Original Research Article

# Impact of Clinical Nutritional Practices and Holistic Care Interventions of Pediatric Oncology Patients: A Single Centre Experience from Jammu and Kashmir

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## Abstract

**Introduction:** Nutrition is a fledgling determinant in managing and suppressing various chronic and life-threatening diseases like cancer. Nutritional status of pediatric oncology patients is particularly an important determinant of their ability to cope with the demands of cancer and its treatment, and ensure proper growth and development. Nutritional assessment and grading each child per their degree of malnutrition helps devise adequate and individualized nutritional intervention. Adequate and timely intervention can largely contribute in improving the nutritional status of the patients and therefore, overall outcome of the treatment.There are limited studies done to understand the area of impact of nutritional interventions in improving the nutritional status of children affected with cancer, therefore with this aim we conducted a study to see the impact of nutritional intervention on nutritional status. **Materials and Methods**: This, first of its kind study on understanding the impact of nutritional intervention on pediatric oncology patients was conducted in the medical oncology department of Sher-I-Kashmir Institute of Medical Sciences (SKIMS), Soura,Srinagar,India, Srinagar, from 1st May 2018 to 31st December 2019. Anthropometric measurement, demographic profiles, and etiological analysis were done and collected pre and post-intervention. 24 hours dietary recalls were collected pre and post-intervention. Food frequency tables were also put forward. Besides these, personal interviews and observation methods were used. **Results:** Nutritional interventions had a measurable positive outcome on the nutritional profiles of the pediatric oncology patients in SKIMS, Soura,Srinagar,India. The grades of nutritional status substantially improved from 46.4%, 24.8%, 16%, and 8% of the well-nourished, mildly malnourished, moderately malnourished, and severely malnourished, to 56.8%, 20%, 12.8%, and 4.8%, respectively, clearly indicating that with appropriate dietary advice and interventions there is a significant impact on improving the grade of malnutrition.

**Keywords:** Nutrition, Pediatric Cancer, Anthropometry, Nutritional Intervention



## Introduction

Nutrition is the provision of energy and other essential and non-essential nutrients required for life-sustaining cellular activities and protection against cellular damage. Adequate and appropriate nutrition is vital to the health, growth, and development of children of all ages. Diet and nutrition are emerging at the forefront as major modifiable determinants in the management and suppression of various chronic diseases, more so in children with cancer.

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Momentum continues to grow in recognising and acknowledging the co-relation and addressing the challenges in the components of the dynamic triangle of the Children, Cancer, and Nutrition[1]. Malnutrition, more precisely under-nutrition, is a state in which the body cannot acquire the nutrients for normal cellular function and structure due to an intake of a diet deficient in essential and non-essential nutrients.Cancer, in itself, represents a biological burden; the presence of mal-nutrition in a cancer patient doubles the load. The existence of malnutrition in cancer often referred to as cancer cachexia can be multifactorial, some significant reasons being increased metabolic rate (due to metabolic alterations like increased lipolysis, increased gluconeogenesis), increased peptides leading to anorexia, poor appetite, and decreased food intake (often due to gut involvement).[2] The state of malnutrition in kids with malignancies

results in intolerance to the treatment modalities- chemotherapy, radiotherapy, and surgery, and in increased incidences of local infections and systemic infections. For this reason, nutritional rehabilitation and repletion are gaining importance as an intervention to improve the outcomes of the treatment. Given the prevalence of malnutrition in the Indian population, it is not surprising that studies of nutritional status have been and must be undertaken in children with cancer in several parts of the country to get a clear picture of the nutritional standing of the population. In a study conducted in September 2014, it was found that 88% of children with ALL were malnourished at diagnosis[3].Moreover, the loss of mid-upper arm muscle area occurred in 56% of this small sample (n=25) during remission induction.Nutritional repletion, especially in pediatric patients with malignancies, can help tolerate the treatment better and can even enhance the survival rates in certain malignancies.There are currently, very few studiesfrom the Indian sub-continent, and no study from Jammu and Kashmir, that access the nutritional profiles of the children with cancer and the impact of the nutritional status on disease management.With this aim, we conducted this study to access the nutritional profiles of the patients that visited the pediatric oncology unit. It elaborates on the impact of nutritional care and intervention in improving the nutritional status and the outcome of the disease management.

