



Nutrition and Cancer: Feeding through Treatment

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Disclosures

- There are no financial interests to disclose for this presentation.
- The views expressed herein are those of the presenters and do not necessarily represent Children's Healthcare of Atlanta's views.
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Objectives

- Describe nutrition goals during cancer treatment
- Identify strategies to optimize oral nutrition intake
- Explain methods, indications, and contraindications for enteral and parenteral nutrition support
- Discuss supplement use and emerging research

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Broad Nutrition Goals



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Nutrition Goals during Cancer Treatment¹

- Promote and maintain age-appropriate growth
- Minimize incidence and severity of malnutrition
- Ensure adequate nutrition support and tolerance
- Maintain or improve quality of life



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Implications of Poor Nutrition

Malnutrition (Undernutrition)

- Increased infection risk, immunodeficiency²
- Decreased tolerance to treatment³
- Higher risk of treatment toxicity⁴
- Refeeding syndrome
- Higher readmission rate³
- Decreased quality of life³
- Increased mortality rate³

Obesity (Overnutrition)

- Decreased health-related quality of life (impaired emotional and cognitive functioning)⁵
- Higher incidence of treatment toxicity and worse event-free survival in acute lymphocytic leukemia (ALL)^{6,7}

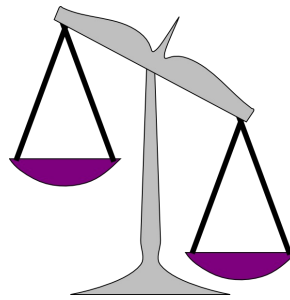
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What is malnutrition?

- A.S.P.E.N. defines pediatric malnutrition as “an imbalance between nutrient requirement and intake, resulting in cumulative deficits of energy, protein or micronutrients that may negatively affect growth, development and other relevant outcomes.”⁸



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Diagnosing Malnutrition

One Data Point:

	Mild Malnutrition	Moderate Malnutrition	Severe Malnutrition
Weight-for-height z score	-1 to -1.9 z score	-2 to -2.9 z score	-3 or greater z score
BMI-for-age z score	-1 to -1.9 z score	-2 to -2.9 z score	-3 or greater z score
Length/height-for-age z score	No data	No data	-3 z score
Mid-upper arm circumference	Greater than or equal to -1 to -1.9 z score	Greater than or equal to -2 to -2.9 z score	Greater than or equal to -3 z score

BMI, body mass index.

Two Data Points:

	Mild Malnutrition	Moderate Malnutrition	Severe Malnutrition
Weight gain velocity (<2 years of age)	Less than 75% ^a of the norm ^b for expected weight gain	Less than 50% ^a of the norm ^b for expected weight gain	Less than 25% ^a of the norm ^b for expected weight gain
Weight loss (2–20 years of age)	5% usual body weight	7.5% usual body weight	10% usual body weight
Deceleration in weight for length/height z score	Decline of 1 z score	Decline of 2 z score	Decline of 3 z score
Inadequate nutrient intake	51%–75% estimated energy/protein need	26%–50% estimated energy/protein need	≤25% estimated energy/protein need

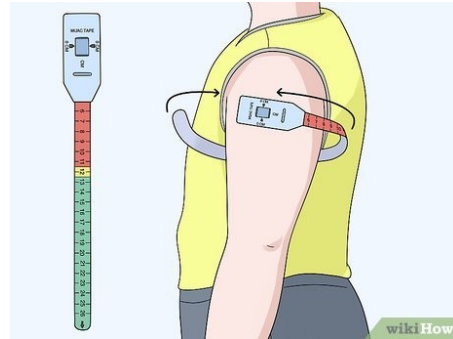
^aGuo S, Roche AF, Foman SJ, et al. Reference data on gains in weight and length during the first two years of life. *Pediatrics*. 1991;119(3):355-362.

^bWorld Health Organization data for patients <2 years old: http://www.who.int/childgrowth/standards/w_velocity/en/index.html.

