




# Safe and Easy Administration of Blenderized Tube Feeding



Teresa Johnson, DCN, RDN  
Professor in the Department of  
Kinesiology and Health  
Promotion at Troy University

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## Disclosures

**Dr. Teresa Johnson, DCN, RDN, FAND is a consultant for Nutricia North America, Abbott Nutrition, Functional Formularies, and Nestle.**

*This will not pose any conflict of interest for this CE-eligible presentation.*

*The opinions reflected in this presentation are those of the speakers and independent of Nutricia North America.*



# Objectives

1. Evaluate blenderized enteral nutrition plans used in current literature.
2. Learn how to administer blenderized tube feeding (BTF) through bolus, gravity, and pump methods.
3. Identify key elements needed for creating a safe home blenderized tube feeding.
4. Evaluate the current literature on safety of reusing administration devices.



# Introduction

- BTF is defined as the use of blended foods and liquids given directly via the feeding tube.<sup>1</sup>
  - homemade BTF
  - commercial formula mixed with pureed baby food
  - commercially available ready to use BTFs





# Historical Perspective

- Historically, food was only option for nutrition support
- Commercial enteral formula (CEF) became standard care by the 1970s
- BTF interest/use re-emerged
  - Patient/caregiver demands
  - Increased home enteral nutrition population (HEN)
  - Nutrition messages on diet diversity
  - Decreased tube feeding intolerance (nausea, vomiting, diarrhea, constipation)
  - Improved weight and nutrient profile
  - Bridge to oral feeding
  - Reduced risk of infections and hospitalizations
  - Reduced need for gastrointestinal (GI) medications
  - Confirmed in published papers



Photo used with permission from Troy University

Carter H, Johnson K, Johnson TW, Spurlock A. Blended tube feeding prevalence, efficacy, and safety: What does the literature say? *J Am Assoc Nur Pract.* 2018;30(3):150–157.



## Why Clinicians are Using BTF

Emerging evidence that BTF may aid with formula related GI intolerances

A growing body of evidence indicates that Blended Tube Feeding may improve common symptoms of formula intolerance, such as:



Spurlock, et al. *Nutr Clin Pract.* 2022;37:615-624. 2. Hron, et al. *J Pediatr.* 2019;211:139-145. 3. Kernizan, et al. *JPGN.* 2020;71:124-128. 4. Batsis, et al. *Nutr Clin Pract.* 2020;35:282-288. 5. Penttiuk, et al. *JPEN.* 2011;35:375-379. 6. Gallagher, et al. *JPEN.* 2018;42:1046-1060. 7. Schmidt, et al. *Clin Nutr.* 2019;38:332-240.



## Clinical Considerations Before Implementing BTF

### Patient Considerations:

- Healed Stoma Site
- Adhere to recipe instructions
- Cost and time
- Ability to obtain and store ingredients and tools for BTF
- Food Safety Practices
- Tube Maintenance
- 14 Fr tube or larger

ASPEN Enteral Nutrition Handbook, 2<sup>nd</sup> edition. P. 165, 203



## Homemade BTF Considerations

### Medical History:

- Tolerance/intolerance of current or past enteral feeding
- Food intolerances/Allergies
- Lifestyle
- Ethnic and religious preferences
- Recipe Creation
- Evaluate nutrient composition



# BRIEF REVIEW OF BTF LITERATURE

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## **Blenderized Food Tube Feeding in Very Young Pediatric Patients with Special Health Care Needs**

Walker S, Johnson T, Carter H, Spurlock A, Johnson K, Hussey J.

*Nutr Clin Pract.* 2024;39:202–209



# BTF in Children

- Retrospective chart review, 16 male and 18 female, n=34
- Average age of transition to BTF = 14.7 months
- Average time on BTF = 15.3 months
- Multiple diagnoses including GI, neurologic, genetic, pulmonary, congenital cardiac, etc.
- Formula prior to transition = 32% bovine-based, 24% hydrolyzed, 13% amino acid-based
- 56% were transitioned due to parent request
- BTF (17.6% homemade; 82.4% commercial BTF) → 56% full and 44% partial

Walker S, Johnson T, Carter H, Spurlock A, Johnson K, Hussey J. Blenderized Food Tube Feeding in Very Young Pediatric Patients with Special Health Care Needs. *Nutr Clin Pract.* 2024;39:202–209



# Results

## Oral intake after BTF

No change	8	24.2
20% increase	10	30.3
40% increase	8	24.2
60% increase	3	9.1
80% increase	1	3.0
100% increase	3	9.1

Abbreviation: BTF, blenderized tube feeding.