**Aims and Objectives**

The aims of the study were:

1) To understand the age, disease patterns, and socio-economic background of the study population.
2) To elaborate on various nutritional practices implemented for the study population.
3) To access the impact of nutritional intervention on the nutritional status of the study population.

**Material and Methods**

The study was conducted at thepediatric unit of the Department of Medical oncology, Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Soura,Srinagar,India, Srinagar. The data of pediatric oncology patients <18 years of age treated from May 2018 to December 2019 was analysed. Details on age, gender, diagnosis, and anthropometry were collected. Anthropometric measurements were taken within 24 to 48 hours of admission for every patient, which include weight (wt), height (ht), MUAC (mid-upper arm circumference) (for solid tumours and patients below 5 years of age and OFC (occipital frontal circumference)/ HC (head circumference) (up to the age of 3 years). Weight (wt) (up to 18 years of age), height (ht) (up to 18 years of age), occipital frontal circumference (OFC)/ head-circumference (HC) (up to 3 years of age), mid-upper arm circumference (MUAC) (up to 5 years of age and in case of solid tumours) at the time of admission (within 24-48 hours), and after 15 days in case of long hospital stays, and monthly for OPDs. Anthropometric assessment was the key step to identify the grade of malnutrition in the kids. Patients falling between -1 SD to 1 SD on the WHO standards were classified as well-nourished. Those between -2 SD to -1 SD were mildly mal-nourished, between -3 SD to -2 SD were moderately malnourished, and those below -3 SD were classified as severely malnourished. Similarly, for children under 5 years, the BMI above 2 SD was classified as over-weight, whereas for children above 5 years, a BMI above 2 SD indicated obesity. For patients below 5 years of age and those with a solid tumour, the grade of nutrition was assessed based on MUAC and above 5 years based on BMI. 24 hours dietary recalls were collected pre and post-intervention to gauge the impact of the interventions done. The patients' caregivers also filled food frequency tables to give a better insight into the food choices and habits of the patient. Other than these, personal interviews and observation methods were used to assess the changes in the food habits of the patients.

**Intervention**

Nutritional intervention is an umbrella term that comprises all the steps undertaken to resolve or improve the nutrition diagnosis, designed specifically for each patient.

- ➔ Nutritional Assessment or Screening- Each child admitted, new or on follow-up, or relapsed was assessed in a systematic ABCD order at each visit.

1) Anthropometric assessment for each patient was done as described.
2) Biochemical assessment was done to monitor the conditions as neutropenia, TLS markers, hyper/hypokalemia, hyper/ hypoglycemia, etc.
3) Clinical assessment for features like oedema, ascites, dehydration, purpura, xerosis, etc. was done to get a better picture of any micro or macro nutrient deficiency.
4) Dietary assessment- 24-hour dietary recall method was most commonly used to assess the dietary intake of the children in both IPD (daily) and OPD.

Grading for Nutritional Status- After the kids were screened in the order of ABCD, each child was graded to assess their nutritional status. The anthropometric measurements of each kid were plotted on standardised growth charts devised by IAP and WHO, which were then converted to z-score charts by WHO for different indices viz., WFA, WFH, HFA, BMIFA, HCFA, for different ages, for both the sexes. For MUAC, WHO cut-offs were used up to the age of 5 years; thereafter Frisancho cut-off charts were referred to. This defines the degree of malnutrition for each child. To track the growth of the patients along the span of their treatment, each child was allotted their growth charts, which were updated monthly.

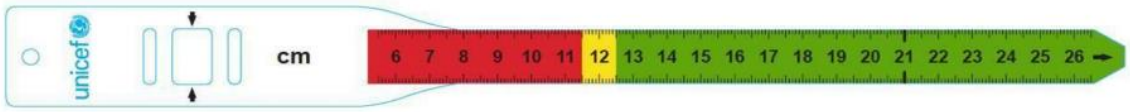


**Fig 1: Shakir's MUAC colour band by UNICEF for less than 5 years of age**

[Green indicates good nourishment, yellow moderate acute malnutrition (MAM), and red indicates severe acute malnutrition (SAM)]

