

ENTERAL NUTRITION by Nick Mark MD

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OBJECTIVES:

- Adequate nutrition is essential to maintain normal physiologic functions
- Enteral feeding also helps maintain an important immunological barrier
- 30-50% of ICU pts are malnourished, malnutrition associated w/ [poor outcomes](#)

WHEN TO START ENTERAL FEEDS?

- Early enteral nutrition (>48 hrs after onset of critical illness) is associated with **reduced mortality and reduced incidence of infections** (particularly pneumonia).
- Deliberate underfeeding is not associated with improved outcomes ([PERMIT 2019](#))
- No survival advantage with early parenteral nutrition ([EPN 2021](#))
- Enteral nutrition can be safely given while in the [prone position](#) or [receiving ECMO](#).
- EN can also be given [while on neurovascular blockers](#) or [while on ECMO](#).

WHEN NOT TO START ENTERAL FEEDS?

- Early EN may be poorly tolerated in patients in shock ([OUTRILLA 21](#)); however the only absolute contraindications to initiating enteral nutrition (EN) are bowel obstruction, perforation, mesenteric ischemia, or major GI bleeding.

ENTERIC FEED FORMULA:

- [Formulas](#) contain a mixture of macronutrients (carbohydrates, lipids, & protein) as well as micronutrients (electrolytes, vitamins, & trace elements). Select based upon clinical context.

- Despite theoretical basis, there is little clinical evidence for many novel disease specific formula (ARDS, COPD, liver).

- There is also limited evidence for additives like glutamine, etc

Carbohydrate	Lipids	Protein	
4.0 kcal/g	9 kcal/g	4.0 kcal/g	Energy content
0.7 U/g	1.4 U/g	0.8 U/g	O ₂ produced
0.9 - 1.0	0.7	0.8	Respiratory quotient

Formula Type	Examples
Standard (2 kcal/mL) – similar to typical US diet in terms of calorie density , used in most ICU patients <div>50-60% 25-40% 20-30%</div>	Ensure, Isosource, Boost, Omnilite
Concentrated (3.5-2.0 kcal/mL) – same contents, less volume, useful in patients on fluid restriction <div>50-60% 25-40% 20-30%</div>	Ensure plus, Impact 1.5, Tasecal HN, Nutren, Renal, Nutren 2.0
High protein – useful for patients with high protein needs (>1.5 g/kg/day) <div>45-55% 30-35% 15-20%</div>	Isosource HN, Omnilite HN, Replete, Boost HP, Peptamen VHP, Ensure HP, Promote
Pre-digested (2.5 kcal/mL) – Low lipid content, partially digested/easily absorbed peptides, used in malabsorption <div>>60% <30% <10%</div>	Peptamen, Vionate P/L/S, Vivonex TEN, Atilaq
High fiber – contains soluble & insoluble fiber, used when there is persistent diarrhea on other feeds <div>50-60% 25-40% 20-30%</div>	Jevity, Ensure with fiber, Promote with fiber, Nutren 1.0 fiber, Compleat, UltraCal
Renal – Concentrated (3.5-2.0 kcal/mL), low K ⁺ & PO ₄ , low protein, used for people with renal failure <div>60-60% 30-40% <10%</div>	Nepro, MagnaCal Renal, Suplena, Novasource Renal, Renalcal
Diabetic – lower carbohydrate content, used in diabetics <div>20-30% 40% 25-30%</div>	Choice Dkt, Glucerna Select, Glytrol, Diabetisource AC

CALCULATING CALORIC NEEDS:

- Energy expenditure depends on mass, metabolism, & illness.
- It is not necessary to meet full caloric needs; many benefits of early feeding are realized with any EN. Paradoxically, achieving 100% of caloric needs in the 1st week [may be harmful](#). Thus, while early feeding is preferable the goal need not be full calories.

- Simple formula to estimate basal energy expenditure (BEE)
 $BEE \text{ kcal/day} = 25 \times \text{weight (kg)}$

For most people use actual weight. If volume overloaded, use dry weight. If obese (BMI > 30 kg/m²) use 110% of BW.