- Increase in oral intake

Walker S, Johnson T, Carter H, Spurlock A, Johnson K, Hussey J. Blenderized Food Tube Feeding in Very Young Pediatric Patients with Special Health Care Needs. *Nutr Clin Pract.* 2024;39:202–209



## Results

TABLE 5 Changes in the frequency of gastrointestinal medication usage after initiation of BTF (N = 34).

	Mean	SD	t	df	P
GI medications					
Baseline	1.72	1.15	6.775	32	0.000
Ending	0.66	0.77			

Abbreviations: BTF, blenderized tube feeding; GI, gastrointestinal.

- Decrease in GI medication use



## Results

Symptom	% reported	% no change	% decrease
Gagging	27.3	72.7	27.3
Retching	18.2	81.8	18.2
Emesis	60.6	42.4	57.6
Cough	24.2	87.9	12.1
Diarrhea	12.1	90.9	9.1
Constipation	78.8	24.2	75.8
Reflux	63.6	39.4	60.6

Abbreviation: BTF, blenderized tube feeding.

- Reduction in adverse GI symptoms



## Results

TABLE 7 Changes in z scores before and after BTF usage (N = 34).

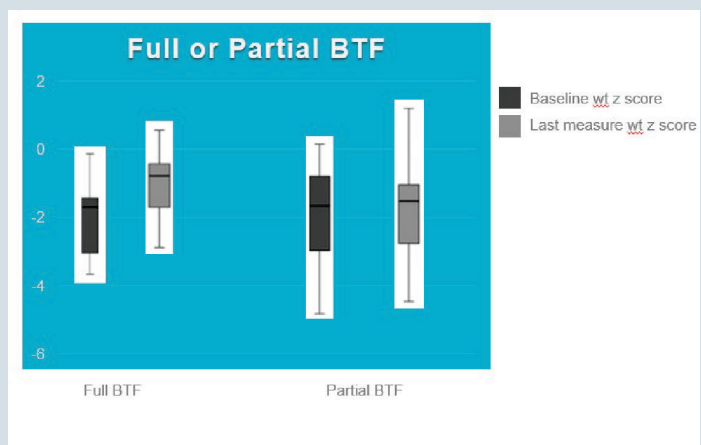
	Pre-BTF			Post-BTF		
	Mean	SD	Range	Mean	SD	Range
Weight	-1.84	1.34	-5.28 to 0.40	-1.32	1.19	-4.40 to 1.33
Length	-1.36	1.19	-5.53 to 0.54	-1.18	1.09	-3.08 to 0.82
Weight to length	-0.81	1.64	-6.02 to 2.60	-0.64	1.42	-3.74 to 2.11

Abbreviation: BTF, blenderized tube feeding.

Walker S, Johnson T, Carter H, Spurlock A, Johnson K, Hussey J. Blenderized Food Tube Feeding in Very Young Pediatric Patients with Special Health Care Needs. *Nutr Clin Pract.* 2024;39:202–209



## Results



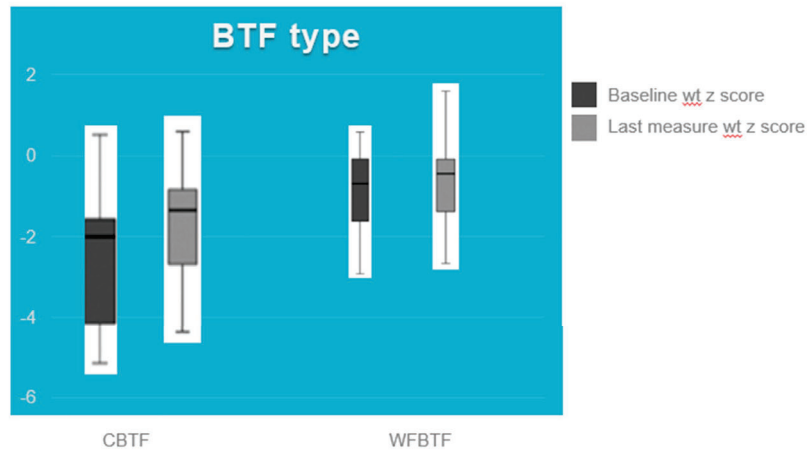
- Growth improved for weight, length, weight for length- for full and partial BTF fed patients