Nutritional Intervention included nutritional counselling and diet prescription to all patients. Nutritional counselling for conditions like hypo/hyperglycemia, hypo/hyperkalemia, hypo/hypertension, TLS, mucositis, diarrhoea, vomiting, and certain drug and nutrient interactions was done. Diet prescriptions specified the mode (oral/enteral/parenteral), amount, type (liquid, soft, normal, iso/hypo/hypercaloric, high/low protein, high/low fibre), and frequency of the nutrition per the requirement of each kid. The nutrient requirements were calculated by the REE equations by WHO. Each kid in the IPD and OPD was prescribed a diet per their requirements, considering their digestive and absorptive capacities, familial food preferences, eating patterns, local availability, and socio-economic conditions.In cases where the patients were kept NPO, and had health conditions that contra-indicated the administration of oral and enteral nutrition and warranted parenteral nutritional intervention, TNA (3 chambers) PN bags, amino-acid infusions, and lipids infusions were provided to the kids for nutritional support/rehabilitation/repletion per their specificity and requirements. In such cases, ESPHAGEN guidelines were referred to for the calculation of different nutrient requirements. The "7-10 days

rule" is a valuable guide to avoid over-utilization of parenteral nutrition and also to prevent "re-feeding syndrome"[4].
In addition to this,

- Nutritional Supplements were provided free of cost, on a monthly basis to the patients under treatment. These supplements include hyper caloric and protein supplements
- In-meals- To meet increased nutrient requirements of kids, some in-meal snacks and energy drinks were provided, in addition to the daily hospital diet provided to the IPD kids. These include thick-skinned fruits like- orange and bananas, and milkshakes, soymilk, lassi, electrolyte drink, peanuts, and chikkis.
- Monthly rations- To help the kids' families bear the burden of the whole process, monthly rations were provided to the family of the kids under treatment[5-8].

**Results**

The study was conducted from 1st May 2018 to 31st December 2019 on 125 pediatric oncology patients under treatment in the medical oncology unit of SKIMS, Soura,Srinagar,India. The outcome of all the aforementioned interventions can be gauged by the changes in the nutritional status of the children under study. Of these 125 patients under study, 83 (66.4%) patients were males, and 42 (33.6%) females (fig. 2); 31.2% were below 5 years of age, and 68.8% were above 5 years of age (fig. 3); 92.8% patients belonged to the low socio-economic class of the society whereas the remaining 7.2% belonged to middle/high socio-economic class (fig. 4); 84.8% hailed from the rural part of the state and the remaining 15.2% were from urban areas (fig. 5). The diagnosis profile of the patients revealed 44 (35.2%) patients were leukemias, 21 (16.8%) were lymphomas, and 60 (48%) were solid tumours (fig. 6). Of all the leukemias, 32 (25.6%) were ALLs, and 12 (9.6%) were AMLs. Among lymphomas, 10 patients (8%) had Hodgkin's disease, 11 (8.8%) patients were NHLs. Among solid tumours, Ewing's sarcomas were 11 (8.8%), Neuroblastomas were 11 (8.8%), osteosarcomas were 9 (7.2%), rhabdomyosarcomas were 8 (6.4%), retinoblastomas were 4 (3.2), with hepatoblastomas were 3 (2.4%). The remaining 11.2% were uncommon solid tumours. The percentage of well-nourished children at the time of admission was 46.4% (58), children with mild acute mal-nutrition were 24.8% (31), children with moderate malnutrition 16% (20), those with severe malnutrition were 8% (10), and those obese were 4.8% (6) (fig. 7). The dietary recalls at the time of admission of the patients met an average of 40% of the energy/ caloric requirements and 60 % of the protein requirements of the patients (fig. 10).Post-intervention and dietary counselling, the percentage of well-nourished children went up to 56.8% (71), of children with mild acute malnutrition was 20% (25), moderately malnourished children were 12.8% (16), severely malnourished children were 4.8% (6) and those obese were 5.6% (7) (fig. 8). The dietary recall of the children post counselling and interventions also showed an upward trend, largely. The caloric intake made up to 70% of the requirements on an average, whereas the protein intake through diet averaged around 85% (fig. 10).