- Disease can modify caloric needs:
 - Fever 10% more calories per degree C
 - Peritonitis 30-50% more, Sepsis 40-60% more
 - Trauma: 20-60% more Burns: +50-100% depends on BSA

- Higher protein may be beneficial in select population ([TARGET 2018](#))
- Most critically ill patients require 1.2-1.5 g/kg/day of protein

- Patient with burns may require high protein 3 g/kg/day (add supplements if needed)
- Consider branched chain amino acids (BCAA) in patients with [hepatic encephalopathy](#)

- Indirect calorimetry measures VCO₂ & VO₂ to calculate EE

$$EE \text{ kcal/day} = 1440 \times [(3.94 \times V\dot{O}_2) + (1.11 \times V\dot{CO}_2)]$$

- Only possible to obtain accurate measurements if FIO₂ is < 0.6
- Respiratory quotient [can identify problems](#) or fine-tune feeding:
 - RQ > 1 suggests overfeeding → decrease carbs or lipids
 - RQ < 0.8 suggest underfeeding → increase calories

Indirect calorimetry results in [more calories & protein administered](#).



Use a [calculator](#) to determine the rates of a particular enteral feed.

RESIDUALS:

- Residuals** are contents that remain in the stomach, after tube feeding is paused.
- At least 500ml of residuals can be safely tolerated without intervention ([MAGNUS 2019](#))
- If TF are poorly tolerated (residuals >500, vomiting, gastric distension), consider the following:
 - Maintain head up >30 degrees (good practice to prevent VAP)
 - Administer pro-kinetic agents (erythromycin is superior to metoclopramide)
 - Consider advancing FT post-pyloric or into jejunum (especially if vomiting)
- Increasingly, there is evidence for NOT checking residuals at all (less RN work, no improvement in outcomes)

FEEDING TUBES (FT):

- Nasal can be used in intubated or non-intubated patients but there is a [higher risk of sinusitis](#) among people who are intubated.

- Gastric – used for bolus or continuous feeds

- Post-pyloric & jejunal can be used only for continuous feeds.

- Post-pyloric (duodenal)** – small
Decrease in pneumonia risk; used in patients w/ gastric outlet obstruction, vomiting.

- Jejunal** – used in specific patients (vomiting, intolerance), O₂/N₂ not superior O₂/N₂ ([BENNETT 2014](#))

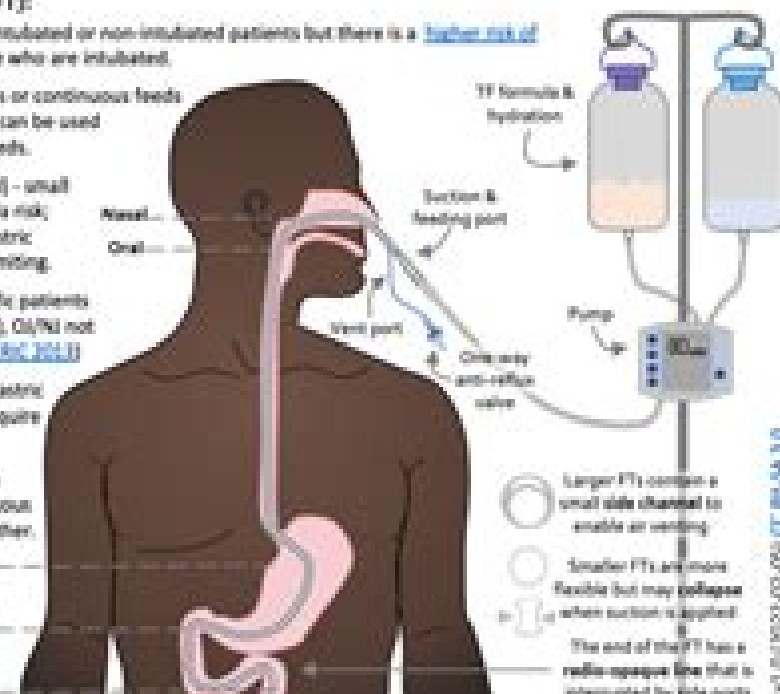
- Consider permanent gastric tube in people who require FT for >4-6 weeks

- [Similar outcomes](#) with intermittent & continuous tube feeds. Can use either.