Walker S, Johnson T, Carter H, Spurlock A, Johnson K, Hussey J. Blenderized Food Tube Feeding in Very Young Pediatric Patients with Special Health Care Needs. *Nutr Clin Pract.* 2024;39:202–209





## Results continued



Walker S, Johnson T, Carter H, Spurlock A, Johnson K, Hussey J. Blended Food Tube Feeding in Very Young Pediatric Patients with Special Health Care Needs. *Nutr Clin Pract.* 2024;39:202–209



## Limitations

### Limitations

- Small sample size
- Short follow up period
- Some data reported by caregivers

Walker S, Johnson T, Carter H, Spurlock A, Johnson K, Hussey J. Blended Food Tube Feeding in Very Young Pediatric Patients with Special Health Care Needs. *Nutr Clin Pract.* 2024;39:202–209



# BTF STUDIES IN ADULTS



## Case Study

- 75-year-old male with recurring thyroid cancer (metastasized to lung), former smoker and alcohol consumer
- Required gastric tube feeding due to poor oral intake related to cancer treatments
- Registered Dietitian/Nutritionist (RDN) nutrition goals were to preserve weight and lower his iodine levels in preparation for RAI (radioactive iodine ablation) treatment for recurring thyroid tumor
- Typical CEF has approximately 200 ug iodine per 1000 kcals formula
- RDNs transition to partial BTF replacing enough of the commercial enteral formula (CEF) to reduce iodine to <50 ug/day



## Case Study continued

- Week 2: 20# weight loss (body mass index 26.54); could not tolerate CEF
- Week 3: tolerated 3-4 BTF feedings per day and re-initiated continuous CEF feeding at night at 20 cc/hour
- Week 4: diarrhea resolved; weight loss decelerating at 1 pound week
- Week 5: weight gain, more food intake by mouth; tolerating CEF at night (60 cc/hr) and 3-4 BTF boluses during the day
- Week 6: iodine levels low enough to receive radioablation iodine (RAI) therapy
- Week 7: eating PO and BTF during the day; no CEF at night. Gained 3 pounds



## Prospective Pilot Study in HEN Oncology Patients



Open label, pilot study in 9 patients transitioned from CEF to BTF over 6 weeks. 8 of the 9 patients had cancer [6 w/HNC (head neck cancer)].



Patients provided with blender and recipe prepared and analyzed by RDN (500 kcals, 25 gm protein per recipe)



Patients completed weekly symptoms surveys; weighed before and after 6 week transition period



BTF intake increased



6 of 9 gained weight, 1 maintained weight, 2 lost weight (one intentionally and the other due to CEF intolerance)



## Prospective Study in Patients with Head & Neck Cancer (HNC)



Prospective open label trial of patients with HNC requiring gastric tube feeding at the initiation of chemoradiation treatments



2 weeks on CEF; 3 weeks on 50% commercial BTF (100% real food commercial BTF); afterward resume 100% CEF with a goal of comparing potential impact of BTF during maximal impact of chemoradiation treatment



Patients to complete surveys (GI symptoms, Quality of life, daily weight assessed weekly as much as possible)



Patients deemed safe for swallow were encouraged to eat food by mouth but RDNs prescribed enteral feeding to meet 100% of estimated needs

Spurlock AY, **Johnson TW**, Pritchett A, et al. Blenderized food tube feeding in patients with head and neck cancer. *Nutrition in Clinical Practice*. 2022; 37:615– 624.



## BTF Transition

First two weeks

Enteral nutrition  
100% standard commercial formula

Beginning week 3

Half of the calories provided by CF and half by BTF beginning week 3

After 2-3 weeks

Return to 100% standard commercial formula

## However...

Spurlock AY, **Johnson TW**, Pritchett A, et al. Blenderized food tube feeding in patients with head and neck cancer. *Nutrition in Clinical Practice*. 2022; 37:615– 624.

