



OBJECTIVES:

- Adequate nutrition is essential to maintain normal physiologic functions
- Enteric feeding also helps maintain an important immunological barrier
- 30-50% of ICU pts are malnourished; malnutrition associated w/ [worse 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 2015](#))
- No survival advantage with early parenteral nutrition ([EPN 2011](#)).
- Enteral nutrition can be safely given while in the [prone position](#) or [receiving TTM](#). EN can also be given [while on neuromuscular blockers](#) or [while on ECMO](#).

WHEN NOT TO START ENTERAL FEEDS?

- Early EN may be poorly tolerated in patients in shock ([NUTRIREA-2](#)); 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 mixtures 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	
Energy content	4.0 kcal/g	9 kcal/g	4.0 kcal/g	
CO ₂ produced	0.7 L/g	1.4 L/g	0.8 L/g	
Respiratory quotient	0.9 - 1.0	0.7	0.8	

Formula Type	Examples
Standard (1 kcal/mL) – similar to typical US diet in terms of carbs/lipid/protein . Used in most ICU patients 50-60% 25-40% 10-15%	Ensure, Isosource, Boost, Osmolite
Concentrated (1.5-2.0 kcal/mL) – same contents, less volume, useful in patients on fluid restriction 50-60% 25-40% 10-15%	Ensure plus, Impact 1.5, Twocal HN, Nutren, Renal, Nutren 2.0
High protein - useful for patients with high protein needs (>1.5 g/kg/day) 45-55% 20-35% ≥20%	Isosource HN, Osmolite HN, Replete, Boost HP, Peptamen VHP, Ensure HP, Promote
Pre-digested (1-1.5 kcal/ml) - Low lipid content, partially digested/easily absorbed peptides , Used in malabsorption >70% <10% 20%	Peptamen, Vivonex PLUS, Vivonex TEN, Alitraq
High fiber – contains soluble & insoluble fiber , used when there is persistent diarrhea on other feeds 50-60% 25-40% 10-15%	Jevity, Ensure with fiber, Promote with fiber, Nutren 1.0 fiber, Compleat, Ultracal
Renal – Concentrated (1.5-2.0 kcal/mL), low K+ & PO ₄ , low protein , used for people with renal failure 30-40% 30-40% <20%	Nepro, Magnacal Renal, Suplena, Novasource Renal, Renalcal
Diabetic – lower carbohydrate content, used in diabetics 20-40% 40% ≥20%	Choice DM, 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 IBW.
- Disease can modify caloric needs:
 - **Fever** 10% more calories per degree C
 - **Peritonitis** 20-50% more, **Sepsis** 40-80% more
 - **Trauma**: 20-40% 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 2 g/kg/day (add supplements if needed)
- Consider branched chain amino acids (BCAA) in patients with [hepatic encephalopathy](#)

- Indirect calorimetry **measures** VO₂ & VCO₂ to **calculate** EE
 $EE \text{ kcal/day} = 1440 \times [(3.94 \times VO_2) + (1.11 \times VCO_2)]$
- 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 enteric 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 ([REGAIN 2010](#))
- 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 metaclopramide)
 - 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), OJ/NJ not superior OG/NG ([ENTERIC 2013](#))

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

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

Gastric 30-36in

Post-pyloric 43in (aka duodenal)

Jejunal >48in