Gastric 10-15mL

Post-pyloric 10-15mL (via duodenal)

Jejunal 10-15mL



Pediatric Enteral Nutrition Guidelines

Sharma Madhu



Pediatric Enteral Nutrition Guidelines:

Pediatric Nutrition in Practice Berthold Koletzko, Peter Cooper, Maria Makrides, R. Uauy, 2008-01-01 There is no other time in life when the provision of appropriate nutrition is of greater importance than during infancy and childhood During this phase of life characterized by rapid growth and development an adequate amount and composition of nutrients both in health and disease are of key importance for growth functional outcomes such as cognition and immune response and long term well being To provide concise information to readers who seek quick guidance on practical relevant issues in the nutrition of infants children and adolescents the editors have developed this compact reference book as busy physicians and other healthcare professionals often find it difficult to devote sufficient time to study elaborate and extensive books on just one aspect of their practice Moreover due to the insightful input of a global editorial board challenges both in affluent and poorer populations are addressed thus providing a truly international perspective which further contributes to the unique worth of this book

Therapeutic Pediatric Nutrition Sharma Madhu, 2011-06 This book covers dietetic management of common as well as uncommon diseases of childhood Each chapter is complete in itself and delineates in detail every aspect of therapeutic dietetics covering physiological background pathogenesis of factors leading to nutritional disorders nutritional requirements in the particular disease entity The scientific basis of the menu planning and development of recipes to provide the calculated amounts of nutrients in a palatable form are explained The chapters on diabetes mellitus kidney disorders celiac disease and enteral feeding need special mention as examples of sound instructions Rare disorders like inborn errors of metabolism are also covered This book is useful guide for all trainers involved in the teaching of nutrition in colleges and other health care institutions

Manual of Pediatric Cardiac Care Talât Mesud Yelbuz, Mohammed Abdullah Bin-Moallim, Wael Jasim Mohamed Husain, Yousif Saleh Alakeel, Mohamed Salim Kabbani, Abdullah Ali Alghamdi, 2024-07-29 This two volume manual covers the most relevant protocols in pediatric cardiac care to serve as a practical guide that matches and reflects the high level of accumulated knowledge and expertise in this clinical field It includes 179 chapters and offers comprehensive precise and up to date practical tips with specific care protocols to provide the most efficient strategies for high quality care in patients with congenital heart disease CHD This book simplifies learning with many tables flowcharts graphs and algorithms for easy access and fast action Volume II covers many vital sections such as ethical considerations in pediatric cardiac patients pediatric cardiac surgery pediatric cardiac intensive care unit PCICU guidelines clinical pharmacy guidelines adults with congenital heart disease appendix with normal values reference tables graphs scores and various calculated indexes used and needed for proper pediatric cardiac care This manual is a must have resource for pediatricians neonatologists clinical pharmacy specialists pediatric intensive care physicians pediatric cardiologists pediatric cardiac intensive care physicians pediatric cardiac surgeons and or surgeons interested in pediatric cardiac surgery

Handbook of Pediatric Surgery Chandrasen K. Sinha, Mark Davenport, 2022-01-17 The new fully updated edition of this book gives a

concise overview of all important topics and is designed to provide information to recognise and treat common pediatric surgical conditions namely symptoms and signs investigation and management A logical evidence based practice is encouraged by the use of flow charts tables and algorithms This edition has been thoroughly revised to reflect the rapid progress in the world of pediatric surgery including the subspecialties of general pediatric surgery urology hepatobiliary surgery organ transplantation minimally invasive surgery including robotic surgery and bariatric surgery This book also provides an anatomical and physiological background to aid understanding Having been authored by international leaders in these fields this book offers comprehensive coverage of various surgical conditions in children with a quick reference format The first edition has been immensely popular with over 160 000 downloads including GPs A E doctors adult surgeons who need to treat children pediatricians and of course pediatric surgeons **Essentials of Pediatric Nutrition** Kathy King (RD.),2011-07 Abridged version of Pediatric nutrition edited by Patricia Queen Samour Kathy King 4th ed c2012