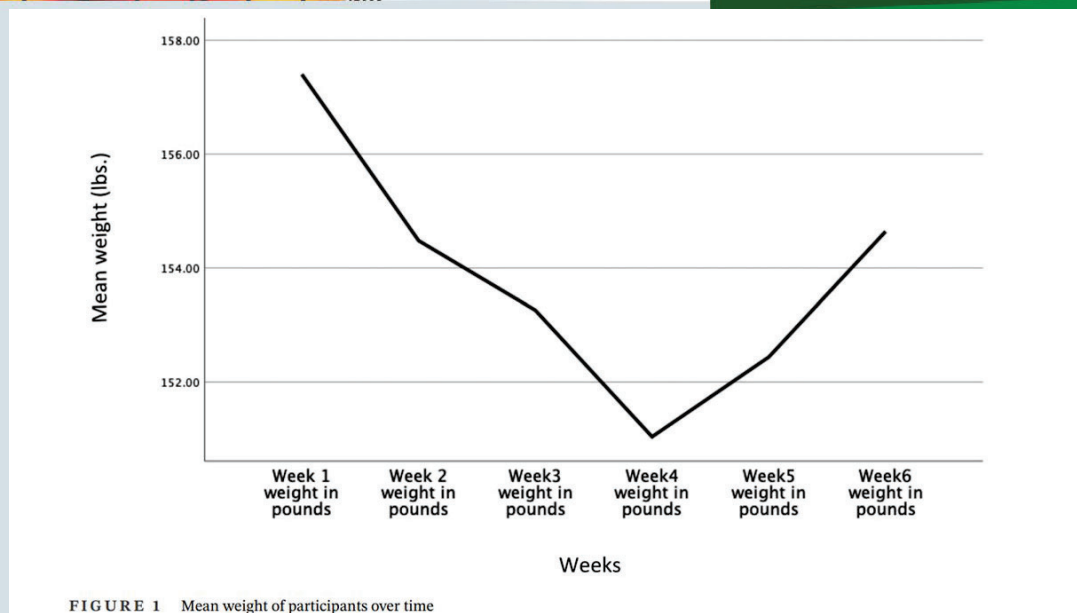


- 30 enrolled; 16 completed (63% male; mean age 58.7 years)
- All on chemoradiation except one patient on chemotherapy only
  - Reasons for non-completion include prolonged hospitalization, lack of caregiver/situational non-compliance (no one to help with completion of logs, bring to appointments for anthropometric measurement), gastric tube removed, tube feeding not needed, or stopped all treatments
  - No one withdrew from the study due to issues with BTF
- After 3 weeks on BTF, no patient wanted to return to CEF
- All except 2 patients opted for 100% BTF

Spurlock AY, Johnson TW, Pritchett A, et al. Blended food tube feeding in patients with head and neck cancer. *Nutrition in Clinical Practice*. 2022; 37:615– 624.



## Mean Weight Change



Spurlock, AY, Johnson, TW, Pritchett, A, et al. Blended food tube feeding in patients with head and neck cancer. *Nutrition in Clinical Practice*. 2021; 1– 10  
<https://doi.org/10.1002/ncp.10760>





# Individual Weight Change Over Time



TABLE 2 Weight of participants over time

ID	Week 1, lbs/kg	Week 2, lbs/kg	Week 3, lbs/kg	Week 4, lbs/kg	Week 5, lbs/kg	Week 6, lbs/kg	Change, %
001	188 (85.45)	190 (86.36)	189.4 (86.09)	188.2 (85.54)	189.2 (86.0)	189 (85.9)	+0.53
002	197.8 (89.9)	184 (83.63)	181 (82.27)	178 (80.9)	179.6 (81.63)	184.4 (83.81)	-6.77
007	147.2 (66.9)	No data	144 (65.45)	146.6 (66.63)	148.0 (67.27)	150.6 (68.45)	+2.2
011	150.8 (68.54)	149.2 (67.81)	147.2 (66.9)	149.2 (67.81)	152.4 (69.27)	151.2 (68.72)	+0.26
012	No data	152.8 (69.45)	No data	143.8 (65.36)	139.4 (63.36)	134.8 (61.27)	-11.7
014	170.4	169.2 (76.9)	No data	163.8 (74.45)	161.6 (73.45)	158.2 (71.9)	-7.15
015	160.8	159.8 (72.63)	No data	158.4 (72.0)	No data	154.8 (70.36)	-3.73
016	148.6	No data	114.4 (52.0)	125.6 (57.09)	No data	132.2 (60.09)	-11.0
017	138.6	135.0 (61.36)	134.9 (61.31)	131.0 (59.54)	127.0 (57.72)	130.0 (59.09)	-6.2
019	No data	No data	164.0 (74.54)	162.0 (73.63)	161.0 (73.18)	157.6 (78.8)	-0.39
024	114.8	No data	111.4 (52.0)	110.8 (50.36)	No data	120.2 (54.63)	+4.5
025	228.2	230.0 (104.54)	No data	227.0 (103.18)	226.8 (103.4)	227.0 (103.18)	-0.52
026	111.8	113.80 (51.72)	113.80 (51.72)	108.80 (49.45)	114.0 (51.81)	118.60 (53.90)	+5.7
028	152.6	152.6 (69.36)	No data	148.80 (67.63)	146.8 (66.72)	151.80 (69.0)	+0.52
029	169.2	172.0 (86.0)	No data	173.8 (79.0)	175.8 (79.9)	174.00 (79.09)	+2.7
030	No data	98.0 (49.0)	No data	No data	No data	97.60 (44.36)	-0.40
Mean	159.98	158.56 (72.07)	144.45 (65.65)	154.38 (70.17)	160.13 (74.6)	152.0 (69.09)	
SD	32.06	35.04	29.09	30.58	30.08	31.48	

