Disclosures

Avanos: General Consulting
Nestlé Health Science: Speaker’s Bureau
Objectives

- Review history of blenderized tube feeding (BTF).
- Review benefits of BTF.
- Review formula options.
- Discuss collaboration between patients and dietitians.
What is Blenderized Tube Feeding (BTF)?

- Blended foods and liquids given via feeding tube.
  - May contain modulars (like protein powder) or commercial formulas.
- AKA: homemade tube feeding, whole food tube feeding, real food tube feeding, food-based tube feeding, pureed diet via gastrostomy.
Early Enteral Feeding

- Rectal feeding
  - Assumed there was enough nutrient absorption.
- Glass and wooden tubes were the first tubes.
- First formulas: broth, milk, eggs
- Nasal feeding tubes became more popular in the late 1800’s.
- Around 1960 more comfortable tubes were starting to be made.
BTF in History

- Ancient Egypt
  - BTF started 3500 years ago (rectally)
  - Jelly, eggs, sugar, milk and wine
  - President James Garfield received rectal feeding in 1881

- 1793 the first BTF formula was administered into the stomach via tube

- Modern commercial tube feeding formulas introduced in 1960-1970s

- Early 2000’s publications citing microbial contamination of BTF

- 2010 Modern Day BTF started to emerge

Oley Foundation Survey

Pediatrics (125 respondents)
- 89.6% of pediatric patients used BTF
- 71% of total daily intake
- 75% used homemade blends

Adults (91 respondents)
- 65.9% of adult patients used BTF
- 56% of total daily intake
- 67% used homemade blends

Results: using commercial EN formula was more likely to lead to weight loss than using BTF ($P < .0001$).

HEN Demographics survey

- Online survey linked on Oley Foundation and Feeding Tube Awareness Foundation online.
- Coram and Pediatric Home Services also helped administer the surveys.
- 1519 surveys completed
  - 1062 <18 years old
    - 23.6% reported use of BTF
  - 457 ≥18 years old
    - 14.9% reported use of BTF

Surveys

Dietitians
- 2,448 dietitians responded
- 58% use and recommend BTF
- Most common reason for use was parent request (70.2%)

Parents
- 244 parents responded, 50% using BTF in some way
  - Only half (49.3%) of parents using BTF referred to dietitians for feeding oversight

RDN Challenges

- 221 RDN responded to survey
  - 24% had confidence in managing patients on BTF
  - 27% of respondents did not have BTF education
    - Informal education
  - Limited perceived competence on BTF practice and formula education opportunities are needed.

### Why BTF?

**Improved Outcomes Associated with BTF**

<table>
<thead>
<tr>
<th>Improved bowel function (diarrhea / constipation)</th>
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</thead>
<tbody>
<tr>
<td>Improvement and diversity of gut microbiota</td>
</tr>
<tr>
<td>Increased patient / caregiver satisfaction</td>
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<tr>
<td>Decreased gagging / retching / reflux / vomiting</td>
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<tr>
<td>Cost savings / decreased healthcare utilization</td>
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<tr>
<td>Accommodate food allergies / intolerances</td>
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<tr>
<td>Personal preference / patient centered care</td>
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<tr>
<td>Improved Quality of Life / psychosocial benefits</td>
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<td>Thicker consistency may improve volume tolerance</td>
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Literature Review

Improve Reflux and Bowel Regularity

- 33 children were given BTF. Primarily used commercial baby food or formula as base for ease of preparation / consistency of nutrients
- 52% had reduction in gagging
- 73% had decrease in overall symptoms
- No child had worsening symptoms
- 57% increased oral intake

Bowel Adaptation

- Ten children with a mean small bowel length of 48.3 cm were trialed on formula with real food ingredients
- 9 children tolerated the transition off elemental formula and had improvement in stooling

17 of 20 Transitioned from Standard Formula to Homemade BTF

- BTF micronutrient content was superior
- Prevalence of vomiting decreased
- The bacterial diversity and richness in stool samples significantly increased, while the relative abundance of Proteobacteria decreased
- Caregivers were more satisfied with BTF and unanimously indicated they would recommend BTF.

42 on Food-Based Blenderized Formulas; 28 on Conventional Formulas

- Greater satisfaction ratings
- Lower symptom scores on Pediatric Gastroesophageal Reflux Disease Symptom and Quality of Life Questionnaire
- Greater scores on the Pediatric Quality of Life Inventory Gastrointestinal Symptoms Scale and fewer total symptoms (less N/V, abdominal pain, diarrhea)

