. Federal Drug Administration (FDA) (Table 2).

TABLE 2 FDA-approved food safety guidelines

FDA-approved food safety guidelines
Shopping
1. Never choose packages that are ripped or leaking or cans that are dented or jars that are cracked. Safety buttons on metal lids should be down and not move or make a clicking noise when pushed.
2. Do not purchase foods if "sell by" or "best used by" date has passed.
3. Choose only pasteurized milk, cheeses, or juices.
4. Buy cold foods last and get them to a refrigerator or freezer as soon as possible.
5. Put raw meat, fish, and poultry into separate plastic bags so the juices will not contaminate other foods.
Food storage
1. Place securely wrapped raw meat, fish, and poultry into the meat drawer or on the bottom of the refrigerator so that the juices will not leak onto other foods.
2. Keep the refrigerator temperature at 40°Fahrenheit (4.4°C), the freezer at 0°F (−17°C).
3. Cook or freeze fresh ground meats, fish, and poultry within two days; other beef, pork, veal, or lamb within 3-5 days.
Food preparation
1. Wash hands well in hot soapy water prior to preparing or eating food.
2. Wash hands before and after handling raw meat, poultry, or fish.
3. Do not cross-contaminate. Keep raw meat, fish, and poultry and their juices away from other food. After cutting these foods, wash utensils, cutting board, knife, and counter top with hot soapy water.
4. Sanitize cutting board in a solution of one teaspoon of chlorine bleach in one quart of water.
5. Wash kitchen towels often.
6. Always wash fresh fruits and vegetables before eating.
7. Use a scrub brush on potatoes or carrots if the skins are to be consumed.
8. Cut away bruised or damaged areas on fruits and vegetables.
Safe cooking
1. Cook eggs until they are firm, not runny. Do not eat foods that include raw or partially cooked eggs.
2. Cook poultry until it has an internal temperature of 180°. It is done when the juices run clear and it is white in the middle. Never eat rare poultry.
3. Cook fish until it is opaque and flaky.
4. Cook ground meat to 160°. It is done when it is brown inside. This is especially critical with hamburger meat.
Safe serving of food
1. Keep hot foods hot and cold foods cold. Do not leave food out more than two hours unless on a heat source or on ice.
2. Use leftovers within four days.

Adapted from Moody et al.[7]

7 | ENTERAL NUTRITION

Enteral tube feeding for the pediatric oncology population has been demonstrated to be a safe and effective method of reversing malnutrition and preventing further weight loss, even in the LMIC setting.[9,40-44] In general, EN should be initiated proactively in those children identified to be at high risk of subsequently becoming nutritionally compromised. The nutritional plan should be individualized as per nutritional needs and goals, for those nutritionally high-risk children (Table 3),[6,45] while also considering any underlying gastrointestinal intolerances. However, in many LMICs, EN is not initiated upfront or may have longer lag times to implementation due to limited personnel or lack of supplies. Frequently, parental resistance is a major barrier preventing placement of nasogastric (NG) tubes. In many cases, medical personnel may use the threat of a NG tube to "frighten" the child to eat. In this setting, remediation of poor nutritional status becomes especially challenging. Education regarding the possible need of NG feeding and its positive elements should be a priority area during counseling and presented in a supportive environment.

7.1 | Types of enteral tubes

Feeding tubes may be (i) NG tubes: for use if nutritional support is only needed for a short time; (ii) nasoduodenal and nasojejunal tubes: tubes that are required when patients are at high risk of

TABLE 3 Patients at high risk of undernutrition.[6,45]

Tumor factors	Metastatic solid tumors Acute myeloid leukemia Acute lymphoblastic leukemia (high risk) Brain tumors Relapsed leukemia Hematopoeitic stem cell transplantation Nasopharyngeal carcinomas
Treatment modality	High-dose chemotherapy Intensive phases of chemotherapy CNS radiation Abdominal surgery
Demographic factors	Socioeconomic status Limited access to appropriate supplementation Age < 1 year