Spurlock, AY, Johnson, TW, Pritchett, A, et al. Blenderized food tube feeding in patients with head and neck cancer. Nutrition in Clinical Practice. 2021; 1– 10 <https://doi.org/10.1002/ncp.10760>.



# BMI Over Time

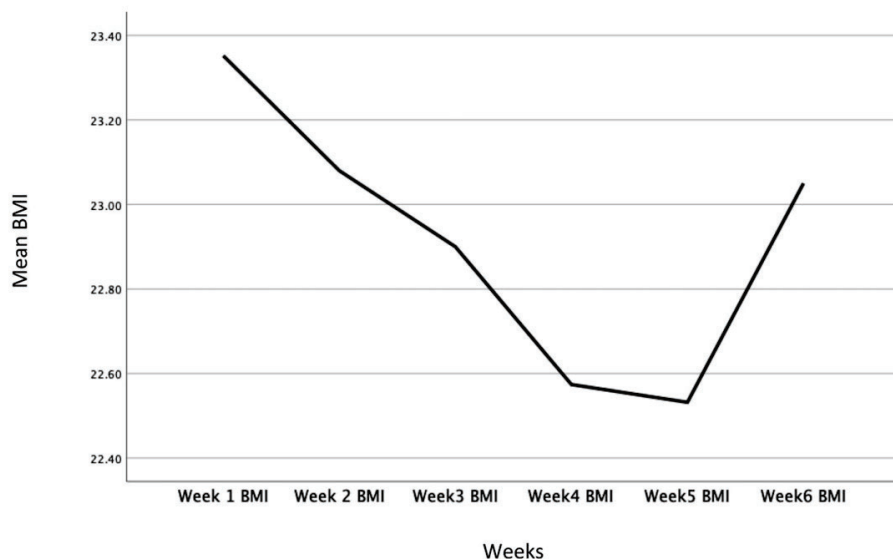
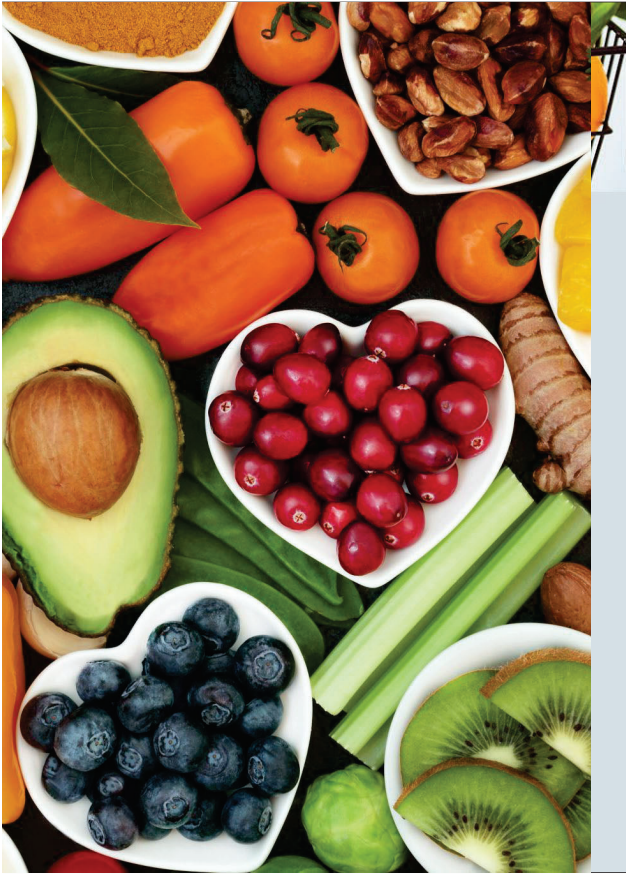


FIGURE 2 Mean BMI of participants over time. BMI, body mass index

Spurlock, AY, Johnson, TW, Pritchett, A, et al. Blenderized food tube feeding in patients with head and neck cancer. Nutrition in Clinical Practice. 2021; 1– 10 <https://doi.org/10.1002/ncp.10760>.