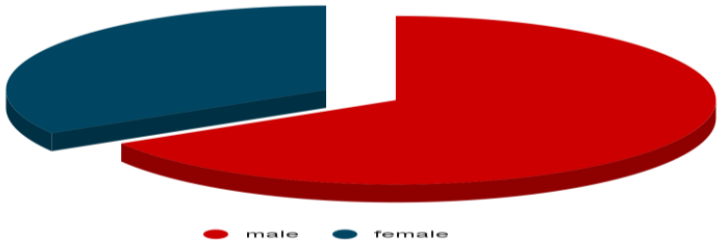


**Fig 2: Classification (in percentage) on the basis of the sex of the population under study**

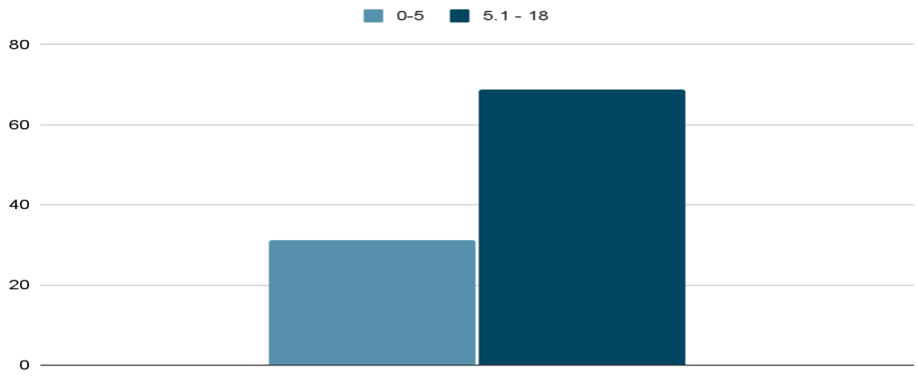


**Fig 3: Classification (in percentage) on the basis of age of the population under study**

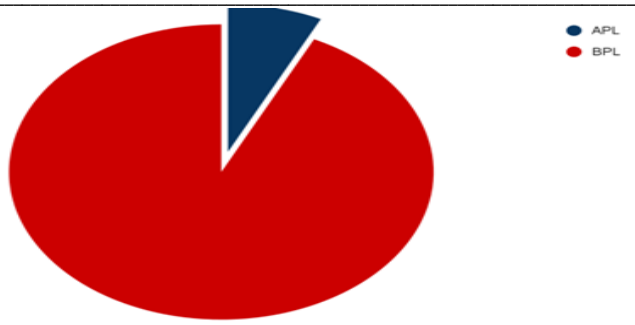


**Fig 4: Classification (in percentage) on the basis of socio-economic status of the population under study**


**Fig 5: Classification (in percentage) on the basis of residence of the population under study**

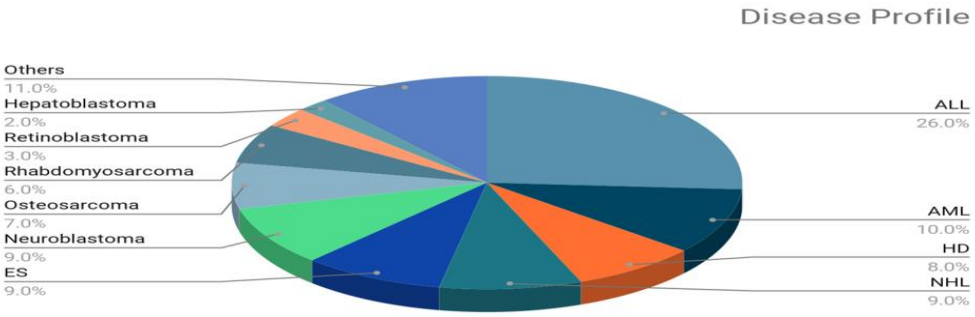


