Malnutrition Screening and Treatment in Pediatric Oncology: A systematic review

Jessica Franke[1], Chris Bishop, MLS[1], Daniel V. Runco, MD, MS[2,3]

1. Marian University College of Osteopathic Medicine
2. Indiana University School of Medicine, Department of Pediatrics
3. Riley Hospital for Children at Indiana University Health, Department of Pediatrics, Division of Hematology/Oncology Indianapolis, IN

Background

- Pediatric cancer is the leading cause of non-accidental childhood death in the United States[34]
- 80% of children experience malnutrition during cancer treatment[34]
- Malnutrition effects with cancer treatment:
  - increases toxicities (neuropathy, infections, physical function, quality of life)[10]
  - Exacerbates dietary and metabolic changes[5,30]
- Malnutrition is variable in diagnosis and interventions
- Standard screening and treatment are not widely agreed upon in pediatrics[25]
- Adult cancer cachexia is more studied and standardized [29]
- Nutritional needs are more static in adults, while protein and caloric needs change and evolve for the growing child [4]

Purpose

This systematic review aims to:

- summarize evidence-based studies of screening and nutritional intervention for children with cancer
- highlight the need for standardizing malnutrition assessment and treatment

Methods

- Databases searched: Ovid Medline, CINAHL, and Cochrane Library
- No statistical analysis was performed due to reported data heterogeneity [16,27]

PICO Criteria	
Population	Pediatric patients (less than 20 years) undergoing cancer treatment
Interventions	Weight loss treatments, cachexia screening tools
Comparison	Malnutrition and nutrition interventions
Outcomes	Primary: malnutrition (objective measurements) Secondary: validation of screening

Table 1: Included studies – nutritional interventions

Publication	Design or sample*	Measures	Results
Liang, et.al. (2018)[19]	Quasi-experimental study Oral formula supplement 127 patients (intervention group n=67; control group n=60)	Biometrics: weight, hemoglobin, total protein, albumin, prealbumin Complications: hypoalbuminaemia, gastrointestinal complications, and infections	• Increase in weight, hemoglobin, with formula supplement (p<0.05) • Formula supplement increased total protein, albumin, and prealbumin (p<0.001) • Decreased complications in intervention group (p<0.05) • Fewer blood and albumin infusions for intervention group (p<0.05)
Gurlek Gokcebay, et.al. (2015)[13]	Monitoring children during cancer therapy Isocaloric versus hypercaloric supplements for children with malnutrition 45 total patients (malnourished n=26; hypercaloric supplement n=18; isocaloric supplement n=8)	Biometrics: weight, BMI, WFH, MUAC, TSF, serum albumin, prealbumin, protein Malnutrition criteria (at least 1 of the following): BMI <5%ile, WFH < 90%ile, TSFT or MUAC <5%ile, or 5% weight loss	• No statistical difference between hypercaloric and isocaloric formula • Decrease in malnutrition diagnosis with supplement (p=0.006) • At 6 months, formula increased WFH (p=0.003), BMI (p=0.003), TSF (P=0.007), and MUAC (p<0.001) • Also increased serum albumin levels (p<0.001) and prealbumin (p=0.005) at 3 and 6 months
Cuvelier, et.al. (2014)[9]	Randomized, double-blind, placebo-controlled study Megestrol acetate (MA) 26 patients (intervention group n=13; placebo group n=13)	Biometrics: weight, WAZ, HAZ, BMI-Z, MUAC, TSF Secondary outcomes: body composition, toxicities	• MA associated with significant weight gain (p=0.003), WAZ (p=0.002), BMI-Z (p=0.006), and MUAC (p=0.01) • No significant difference in HAZ or TSF
Sacks, et.al. (2014)[28]	Pilot study Proactive enteral tube feeding 53 patients (intervention group n=20; control group n=33)	Biometrics: WFH, BMI, WAZ Secondary outcomes: infection	• Intervention group had less of a loss in WAZ than control group (19% decrease vs. 40% decrease, respectively) from diagnosis to tube feeding initiation (p=0.037) • No p-values were reported for changes in WFH and BMI • No difference in infectious complications
Couluris, et.al. (2008)[8]	Open label phase 2 trial Cyproheptadine hydrochloride (CH) and megestrol acetate (MA) for CH failure CH intervention n=66; MA intervention n=6	Biometrics: weight, growth rate, WFH, WAZ, prealbumin, leptin Treatment response (stable or increased weight)	• CH significantly increased weight (p=0.001), WAZ (p=0.001), serum leptin levels (p=0.0004) • 76% treatment response with CH • 5 of 6 patients on MA responded to therapy • No significant difference in prealbumin
Prasad, et.al. (2021)[22]	Randomized, open-label phase 3 trial Ready-to-use therapeutic food (RUTF) 260 patients (intervention group n=130; control group n=130)	Biometrics: weight, nutritional status, fat mass Complications: infection, mucositis	• Intervention increased weight gain (77.8% vs 64.2%) (p=0.025) • Significant increase in fat mass (p=0.005) • Increased number of patients with normal nutritional status (p=0.02) • Decreased complications (infections: p<0.0001; mucositis: p=0.006)