Handbook of Pediatric Nutrition Patricia Queen Samour,Kathy King (RD.),2005 Handbook of Pediatric Nutrition Third Edition provides cutting edge research and resources on the most important pediatric issues and therapies such as prenatal nutrition weight management vegetarian diets diabetes guidelines and transplant nutrition concerns Commonly used by dietetic practitioners studying for their Pediatric Specialty exams registered dietitians dietetic technicians nutritionists pediatricians nurses and dietetic students this book is considered the last word in pediatric nutrition *Practical Approach to Pediatric Intensive Care* Praveen Khilnani,2023-10-31 This book is a comprehensive guide to all aspects on paediatric intensive care The fourth edition has been fully revised to include the latest guidelines and advances in technology The extensive text of 1200 pages explains practical and surgical issues with thorough coverage of respiratory and cardiac care Other conditions specific to different systems of the body are also discussed endocrine gastrointestinal neurological and more Several chapters are dedicated to environmental injuries including burns electric shock heat disorders near drowning and poisoning The book concludes with discussion on psychosocial issues ethical and medicolegal aspects training research quality improvement and use of therapeutic drugs in paediatric intensive care The text is highly illustrated with clinical photographs diagrams and flowcharts Key points Comprehensive guide to all aspects of paediatric intensive care Fully revised fourth edition featuring latest guidelines and technological advances Extensive text of 1200 pages further enhanced by clinical photographs diagrams and flowcharts Previous edition 9789351527398 published in 2015 **Samour & King's Pediatric Nutrition in Clinical Care** Susan H Konek,Patricia J Becker,2019-03-12 Samour King s Pediatric Nutrition in Clinical Care Fifth Edition provides comprehensive coverage of the nutritional aspects of pediatric clinical care A widely trusted resource for more than twenty years this text combines coverage of nutrition assessment and care with detailed coverage of normal growth relevant disease states and medical nutrition therapy *Manual of Pediatric Nutrition* ,1997-10-01 This revised 3rd edition of the Twin Cities District Dietetic Association TCDDA Manual of Pediatric Nutrition is

the result of a cooperative effort on the part of the pediatric dietitians from the major children's hospitals pediatric units and public health agencies serving children in the Minneapolis St Paul metropolitan area This joint effort was undertaken with the belief that a single manual written by dietitians with experience and expertise in various areas of pediatrics would promote continuity in the nutritional care of the pediatric population in the Twin Cities Topics include General Nutrition Nutrition Assessment Consistency Modifications Diabetes Weight Management Nutrition for Children with Special Health Care Needs and many more

Pediatric Gastrointestinal and Liver Disease - E-BOOK Robert Wyllie, Jeffrey S. Hyams, Marsha Kay, 2025-05-31 Accessible practical and focused on diagnosis and treatment Pediatric Gastrointestinal and Liver Disease Seventh Edition covers the entire spectrum of pediatric GI hepatic and nutritional disorders This popular reference offers definitive guidance from experienced editors Drs Robert Wyllie Jeffrey S Hyams and Marsha Kay as well as globally renowned contributors who share their knowledge and expertise on complex issues Full color illustrations review questions online real world case studies and detailed instruction on performing key procedures ensure that this updated edition remains your reference of choice in this fast changing area Includes significantly updated coverage of the gut microbiome new biologic therapies for the treatment of pediatric inflammatory bowel diseases advancements in the treatment of pediatric liver diseases including metabolic associated fatty liver disease MAFLD and new diagnostic imaging techniques Features a robust art program with full color anatomical figures clinical photos and other illustrations throughout the text Details key procedures such as esophagogastroduodenoscopy and related techniques colonoscopy and polypectomy endoscopic retrograde cholangiopancreatography and endoscopic ultrasound capsule endoscopy and small bowel enteroscopy GI motility procedures and more Prepares you for certification and recertification with more than 400 board style review questions answers and rationales online Contains numerous algorithms that provide quick and easy retrieval of diagnostic screening and treatment information as well as detailed diagrams that accurately illustrate complex concepts and provide at a glance recognition of disease processes An ideal everyday resource for pediatric gastroenterologists and hepatologists pediatric dietitians and nutritionists pediatricians family medicine practitioners PAs and NPs Any additional digital ancillary content may publish up to 6 weeks following the publication date

A Practical Manual of Pediatric Cardiac Intensive Care Rakhi Balachandran, Aveet Jayant, R Krishna Kumar, 2021-08-31 Sect 1 General Topics Sect 2 Cardiac Lesion Specific Postoperative Management Sect 3 Common Complications Sect 4 Miscellaneous Topics