TABLE 4 Complications of nasogastric tube insertion[47-49]

Misplacement (trachea/small intestine/bronchopulmonary placement)
Local infection and irritation
Aspiration
Mechanical obstruction
Mucosal laceration
Tube occlusion
Dysphagia
Nausea
Ulceration/perforation
Respiratory infections
Pneumothorax
Anxiety and poor compliance

pulmonary regurgitation or persistent and severe vomiting; (iii) gastrostomy and percutaneous endoscopic gastrostomy (PEG) tubes are suggested when prolonged nutritional support is required or when the nasopharynx needs to be bypassed as in situations of a tumor in the region. PEGs are especially useful in adolescents as they help maintain body image[46]; (iv) jejunostomy tubes are planned in situations when the stomach has to be bypassed as in intractable vomiting. Recommendations have been proposed with a decision algorithm for gastrostomy insertion and management in children with cancer. Gastrostomy and jejunostomy feeding tubes should only be placed by an experienced surgeon or endoscopist and require adequate staffing to ensure ongoing monitoring.

The size of the feeding tube is typically determined by the weight and age of the child. The tube should be placed by a trained professional. To place an NG tube, the length of the tube required to reach the patients stomach is measured from the nose to earlobe and then to the xiphisternum. There is no standard to verify insertion. Auscultation and aspiration of gastric contents have limitations in verification. An X-ray, considered the gold standard, has problems related to radiation exposure.[47] The American Society for Parenteral and Enteral Nutrition (ASPEN) recommends the use of gastric pH testing as the first-line method for NG location verification, with a pH of 1–1.5 being indicative of correct placement.[48] Although sedation is not necessary for the placement of NG feeding tubes, it is recommended that placement be performed during routine sedation for other medical procedures to ameliorate an invasive intervention.[5] Misplacement of the NG tube is seen occasionally (1%-2.5%) with the possibility of serious complications.[47,49] Aspiration, gastrointestinal complications, and tube occlusion are frequently encountered complications with an NG tube (Table 4).[47-49]

ASPEN recommends instillation of warm water and applying a gentle back-and-forth motion with a large syringe as the best option for trying to unclog a feeding tube.[49] Contraindications to NG insertion may include persistent vomiting, gastrointestinal obstruction, and severe gastroesophageal reflux. Care should also be taken on insertion during periods of moderate-to-severe mucositis or severe thrombocytopenia.[47,48]

Plastic NG tubes should ideally be replaced every 5-7 days, whereas silicon/polyurethane ones should be replaced every 3 to 6 weeks if tube maintenance (e.g., cleaning) is performed daily.[5] In most cases, children in LMICs have their plastic tube changed every 10-14 days. No study of optimal duration has been conducted; therefore, functional tubes may be used longer if working well.

7.2 | Approaches to feeding by EN

There are two methods of providing enteral feeding. (1) Bolus feeding: feeds administered by the gravity method or feeding pump. Using bolus feeds is more physiological than continuous feeds as it stimulates a normal and enzymatic feeding response. This also enables a more "normal" life for the child's family as it allows time lapse between feedings. Bolus feeds are usually given every two to four hours. They can also be given hourly in small quantities if a child is unable to tolerate large boluses in situations where a feeding pump is not available. (2) Continuous feeding entails the use of a feeding pump. Continuous feeds allow the administration at a slower rate over a prolonged period of time, often required in oncology patients when they are unable to tolerate bolus feeds. In the absence of diet pumps, a common situation in LMICs, a slow diet administration is possible via gravity using a large sterile syringe, or by using an infusion syringe pump for continuous feeding, which is an inexpensive and easy way to deliver EN.[48,50] Gravity feeds should be administered with elevated head-end of bed and as slowly as possible using the feeding bag tubing clamp to control speed, while always monitoring the child's tolerance to the diet. A number of commercially prepared enteral feeds are available and are selected as per the clinical condition of the patient.[51] In most oncology patients, standard polymeric formulas are available in a variety of energy, protein, and fiber contents and are suitable for patients with a normally functioning gut, as they contain intact proteins and lipids usually in the form of long-chain triglycerides. Concentrated formulas can be used when there is reduced gastric capacity, fluid restriction, or limitations in duration of time for tube feeds. However, osmolarity may result in gastrointestinal side effects. Elemental feeds contain predigested protein and provide peptides and/or amino acids, as well as medium