## Additional

- Weight/BMI observations coincide with increased use of BTF
- The amount of BTF contributing to total energy needs increased as did intake of solid foods (50% to 77.7%)
- Only 4 instances of clogged tubes were reported but were easily resolved
- QOL scores increased
- 92.7% disagreed or strongly disagreed that BTF overwhelmed their caregiver
- Vomiting, constipation decreased; no reports of diarrhea at week 6
- “Other” GI symptom category reports dropped to zero at 6 weeks

Spurlock, AY, Johnson, TW, Pritchett, A, et al. Blenderized food tube feeding in patients with head and neck cancer. Nutrition in Clinical Practice. 2021; 1– 10 <https://doi.org/10.1002/ncp.10760>.



Limitations: small sample size due to difficulties inherent in HNC population compounded by Covid 19



Most studies of HNC patients report significant weight loss during weeks 3-4 of chemoradiation that persists after treatment ends



Our observations and those in the Hurt pilot study show maximal mean weight loss experienced at the end of week 3 began to rebound at week 4- two weeks after BTF initiation and trended up afterward



Potential for addition of BTF to arrest weight loss at a critical point in chemoradiation therapy has implications for post treatment outcomes



## Additional Comments

01

CEF is monotonous and highly processed

02

CEF is inconsistent with the American Institute of Cancer Research (AICR) diet recommendations<sup>1</sup>

03

BTF meets the guidelines of a diverse, plant-based diet

04

The diet quality of cancer survivors is poor (HEI score 55.6/100)<sup>2</sup>

05

BTF in cancer may be ideal feeding substrate

1. World Cancer Research Fund, American Institute for Cancer Research. Diet, nutrition, physical activity and cancer: a global perspective. Continuous update project expert report 2018. <https://www.wcrf.org/sites/default/files/Summary-of-Third-Expert-Report-2018.pdf>.
2. Lee E, Zhu J, Velazquez J, et al. Evaluation of diet quality among American adult cancer survivors: results from 2005–2016 National Health and Nutrition Examination Survey. *J Acad Nutr Diet*. 2021;121(2):217-232



## Additional Published BTF Studies in Adults



Fabiani A, Sanson G, Bottigliengo D, et al. Impact of a natural versus commercial enteral-feeding on the occurrence of diarrhea in critically ill cardiac surgery patients. A retrospective cohort study. *Int J Nurs Studies*. 2020;108:103605.



Schmidt SB, Kulig W, Winter R, Vasold AS, Knoll AE, Rollnik JD. The effect of a natural food based tube feeding in minimizing diarrhea in critically ill neurological patients. *Clin Nutr*. 2019 Feb;38(1):332-340.



Papakostas P, Tsaousi G, Stavrou G, et al. Percutaneous endoscopic gastrostomy feeding of locally advanced oropharyngolaryngeal cancer patients: blenderized or commercial food? *Oral Oncol*. 2017;74:135-141.





## Comments

- Safety / efficacy studies
- Unknown / inconsistent nutrient composition
- Cost
- Labor intense
- Support from industry
- Guidance from professional organizations<sup>1</sup>



Photo used with permission from Troy University

Epp L, Blackmer A, Church A, et al. Blenderized tube feedings: practice recommendations from the American Society for Parenteral and Enteral Nutrition. *Nutr Clin Pract.* 2023; 38: 1190-1219.



## BTF ADMINISTRATION



## Poll Question:

Do you educate your patients with hands-on education on how to administer enteral formula or BTF?

- a) Yes, I educate on formula administration
- b) No, I expect the DME company or nurse to educate
- c) I work inpatient and it's not needed
- d) I would like to learn more about administration



## High Viscosity of a BTF

The high viscosity of a true blenderized enteral diet may help improve GI intolerance symptoms.

*"It is known that hyperosmolar standard formulas have low viscosity, which may lead to rapid gastric emptying and symptoms of dumping syndrome."*  
(Batsis, 2020)

*"A potential cause that BTF aids with gagging/retching is the higher viscosity of the feedings allows for slower emptying of the stomach, leading to a decrease in dumping syndrome."* (Pentiuk 2011)





# Viscosity of Commercial Food Based Formulas and Home Prepared Blenderized Feeds.

Bridget Hron, MD, MMSc, Rachel Rosen, MD, MPH

J Pediatr Gastroenterology Nutr. 2020 June;70(6):124-128.