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Prevention/Treatment of Malnutrition

- Close monitoring of growth parameters
- Nutrition-focused physical exam
- Intervention with oral nutrition supplements, appetite stimulants, and/or enteral and parenteral nutrition support as warranted



Feeding: Oral Route



Feed me!

- Oral intake is encouraged – balanced diet with foods from each food group when possible
 - Can help promote and maintain development of oral motor skills in infants and young children
 - Maintain gut integrity
 - Physiological ideal
- Feeding IS parenting
- Feeding IS personal
- Feeding IS cultural



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Oral Feeding Strategies

Undernutrition

- Consistent and routine meals and snacks
- Family meals when able
- Eating a variety of foods from every food group
- Dealing with stress, emotions, boredom without using food
- May add high-calorie food fortifiers

Overnutrition

- Consistent and routine meals and snacks
- Family meals when able
- Eating a variety of foods from every food group
- Dealing with stress, emotions, boredom without using food

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Nutrition Tips for Treatment-Related Side Effects

Symptom	Nutrition Tips
Poor Appetite	<ul style="list-style-type: none"> • Small, frequent meals and snacks on a set schedule • High calorie/high protein foods and beverages, including shakes/smoothies and oral nutrition supplements
Nausea/vomiting	<ul style="list-style-type: none"> • Bland, room temperature and cold foods • Sips of fluids between meals – electrolyte repletion if vomiting • Ginger⁹, peppermint¹⁰
Diarrhea	<ul style="list-style-type: none"> • Increase soluble fiber in diet (oats, applesauce, bananas, green beans, rice) • Decrease sugar, sugar-substitutes, and high-fat/greasy foods
Constipation	<ul style="list-style-type: none"> • Increase insoluble fiber in diet (fruits & vegetables, whole grains, nuts/seeds) • Increase fluid intake; try warm beverages
Taste Changes	<ul style="list-style-type: none"> • Try tangy/tart foods (fruit, Greek yogurt, sherbet, tangy sauces, candies) and spices • Add lemon juice to foods or water • Avoid metal utensils
Mucositis	<ul style="list-style-type: none"> • Bland, soft foods; avoid spicy, crunchy, and acidic foods and fruits/juices • Mouth care; try viscous lidocaine before eating • High calorie liquids/shakes; drink with a straw

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Oral Nutrition Supplements

Type	Supplement Name
Standard	Pediatric – Pediasure®, Boost Kids Essentials®, Carnation Breakfast Essentials® Adult – Ensure®, Boost®, Equate®, or Fortify® <u>Original</u>
High Calorie	Pediatric – Pediasure 1.5®, Boost Kids Essentials 1.5® Adult – Ensure®, Boost®, Equate®, or Fortify® <u>Plus</u>
Clear Liquid	Ensure Clear®, Boost Breeze® (no specific pediatric formulations available)
Plant-Based	Pediatric – Orgain Kids Plant Protein®, Kate Farms Pediatric Standard 1.2® Adult – Orgain Plant Protein Shake®, Kate Farms Standard 1.0 or 1.4®



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Appetite Stimulants

- Used when weight loss/poor intake persist despite dietary interventions¹¹

Drug Name	Class	Side Effects
Periactin® (cyproheptadine)	Antihistamine	Drowsiness, thick secretions, mood changes
Marinol® (dronabinol)	Antiemetic, cannabinoid type	Drowsiness, confusion, mood changes
Remeron® (mirtazapine)	Antidepressant	Drowsiness, mood changes, dry mouth, constipation
Zyprexa® (olanzapine)	Antipsychotic - atypical	Headache, dizziness, confusion, constipation
Megace® (megestrol acetate)	Progestin	Adrenal suppression, thrombosis, insomnia, increased fat mass

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Feeding: Enteral Route



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Enteral Nutrition (EN)

- Definition: Liquid nutrition formula that is delivered into the digestive system (stomach or small intestine) via a temporary or permanent tube