chain triglycerides, which can facilitate absorption. They are indicated when there is a significant impairment of gastrointestinal digestive and absorptive functions such as mucositis. Modification of any selected formula may be necessary if intolerance develops with symptoms such as abdominal pain, persistent constipation, or diarrhea.[25]

7.3 | Considerations for LMICs

Depending on the available resources, part industrialized and part homemade feeds may be used to reduce expenses and prolong the delivery of nutrients. In less-resourced settings, industrialized feeds can be replaced by homemade, nutrient-dense blenderized foods, adapted to local availability and eating habits. The quality of the homemade enteral diet should be based on regular healthy eating recommendations and, whenever possible, be standardized to ensure the delivery of adequate calories, macronutrients, and micronutrients. Ensuring food safety is essential when relying on homemade feeds. Industrialized diets, however, have the advantage of being ready to use or easy to prepare, which makes it safer since there is less handling of the diet. Cleaning the feeding tube with sterile water or sodium bicarbonate after each use will reduce the risk of blockages as well as the risk of infection.[5,21]

8 | SEVERE ACUTE MALNUTRITION (SAM)

In cases of SAM, the World Health Organization's (WHO) protocol for intervention and management should be implemented upon diagnosis.[52,53] There are definite medical risks of implementing feeds too quickly. Key components in the management of SAM include a careful initial evaluation, anticipation, prevention, early intervention and management of complications, avoidance of using intravenous fluids, and promotion of oral intake by the mouth or enteral feeding. Enteral feeding is instituted if the child is unable to take the required amount orally. There are three phases of treatment: initial stabilization, rehabilitation, and follow-up.[52,53] Stabilization includes treatment of hypoglycemia, hypothermia, dehydration, correction of electrolyte imbalance, and management of infection. Initial stabilization feeding begins with F75 feed (75 kcal, 0.9 g protein in 100 mL, prepared by adding skimmed milk powder [SMP]: 2.5 g, sugar: 7 g, oil: 2.7 mL and 3.5 g of cereal flour to 100 mL water) initially followed by F100 (100 kcal, 2.9 g protein in 100 mL prepared by adding SMP: 8 g, sugar: 5 g and 6 mL oil in 100 mL water).[52,53] Micronutrient supplementation needs to be initiated with iron supplementation being added when there is no evidence of infection. Parasite infestations and coinfections such as tuberculosis, HIV, and malaria warrant special attention in LMICs. A patient is discharged once weight gain is documented and there is no infection. Subsequent management is centered on nutritional rehabilitation and attentive follow-up.[52,53] The vital principles of management are provided in the case illustration.

9 | CONCLUSIONS

Children with cancer are at a high risk of undernutrition, which is related to a preexisting poor nutritional status in some patients and may be compounded by the intense therapy received.[6,13] Appropriate and timely nutritional intervention based on regular assessment[54] and the infrastructure of the pediatric cancer unit is vital to improve outcomes in children with cancer and needs to be a recommended guideline in all therapeutic protocols. Strategies for the management and prevention of malnutrition need to be implemented at diagnosis and continued throughout therapy and into survivorship so as to improve outcomes and minimize treatment-related toxicities. Children who have undernutrition at diagnosis or on assessment during treatment and are observed to have over 5% weight loss, a decrease in MUAC over 10% and an oral intake that is less than 60% to 80% of the recommended for the patient are candidates for enteral feeding.[17,21] The use of EN needs to be encouraged as its benefits over other modes of nutritional support are well documented in the pediatric oncology population.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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