The Ins and Outs of Enteral Nutrition

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Disclosures

- Abbott Speakers Bureau – honoraria
  (Not product related)
Objectives

- Provide information on the differences in enteral formula categories (polymeric or standard, peptide based, elemental, commercially prepared blenderized).
- Discuss the home made blenderized diet – advantages and disadvantages.
- Discuss ENFit
- Describe common symptoms of formula intolerance and other medical related reasons for intolerance.
The Ins

FORMULAS
BLENDERIZED TUBE
FEEDINGS
ADMINISTRATION
Enteral Formula Regulation

- Considered **Medical Foods** by the United States Food and Drug Administration.
  - "a food which is formulated to be consumed or administered enterally under the supervision of a physician and which is intended for the specific dietary management of a disease or condition for which distinctive nutritional requirements, based on recognized scientific principles, are established by medical evaluation."

- Efficacy studies are not required.
- Pre-marketing review or approval is not required.
- Manufacturing is monitored and regulated.

Escuro NCP 2016;31(6):709-722
Brown NCP 2015;30(1):72-85
## Enteral Formulas

(P) = Pediatric Product available

<table>
<thead>
<tr>
<th>Standard/Polymeric (P)</th>
<th>Peptide based/Semi-elemental (P)</th>
<th>Elemental (P)</th>
<th>Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufactured Blenderized (P)</td>
<td></td>
<td></td>
<td>Diabetes/glucose intolerance</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Renal (P)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Hepatic</td>
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<td></td>
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<td>Pulmonary</td>
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<td></td>
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<td>Immune modulating</td>
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</table>
Pediatric versus Adult Products

Pediatric Products:
- 12% kcals from protein
- 34-43% kcals from fat
- 45-57% kcals from carbohydrate
- Higher in calcium and vitamin D

Adult Products:
- 16% kcals from protein
- 30% kcals from fat
- 54-61% kcals from carbohydrate
- Higher in Folic Acid and Zinc
Composition of enteral formulas

- **Protein**
  - Animal sources have a higher biological value than plant sources.
  - Intact, hydrolyzed, amino acid

- **Fat**
  - Essential Fatty Acids
  - LCT versus MCT

Composition of enteral formulas

- Carbohydrate
  - FODMAPs (fermentable fiber, oligosaccharides, disaccharides, monosaccharides, and polyalcohols)

- Fiber
  - Soluble and Insoluble both arrive to the colon unchanged (not digested and absorbed)
  - Insoluble does not dissolve in water and retains water making stools softer
  - Prebiotic fiber is soluble and fermented in the colon and include FOS and inulin.

Tube feeding Administration

- Continuous infusion (pump)
- Intermittent/Cyclic feedings (pump)
- Bolus/Gavage (syringe)
- Gravity Drip – many times forgotten

Pump Feedings

- Not as precise as we might assume
- Walker et al in Houston
  - Compared actual volume of formula infused (container catching it, not human subjects) to pump rate and volume infused from the pump.
  - The variable was hang height.
  - They found: The volume deliver was less than what was calculated from the rate and from the volume the pump recorded. The higher the hang height the closer these numbers were, so hang height is a significant factor.

Walker NCP 2018;33(1):151-157
Choosing the Best Enteral Regimen

<table>
<thead>
<tr>
<th>Type</th>
<th>Factors</th>
</tr>
</thead>
</table>
| Patient related       | - Nutrition requirements  
                       | - Past medical history and present problems  
                       | - Organ function (renal, hepatic, pulmonary)  
                       | - Gastrointestinal function  
                       | - Enteral access  
                       | - Fluid status |
| Formula related       | - Macronutrient and micronutrient composition  
                       | - Caloric density  
                       | - Polymeric vs hydrolyzed  
                       | - Fiber/no fiber content  
                       | - Osmolality  
                       | - Product viscosity and tube size  
                       | - Method of enteral nutrition administration  
                       | - Cost /Reimbursement |

Escuro AA, NCP, 2016;31(6):709-722
What is a blenderized tube feeding (BTF)?

- Sometimes referred to as:
  - Pureed diet through gastrostomy tube (PDGT)
  - Homemade tube feeding (HMTF)
  - Real foods/Whole foods
- Home prepared foods are liquefied in a blender and given through a g-tube
- BTF can replace some of the feedings or all of the feedings
- Can be made using a commercial product as part of the recipe
- Some recipes use baby foods for increased consistency and eliminating the need for a high quality blender.

## Reasons for Increased Interest

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Supporting Details</th>
</tr>
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<tbody>
<tr>
<td>Perceived nutrition</td>
<td>Can be prepared using organic or GMO-free foods</td>
</tr>
<tr>
<td>benefits</td>
<td>Can be tailored to satisfy specific diets (e.g., vegetarian, vegan)</td>
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<td></td>
<td>Can be developed to avoid food allergens or sensitivities</td>
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<td>Perceived improvement</td>
<td>Reduction in reflux</td>
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<tr>
<td>in feeding tolerance</td>
<td>Reduction in retching/gagging</td>
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<tr>
<td></td>
<td>Reduction in constipation</td>
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<td></td>
<td>Improved volume tolerance</td>
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<tr>
<td></td>
<td>Reduction in oral aversion</td>
</tr>
<tr>
<td>Psychosocial aspects</td>
<td>Normalizes mealtimes</td>
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<td></td>
<td>Allows patients to participate in food preparation</td>
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<td></td>
<td>Allows caregiver(s) to have a sense of nurturing their loved one</td>
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<tr>
<td>Financial consideration</td>
<td>Less expense if commercial formula is not covered by insurance</td>
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</tbody>
</table>

GMO, genetically modified organism.
Why do Patients choose BTF?