- Preferred method of nutrition support^{1,14-17}
 - Maintains mucosal integrity/function of GI tract
 - Lower risk of infections
 - Lower cost than IV nutrition
 - Feasible and safe for patients with mucositis, severe neutropenia, and thrombocytopenia¹

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Enteral Nutrition (EN) Considerations

Indications ^{1,11,14,17}	Contraindications
Unable to meet needs by mouth	Severe GI dysfunction: GI infection, bowel perforation, bowel obstruction
Weight loss/Malnutrition	Severe nausea, vomiting, diarrhea, intolerance
Swallowing dysfunction/Aspiration risk	Lack of access (no tube)
Compromised/Mildly altered GI function	Hemodynamically unstable

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Enteral Feeding Routes

NG/NJ

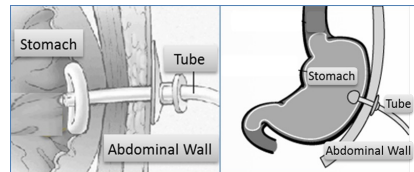
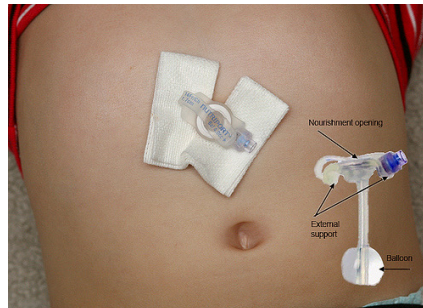
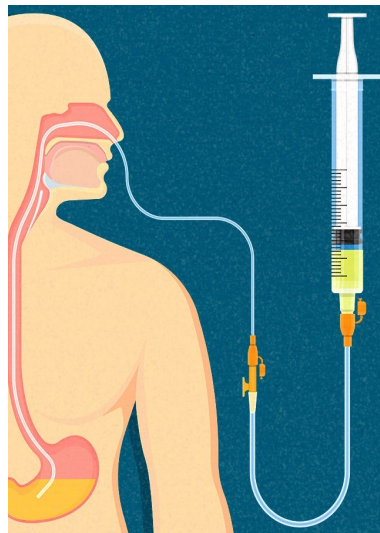
- Temporary access only, short term EN
- Tube placed from nose down throat into stomach (NG) or jejunum (NJ)
- Non surgical option, placed at bedside
- Can be placed with bridle

GT/JT

- Better for longer term EN
- Requires surgical placement, sedation
- Better for patients who may lose NG access from chemo related emesis, concern for pulling out NG (younger patients)
- Not placed when neutropenic
- Remain an infection risk during treatment

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Enteral Feeding Routes



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Enteral Formula Selection Considerations

Age and condition specific formulas	Calorie and volume requirement	Tube size and feeding pump
Formula hang time	Protein type	Modulars and additives
Ease of obtaining formula	Caregiver or cultural preferences	Regimen desired for home

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Enteral Formula Examples

Infant: Breastmilk, RTF, concentrate, powder formula, hypoallergenic, preemie. Calories increased with modulars or less added water.



Pediatric (1-12 yrs): RTF/standard, vegan, whole food based, blenderized, hypoallergenic, high or low cal options.



Adult (12-14 yrs+): RTF/standard, vegan, whole food, blenderized, disease specific, high or low cal options, peptide based.



*RTF = Ready to feed

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Designing Realistic Feeding Regimens

- Continuous vs overnight vs bolus:
 - Is goal just supplemental?
 - Bolus more physiologic, daytime bolus/ nighttime continuous may be better for volume sensitive patients.
 - Can't do bolus with NJ or Jtubes.
 - Use measurable volumes
- Schedules:
 - Family and patient schedule- school, work, activities, etc
 - Radiation therapy schedule, PT
 - Medications
- Consider education level of caregiver
- Consider time commitment



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Feeding: Parenteral Route

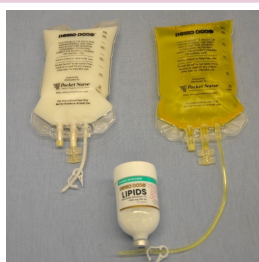


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Parenteral (IV) Nutrition (PN)

- Definition: Providing a custom or premade dextrose, protein, lipid, electrolyte and vitamin/mineral solution via an IV. Bypasses the digestive tract for nutrition.¹⁶

Indications ^{1,14,16,18}	Contraindications/Complications
Failed or EN refusal	Lack of appropriate IV access
Severe GI dysfunction	Pts liver or kidney concerns
Electrolyte supplementation	Higher infection risk and cost



What it looks like vs what it is providing!