**Fig 6: Classification (in percentage) on the basis of disease occurrence in the population under study**

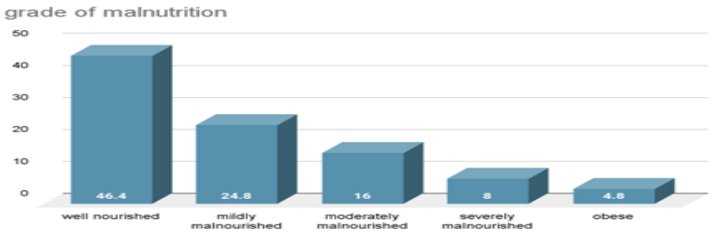


**Fig 7: Nutritional status (in percentage) at the time of admission of the population under study**

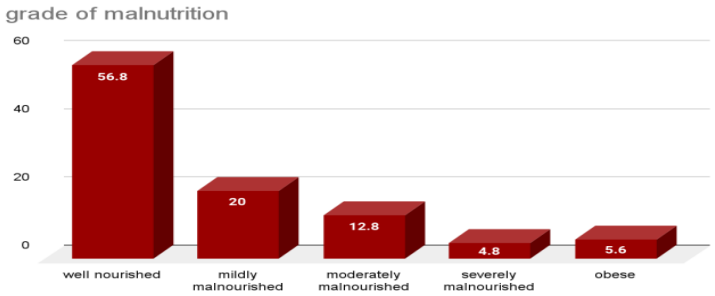


**Fig 8: Nutritional status (in percentage) post-intervention of the population under study**

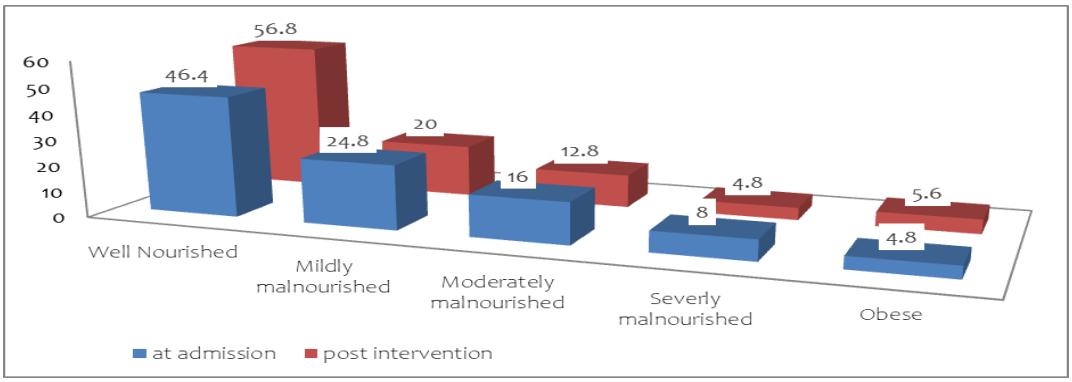


**Fig 9: Nutritional status (in percentage) pre and post-intervention of the population under study**

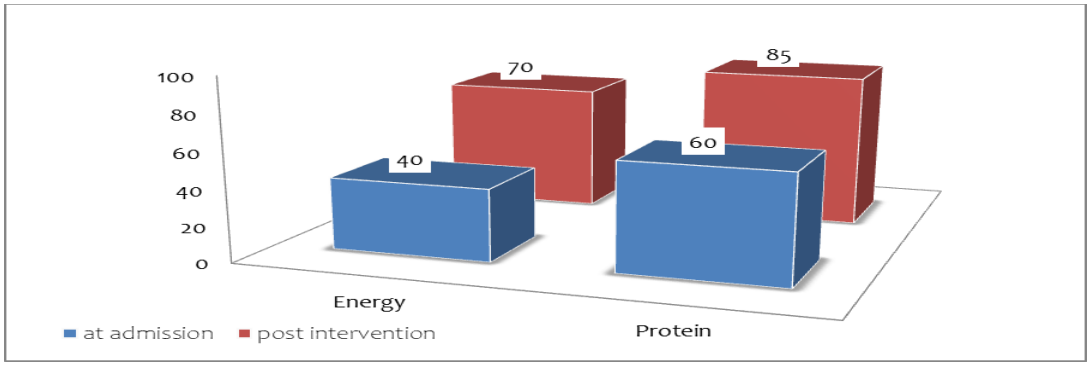


**Fig 10: Dietary intake in terms of energy and protein (in percentage) pre and post-intervention of the population under study**