- More natural
- Like eating what the family is eating
- Makes them feel normal
- Better tolerance
- Don’t like the ingredients in the commercial products
- Food allergies

Risks

- Microbial contamination
- Unbalanced nutrition/malnutrition – too much or too little
- Tube clogging and increased wear on tubing

What do the Enteral Nutrition Practice Recommendations say?

- Suggest commercial products
- BTF requires additional attention to safe food handling and storage

Campbell, NCP, 2006; Hurt RT, NCP 2013; Bankhead R et al, JPEN, 2013
Who is appropriate for BTF?

- Medically stable on an enteral regimen at home
- Syringe, Bolus feedings or feedings with hang time less than 2 hours
- >10 French tube size (usually 14 French)
- Gastric feedings
- Appropriate growth or clearly able to meet needs with the diet
- Caregivers have a good working relationship with healthcare professionals, esp. a dietitian
- Motivated parents/caregivers
- Refrigerator, electricity, blender
- Volume tolerance
- Access to clean water and food
- > 8 months of age
- Able to meet fluid needs with flushes

Contraindications to BTF

- Less than 6 months of age
- Gastrostomy tube smaller than 10 French
- Jejunostomy tube (or g-j-tube)
- Requires continuous feedings
- Immunocompromised
- Lack of resources/motivation/skills
- Significant malabsorption issues
Considerations

- Food borne illness (home versus hospital)
  - Safe preparation is crucial
- Nutrient variability
- Inconsistency in recipes/food quality
- Requires high level of commitment from the caregiver
- Higher viscosity (increased risk for tube occlusion)
- Increased osmolality
  - Could contribute to adverse GI symptoms. (more research needed)

Potential Benefits

There are no randomized controlled studies comparing BTF to formulas.

- Psycho-social needs met
  - Caregiver feels in control and food is nurturing
  - Can participate in preparation of family meals
  - “Eating” the same meal as everyone else
- Decreased reflux symptoms
- Decreased reports of constipation
- Provides phytochemicals and fibers not found in commercial products
- Improved retching and gagging with fundoplication
- May promote oral intake
Required 50% more calories on the BTF to maintain BMI
BTF micronutrient was superior
Significant decrease in vomiting and use of acid-suppressive agents
Stool consistency and frequency was unchanged but stool softener increased
Caregivers were more satisfied and would recommend it

Gallager NCP 2018;42(6):1046-1060.
Developed to prevent misconnections. (cannot be connected to IV or respiratory equipment.)

Screw, so unlikely to slip and come apart and helps prevent leaks.
ENFit - Challenges

- It is a small bore connector.
- Medication administration.
- Bacterial contamination – attention to cleaning.
- Blenderized Tube Feeding
  - Mundi and colleagues found that formula, size of tube, blender used, and time of blending had more impact on the force needed to push the feeding through the tube than the connector used.

Mundi JPEN 2018 – online first
The Outs

DIARRHEA
CONSTIPATION
GASTRIC RESIDUALS
REFLUX
Diarrhea

- Usually defined based on stool frequency and consistency, but no standard definition.

- It can cause:
  - Electrolyte abnormalities
  - Pressure sores
  - Malnutrition (increased frequency of holding feedings)

Diarrhea - Evaluation

- Protocols are helpful.
- What type of diarrhea?
  - Motility, inflammatory, malabsorption, osmotic, secretory
- Recent changes in regimens?
  - Medications (sorbitol, antibiotics, antacids, laxatives, H2 blockers, stool softeners)
  - Formula Composition
  - Fiber – prebiotic fiber (FOS)
- Bacterial Contamination

Constipation

- More frequent than diarrhea.
- Associated with increased ICU stay, feeding intolerance, and difficulty weaning from the vent.

Causes include:
- Medications (H2 Blockers)
- Dehydration
- Decreased motility

Soluble fibers reduce gastric emptying and are associated with decreasing cholesterol and triglyceride levels.

Insoluble fiber:
- Increase fecal mass
- Promote optimal intestinal functioning/transit
- Prevent/decrease constipation
- Reduce laxative use

Gastric Residuals

What amount of residuals is significant?

- Time consuming
- Increase risk of clogging the tube
- Increase risk of contaminating the feedings
- Electrolyte imbalances if not replaced
- May result in holding feedings unnecessarily negatively impacting nutrition status.

Gastroesophageal Reflux

- Increased LES relaxations
- Increased intra-abdominal pressure
- Delayed gastric emptying
- Increased gastric acid secretion
- Overeating/overfeeding –
  - bolus too large/infused too fast
Enteral formulas are safe and provide adequate nutrition but as professionals and consumers need to be aware of differences in each understanding that marketing can be misleading.

BTF is a viable option for many home enteral nutrition recipients, but it is not appropriate for everyone and needs close monitoring by a registered dietitian and team.

Enfit was developed to improve patient safety, yet we need to evaluate challenges associated with this change.

Intolerances can happen and can be related to formula or may be secondary to many things.
References

Gallagher K et al. Blenderized enteral nutrition diet study: feasibility, clinical, and microbiome outcomes of providing, blended feeds through a gastric tube in a medically complex pediatric population. NCP. 2018;42(6):1046-1060.


Savino P. Knowledge of constituent ingredients in enteral nutrition formulas can make a difference in patient response to enteral feeding. NCP 2018;33(1):90-98.