Pediatric Nutrition in Practice B. Koletzko, J. Bhatia, Z. A. Bhutta, P. Cooper, M. Makrides, R. Uauy, W. Wang, 2015-04-17 There is no other time in life when the provision of adequate and balanced nutrition is of greater importance than during infancy and childhood During this dynamic phase characterized by rapid growth development and developmental plasticity a sufficient amount and appropriate composition of nutrients both in health and disease are of key importance for growth functional outcomes such as cognition and immune response and the metabolic programming of long term health and well being This compact

reference text provides concise information to readers who seek quick guidance on practical issues in the nutrition of infants children and adolescents After the success of the first edition which sold more than 50 000 copies in several languages the editors prepared this thoroughly revised and updated second edition which focuses again on nutritional challenges in both affluent and poor populations around the world Serving as a practical reference guide this book will contribute to further improving the quality of feeding of healthy infants and children as well as enhancing the standards of nutritional care in sick children

Clinical Management of Intestinal Failure Christopher P. Duggan, Kathleen M. Gura, Tom Jaksic, 2011-12-07 A complex disease entity intestinal failure IF has only recently become accepted as a distinct clinical syndrome Improvements across a wide range of disciplines including critical care and organ transplantation as well as surgical medical and nutritional therapies have led to a steady rise in survival and quality of life for patients with IF

Handbook of Home Nutrition Support Carol S. Ireton-Jones, 2007 Home nutrition support provides essential nutritional assessments and artificial feeding in the form of either tube or vein This book covers a multitude of specific applications for various needs

Paediatric Formulation Nunzio Denora, Antonio Lopalco, 2021-09-02 The development of paediatric medicines can be challenging since this is a different patient population with specific needs A medicine designed for use in paediatric patients must consider the following aspects patient population variability the need for dose flexibility route of administration patient compliance excipient tolerability For example the toxicity of excipients may differ in children compared to adults and children have different taste preferences Globally about 75% of drugs do not carry regulatory approval for use in children worldwide many medications prescribed for the treatment of paediatric diseases are used off label and less than 20% of package inserts have sufficient information for treating children This book provides an update on both state of the art methodology and operational challenges in paediatric formulation design and development It aims at re evaluating what is needed for more progress in the design and development of age appropriate treatments for paediatric diseases focusing on formulation development drug delivery design efficacy safety and tolerability of drugs and excipients

Pediatric Stem Cell Transplantation Paulette Mehta, 2004 This textbook examines stem cell transplantation in pediatric patients

Workbook in Practical Neonatology - E-Book Richard Polin, Thomas Hays, 2025-01-02 Now in full color for the first time Workbook in Practical Neonatology Seventh Edition uses a highly effective case based approach to provide practical clinical guidance on evaluation diagnosis and treatment of newborns World renowned neonatologist Dr Richard Polin and new editor Dr Thomas Hays lead a team of expert contributing authors who offer case studies followed by questions answers and explanations in every chapter You ll find authoritative guidance on the problems you re most likely to see in practice including issues regarding resuscitation mechanical ventilation anemia fluid therapy and bronchopulmonary dysplasia The 7th Edition has been extensively revised with new authors new charts and graphs and many new cases throughout Organizes chapters around case studies followed by questions and answers that require you to make diagnostic decisions and help you understand how scientific concepts

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TRAINING SECTION 2 FETAL UROLOGY SECTION 3 MALE GENITAL RECONSTRUCTION SECTION 4 FEMALE GENITAL RECONSTRUCTION SECTION 5 RENAL RECONSTRUCTIONS SECTION 6 URETERAL RECONSTRUCTIONS SECTION 7 PREREQUISITES PRIOR TO LOWER TRACT RECONSTRUCTIONS SECTION 8 BLADDER BLADDER NECK AND CONTINENCE PROCEDURES SECTION 9 RECONSTRUCTION INVOLVING GI SEGMENTS SECTION 10 ONCOLOGICAL AND OTHER RECONSTRUCTIONS SECTION 11 FUTURE OF PEDIATRIC UROLOGY SECTION 12 STONES SECTION 13 IMAGING OF URINARY TRACT PRIOR TO RECONSTRUCTION Index

The book delves into Pediatric Enteral Nutrition Guidelines. Pediatric Enteral Nutrition Guidelines is an essential topic that needs to be grasped by everyone, from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Pediatric Enteral Nutrition Guidelines, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:
 - Chapter 1: Introduction to Pediatric Enteral Nutrition Guidelines
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 - Chapter 4: Pediatric Enteral Nutrition Guidelines in Specific Contexts
 - Chapter 5: Conclusion
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This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. It is highly recommended for anyone seeking to gain a comprehensive understanding of Pediatric Enteral Nutrition Guidelines.

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