**Discussion**

Nutrition is vital to the health, growth, and development of children. Nutrition is a crucial component in the treatment and outcome of the management of pediatric cancer. Therefore, consistent nutritional assessment, care, and monitoring are essential throughout to avoid any nutritional deterioration and to improve treatment tolerance and outcome. Nutritional intervention in terms of knowledge and provision form the key components throughout disease management. However, compliance and implementation of the suggestions and interventions is the decisive element for the successful outcome. Nutritional therapy is crucial to the treatment of childhood cancer. It, therefore, should be regarded as an essential part of it, especially within the developing countries, essentially due to the magnitude of malnutrition within such countries.Appropriate growth and development of a child stems in large part from proper nutrition. Malnutrition is anadversarial prognostic element in kids with cancer, and its incidence is highly variable[5]. Most children with cancer come from low- and middle-income backgrounds, where there are many barriers to optimising treatment. Nutritional support for pediatric patients with cancer is a challenge. Nonetheless, this challenge can and should be commenced by getting the best out of the obtainablemeans and resources. External aids, like charitable foundations, can also largely contribute to ameliorating the battle against Cancer.Heretofore, pediatric oncology patients faced tremendous challenges, more so in the form of access to and know-how about adequate nutrition, and thus resultant lack of motivation for treatment. These are challenges common to most oncology treatment centres in low and middle-income countries (LMICs) like ours, primarily those where access to pediatric oncology care itself may have been deficient[6]. In a study from North India, it was totaled that 34% of fathers of minors with cancer lost their livelihoods and nonmedical costs were 2.5 times the average per capita income. Families exhausted up to approximately 7 times of their monthly incomes over a term of 1 month on an unanticipated illness like cancer[7]. This program was unique in its scale and ambition, and our results show a quantum jump in the improvement

of outcomes, both quantitatively and qualitatively. Our department has a dietetic unit providing all the nutritional support and interventions to the patients of the pediatric oncology unit of Sher-I-Kashmir Institute of Medical Sciences, Soura,Srinagar,India. All the aid and assistance aforementioned are provided, with special focus on the patients belonging to the underprivileged section of society. The holistic programs and practices were unique in scale and ambition, and the results of this study have reflected both qualitative and quantitative improvement in the overall patient profiles. The principal picture of the impact of the interventions can be seen in the nutritional status of the pediatric patients under study. According to a study conducted in Turkey inJanuary 2002, on 47 pediatric patients the overall cases of malnutrition were 29.8%, the percentage went up to 38.3% during the treatment. By the end of the treatment, it was 18.5%[8].However, on the other hand the results of our study show an improvement in the percentage of malnutrition by 10.4% in the period of 1 year. In our study, the percentage of well-nourished children at the time of admission was 46.4% (58), children with mild acute mal-nutrition were 24.8% (31), children with moderate malnutrition 16% (20), those with severe malnutrition were 8% (10) and those obese were 4.8% (6). The dietary recalls at the time of admission of the patients met an average of 40% of the energy/ caloric requirements and 60 % of the protein requirements of the patients.Post intervention and dietary counseling, the percentage of well-nourished children went up to 56.8% (71), of children with mild acute malnutrition was 20% (25), moderately mal-nourished children were 12.8% (16), severely malnourished children were 4.8% (6) and those obese were 5.6% (7). The dietary recall of the children post counseling and interventions also showed an upward trend, largely. The caloric intake made up to 70% of the requirements on an average whereas the protein intake through diet averaged around 85%. Therefore, clearly nutritional intervention at the time of detection of the disease can be instrumental in improving the nutritional status through the span of treatment. Another area of significant impact is the improvement in the quality of foods consumed and the quantity consumed to suffice to the requirements of the patients. Nutritional assessment and guidance should start soon after the diagnosis and should continue throughout the treatment, even to the survivorship phase. This will aid in preventing or reversing nutritional deficiencies, preserve lean body mass, minimise nutrition-related side effects and improve the quality of life of future survivors[9]. Idyllically, we'd suggest that all the patients be provided with repetitive follow-up assessments as constant nutritional monitoring consults are important to provide the caregiver with basic nutrition education. However, this may not be feasible for many pediatric cancer care set-ups, since repeated visits require means and resources, and trained personnel. It is recommended that depending on institutional nutritional infrastructure, nutritionally at-risk patients should be followed up as a priority, when possible, on a consistent schedule[10].Childhood cancer survivors are known to have a predisposition toward obesity and metabolic syndrome. Sarcopenic obesity has been identified in approximately 40% of survivors of acute lymphoblastic leukemia[12]. This can be seen in the patients under study as well, as the percentage of obese children increased from 4.8% to 5.6% (ref. to fig. 9). As there are large populations of pediatric cancer patients presenting to numerous institutions in India, there is a recognizable opportunity to undertake well-designed studies, including nutritional care and intervention trials. To be sure, India could lead the way in these endeavours and even rise to the challenge of measuring health-related quality of life in this context, and the way ahead may well be through the charitable foundations and NGOs[13]

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