Objective: Quantify the differences in viscosity of a range of commercial food-based formulas and home prepared BTF used as enteral feedings to manage reflux and reflux related aspiration.



## Viscosity and BTF

Objective: Test homemade and commercial BTF viscosity

Thick feeds may be beneficial to reduce GI reflux disease

Viscosity of home and commercial BTF varied greatly

# Viscosity of Commercial BTF

Weston and  
Clarke  
JPEN  
2020



Commercial Formulas with Varying Amounts of whole foods	Viscosity
Slightly Thick	3
Mildly Thick	2
Moderately Thick	7
Extremely Thick	2

# Viscosity and BTF

Thick feeds may be beneficial to reduce GI reflux disease

Viscosity of home and commercial BTF varied greatly

IDDSI Guidelines	Commercial BTF Products
Thin	2
Slightly Thick	1
Mildly Thick	1
Moderately Thick	4
Extremely Thick	3

Home BTF blends varied from extremely thick to mildly thick.



# Viscosity of Commercial BTF

Weston and  
Clarke  
JPEN  
2020



Reference formula  
was a standard  
formula, not a BTF

*“Extremely thick  
formulas can be used to  
help improve GI  
symptoms in orally and  
gastrostomy-fed  
children”*

These are NOT official IDDSI resources,  
educational materials or education programs  
and they are NOT meant to replace materials  
and resources on [www.IDDSI.org](http://www.IDDSI.org)

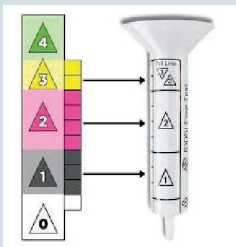
The International Dysphagia Diet Standardisation Initiative 2019  
@ <https://iddsi.org/framework>. Licensed under the Creative Commons Attribution Sharealike 4.0  
License <https://creativecommons.org/licenses/by-sa/4.0/legalcode>



# Viscosity of Commercial BTF

Weston and  
Clarke  
JPEN  
2020

IDDSI test to determine volume of liquid to add to achieve  
standard formula viscosity



IDDSI  
Funnel



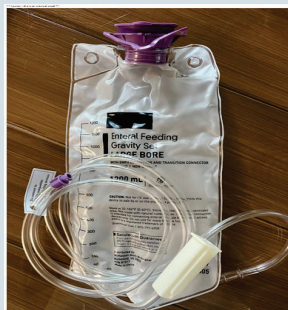
10 seconds



Volume  
remaining  
indicated  
IDDSI  
value

# BOLUS, GRAVITY, OR PUMP?

## Tools Needed for BTF



*Assistance from a clinical dietitian*



# Bolus Feeding with BTF



## **SLOW PUSH METHOD**

Fluid can be mixed into the recipes or given as boluses between feedings.

**Suggested not to thin BTF**

1.Epp, L. Blenderized Feeding Options – The Sky's The Limit. Practical Gastroenterology, June 2018, p. 30-39. 2.Batsis 3. ASPEN Enteral Nutrition Handbook, 2<sup>nd</sup> edition, p257-258.



# Bolus Feeding with BTF



## **SLOW PUSH METHOD**

Fluid can be mixed into the recipes or given as boluses between feedings.

**Suggested not to thin BTF**



## **Timing**

- 15-20 minutes<sup>1</sup>
- 15-30 minutes<sup>2</sup>
- Short period of time eg <30 min. <sup>3</sup>



## **Advantages:**

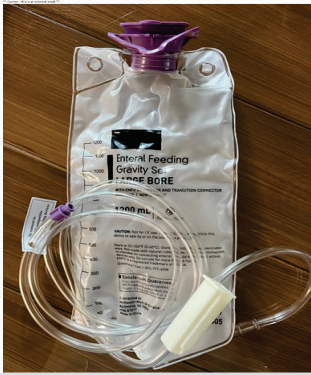
- Reflect typical eating pattern
- Greater ambulation
- May help prevent constipation by inducing the gastrocolic reflex.<sup>3</sup>

Epp, L. Blenderized Feeding Options – The Sky's The Limit. Practical Gastroenterology, June 2018, p. 30-39. 2.Batsis 3. ASPEN Enteral Nutrition Handbook, 2<sup>nd</sup> edition, p257-258.