Table 2: Included studies – screening tools

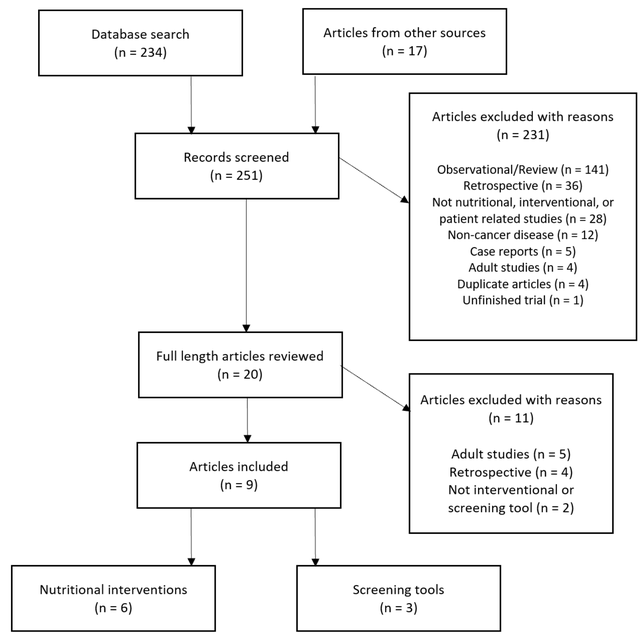
Publication	Design or sample	Measures	Results
Gallo, et.al. (2021)[11]	Quality improvement report (pre and post intervention) Nutritional support team Control group n=73; intervention group n=72	Survival, body measurements, hospitalization and treatment characteristics	• Decreased need for antibiotic treatment (p=0.036) • Nutrition support decreased length of treatment (p<0.001) • No significant improvement in survival, or hospital, treatment, and antibiotic days (p>0.05)
Han, et.al. (2021)[14]	Quality improvement report (pre and post intervention) Nutritional screening tool for childhood cancer (SCAN) Intervention group n=267	Biometrics: weight, malnutrition rates Dietitian referral and timeliness	• Improved dietician referral and timeliness (from 36.4% to 85.7%; p<0.001) • Improved percent weight change, but not significant (p=0.036)
Totadri, et.al. (2019)[32]	Validation study SIOP-PODC algorithm 50 patients (intervention group n=25; control group n=25)	Biometrics: MUAC, weight Complications: mucositis, transfusions, febrile neutropenia	• No significant weight increase • Significant increases in MUAC (p=0.02), and oral supplements (p=0.011) • Fewer platelet transfusions in intervention group (p=0.02) • No difference in mucositis occurrence

WFH = weight-for-height; BMI = body mass index; MUAC = mid-upper arm circumference; MA = megestrol acetate, WAZ = weight-for-age z-score; ALL = acute lymphoblastic leukemia; TSF = triceps skinfold thickness; *sample included analyzed patients only

Results

- Of the 251 articles found from the search results and external sources, 9 were included in this review (6 for nutritional intervention and 3 for nutritional screening tool implementation and validation)
- Interventions included:
  - Appetite stimulants (megestrol or cyproheptadine)
  - Nutritional supplementation (ready-to-use, iso- or hypercaloric)
  - Proactive feeding tube placement
- Screening tools included:
  - Nutritional support algorithm
  - Nutritional support teams
  - Nutritional screening tool for childhood cancer

Figure 1: Article search results with reasons for exclusion



Conclusion

- Nutrition intervention increases patient weight and decrease complications
- Screening tools decreased malnutrition risk with some weight gain
- Potential age- and disease-specific nutritional benefits exist

Future Directions

- Studies are needed in order to standardized nutritional care and assessment

QR code