Recent Evidence

**2020**


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**2021**


# Recent Studies Assessing Outcomes Associated with BTF

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Design</th>
<th>Population Size, Characteristics</th>
<th>Type of BTF</th>
<th>Quality of Life</th>
<th>Upper GI Symptoms</th>
<th>Lower GI Symptoms</th>
<th>Weight / Height</th>
<th>Microbiota</th>
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</thead>
<tbody>
<tr>
<td>Hron 2019</td>
<td>Prospective Cohort</td>
<td>70 children, ages 1-18 years, who were hospitalized or came through the ED at Boston Children's Hospital receiving BTF vs. SF</td>
<td>Classified in the BTF group if &gt;50% of diet was from a BTF. Of the 42 participants receiving BTFs, 40% used homemade BTF with a conventional formula base, 33% used commercial BTFs, 26% used homemade BTFs</td>
<td>+*</td>
<td>+*</td>
<td>+*</td>
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<tr>
<td>Trollip 2019</td>
<td>Parental Survey</td>
<td>12 parents of children (ages 1-14 years) on HEN, assessed changes after transition from SF to BTFs</td>
<td>BTF type unspecified, 8 of 12 received SF + BTF</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Batsis 2020</td>
<td>Retrospective</td>
<td>23 children, ages 1-18 years with G-tube switched from SF to BTF</td>
<td>Homemade (65%), commercial (17.5%) BTFs or blend of both (17.5%)</td>
<td>+*</td>
<td>-</td>
<td>+</td>
<td></td>
<td>+*</td>
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<tr>
<td>Gallagher 2018</td>
<td>Prospective Trial (6-month feasibility study)</td>
<td>20 children, ages 1-16 years, followed at outpatient clinic in Canada were transitioned from SF to BTF over 4 weeks</td>
<td>RDN provided personalized homemade BTF prescription</td>
<td>+*</td>
<td>+</td>
<td>+*</td>
<td>+*</td>
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<td>Johnson 2018</td>
<td>Parental Survey</td>
<td>433 parents of children on HEN in an online tube feeding support group, SF (50.5%) and BTF (49.5%)</td>
<td>Homemade BTF (61.8%), commercial BTF (9.2%), blend of homemade and commercial (27.1%), no response (1.9%)</td>
<td>+</td>
<td>+/ -</td>
<td>+</td>
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<tr>
<td>McClanahan 2019</td>
<td>Prospective Pilot Study</td>
<td>10 children, ages 2-8 years, transitioned from SF to plant-based commercial BTF over 2 mos</td>
<td>Commercial, plant-based BTF</td>
<td>+</td>
<td>+*</td>
<td>+*</td>
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+Indicates positive outcome for BTF; -Indicates negative outcome for BTF; *Indicates significant difference (P<0.05)
Meeting Nutritional Needs

Blenderized Tube Feedings for Adult Patients on Home Enteral Nutrition: A Pilot Study

- Open-label pilot study, in which all participants who had been on traditional EN formulas were changed to BTF for 6 weeks.
- BTF was found to be safe and effective in promoting weight gain in adult participants who required HEN for at least 6 weeks.
ENFit® and BTF

- Jevity, Nourish, Real Food Blends, Mayo blended recipe
- Blended 3 and 6 minutes with Ninja, Oster and Vitamix
- 14-24 french tubes

ENFit®

Results

- BTF formula revealed that legacy tubes had lower syringe compression force than ENFit tubes for 14Fr tube size. Remaining measurements revealed no significant difference.

- When evaluating the impact of tube size, blender, time of blending, and legacy vs ENFit revealed that tube size, blender used, and blending time were significant with legacy vs ENFit being nonsignificant.

- Regression analysis revealed that variables such as formula, size of tube, blender used, and time of blending may have more impact on compression force.
ENFit®

- BTF recipes of different consistencies were tested on tubes 14-24 french.

Results

- For 60-second pushes less effort will be required with ENFit G-tubes (61% ± 21% as much force)
- For very fast pushes (5 seconds), considerably more effort would be necessary with ENFit g-tubes.
- Low-profile G-tubes will require less effort compared to legacy counterparts regardless of the push time (72% ± 22% for 60 seconds and 90% ± 19% for 5 seconds).
- Assuming that patients do not typically intentionally create extremely thick diets such as the enchilada diet, or do not push very fast, we conclude that most push-mode users will not require significantly more force to push their diets through ENFit devices.

For a push mode of feeding, patients will largely be unimpacted after the transition to ENFit®.
Clogging before and after ENFit®?

- In children, ENFit® connectors were associated with:
  - Significantly less frequent disconnection
  - Slightly higher clogging compared to when legacy connectors were used.
  - No difference in tube kinking rates between both connector types.

- In adults, ENFit® connectors were associated with:
  - Less frequent disconnections compared to legacy connectors.
  - More frequent incidents of tube kinking.
  - There was no difference between both connector types in tube clogging rates.

Patel A, Mohamed Elfadil, O et al Real-World Home Enteral Nutrition Experience Among Consumers and Caregivers. JPEN Abstract
Patient-Centered Care

Over 130 formulas available

Mimic previous oral diet
“What did you eat before?”

Patient / caregiver may not be part of formula decision in hospital
Involve patient, when possible, to provide patient-centered care.
BTF: Its Just Food and Water!
Formula Options

- Blend foods into standard commercial formula
- Food based formulas plus added foods
- Food based formula
- Home blending
- Somewhere in between

Commercial formula + carrot and applesauce
Considerations between prepared and commercial BTF.

Tubes recommended

Blenders

Hospital use

How to measure appropriate consistency

Sample recipes and MORE!
References