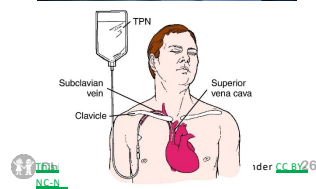
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IV Nutrition Routes

- Peripheral parenteral nutrition (PPN) vs total parenteral nutrition (TPN)
- Customized "recipe" compounded in pharmacy
 - General macronutrient distribution ranges:¹⁶
 - 40-65% CHO
 - 10-20% PRO
 - 20-40% FAT
 - Can be infused for 8-24 hours
 - Micronutrients and electrolytes given at standard doses and adjusted as labs require.



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Supplement Use



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Vitamins/Minerals

- **Vitamin D** – regular monitoring of serum levels and supplementation (as indicated)
 - Serum levels >30 ng/mL may be the most appropriate goal¹¹
 - Important to meet calcium requirements too
- **Folic acid** – contraindicated with high-dose methotrexate
- **Vitamin A** – contraindicated with Isotretinoin (Accutane)
- **Iron** – normally contraindicated due to risk of iron overload if patient is receiving blood transfusions
- **Antioxidants (such as vitamins C, E, selenium)** – unable to make recommendation; concern for interference with treatment efficacy¹⁹



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Electrolytes

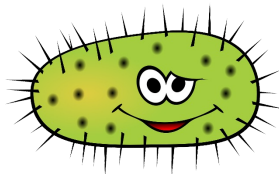
- Medications/chemotherapies and GI losses (vomiting, diarrhea) can cause electrolyte derangements
- May require oral or IV supplementation
 - Potassium
 - Phosphorus
 - Magnesium
- Oral Electrolyte Solutions
 - Enterade®
 - Pedialyte®, Kinderlyte®



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Probiotics

- Probiotics are defined by the World Health Organization as “live microorganisms, which when consumed in adequate amounts, confer a health effect on the host”²⁰
 - Most consist of bacteria such as *Lactobacillus*, *Streptococcus*, *Bifidobacterium*, *Propionibacterium* and *Enterococcus*
- May aid in improvement of cancer treatment-related diarrhea
- Concern for infection risk in immunocompromised patients²¹
- Area of emerging research – **need well-designed studies!**



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Wound Healing

- **Juven**[®] – Immunonutrition wound healing supplement.
 - Contains Vit C, Zinc, arginine, glutamine, collagen, Vit E, B12, HMB^{22,23}
- **Vitamin C** – 5 x DRI²⁴
- **Zinc** – 2 x DRI x 14 days²⁴
 - Adequate calorie and protein intake
- **Nestle Impact AR**[®] – L arginine, EPA/DHA (fish oil) and nucleotides
 - Studies show decreased arginine = decreased T cell function and decreased wound healing²⁵



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Mucositis

- **Vitamins A and E** – topical performed better than oral supplementation²⁶
 - Limited evidence/small sample sizes
- **Healios**[®] – L-glutamine, L-arginine, and trehalose
 - Trehalose + L-G and L-A combination shown to assist absorption by more than 100x and within 10 seconds.²⁷
- **Glutamine** –
 - Oral supplementation may decrease oral mucositis in chemo or BMT patients²⁷
 - Conflicting evidence on risks vs benefits of IV glutamine use in HSCT patients²⁸
- **Zinc carnosine** – new and emerging research^{29,30}
 - Promotes mucosal healing. Lozenge before chemo = less pain meds, less mucositis
 - Treats taste changes caused by chemo with up to 70% improvement



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Questions

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