## Gravity Feeding with BTF



**Large Bore  
Gravity Bag**



**Reusable  
nutrition  
bags**



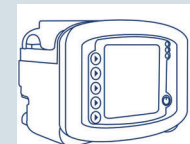
## Pump Feeding with BTF

### Enteral Pump Manufacturer's Recommendations:



*Use **ONLY** commercially available pre-packed or commercially prepared feeding solutions formulated for use with a feeding pump that are prescribed by a licensed health care provider or dietitian.*

*The use of commercially available blenderized formula (HCPCS Code: B4149) can impact pump accuracy and performance. It is recommended to follow the formula manufacture guidelines for pump use.*



*Use only commercially available pre-packed or commercially prepared feeding solutions prescribed by a licensed health care provider, dietitian or physician. Do not use homemade or blenderized foods or other non-prescribed, non-commercially available feeding solutions.*



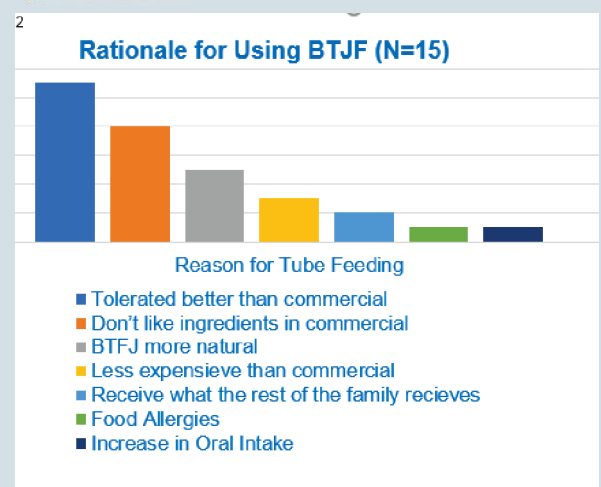
## What about Jejunostomy Tubes?

- O'Connor G, Hartfiel-Capriles Z, Saduera S. Intermittent bolus versus continuous feeding in children receiving an enteral formula with food derived ingredients: A national multicentre retrospective study. *Clin Nutr ESPEN*. 2023;54:175-179.
- O'Connor G, Watson M, Van Der Linde M, Bonner RS, Hopkins J, Saduera S. Monitor gastrointestinal tolerance in children who have switched to an "enteral formula with food-derived ingredients": A national, multicenter retrospective chart review (RICIMIX study). *Nutr Clin Pract*. 2022;37(4):929-934.
- Kernizan D, Mintz D, Colin M, et al.. Outcomes and Safety of Blenderized Tube Feedings in Pediatric Patients: A Single Center's Experience. *J Pediatr Gastroenterol Nutr*. 2020;71(4):e124-e128.
- Walker S, Johnson T, Carter H, Spurlock A, Johnson K, Hussey J. Blenderized Food Tube Feeding in Very Young Pediatric Patients with Special Health Care Needs. *Nutr Clin Pract*. 2024;39:202–209



## What about Jejunostomy Tubes?

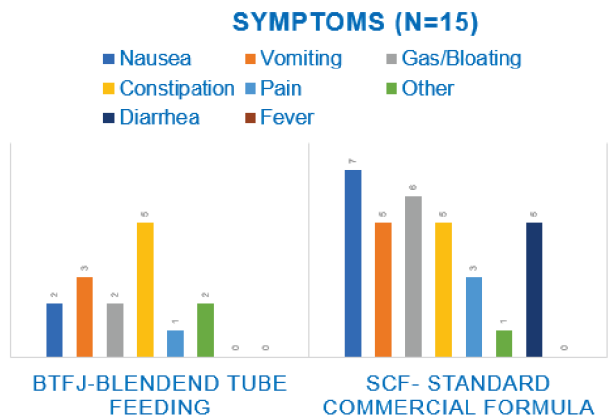
- Survey to RDNs in US and Canada (ASPEN, Oley, snowball technique)
- 15 complete responses (of 89 total)
- Results
  - Rationale for use same as BTF in G-tube fed patients





## BTF via Jejunostomy Tube

- Avg age ~33 range 1-76
- 9 male; 6 female
- Avg months on BTF/j-tube ~25 +/- 32



Marsh J, Spurlock A, **Johnson T**, Landsberg W. Blenderized Food for Jejunostomy Tube Feeding. *Top Clin Nutr.* 2/8/2024. (in press)

Epp L, Blackmer A, Church A, et al. Blenderized tube feedings: Practice recommendations from the American Society for Parenteral and Enteral Nutrition. *Nutr Clin Pract.* 2023;38(6):1190-1219.



## Evidence Supporting Safe BTF Practices

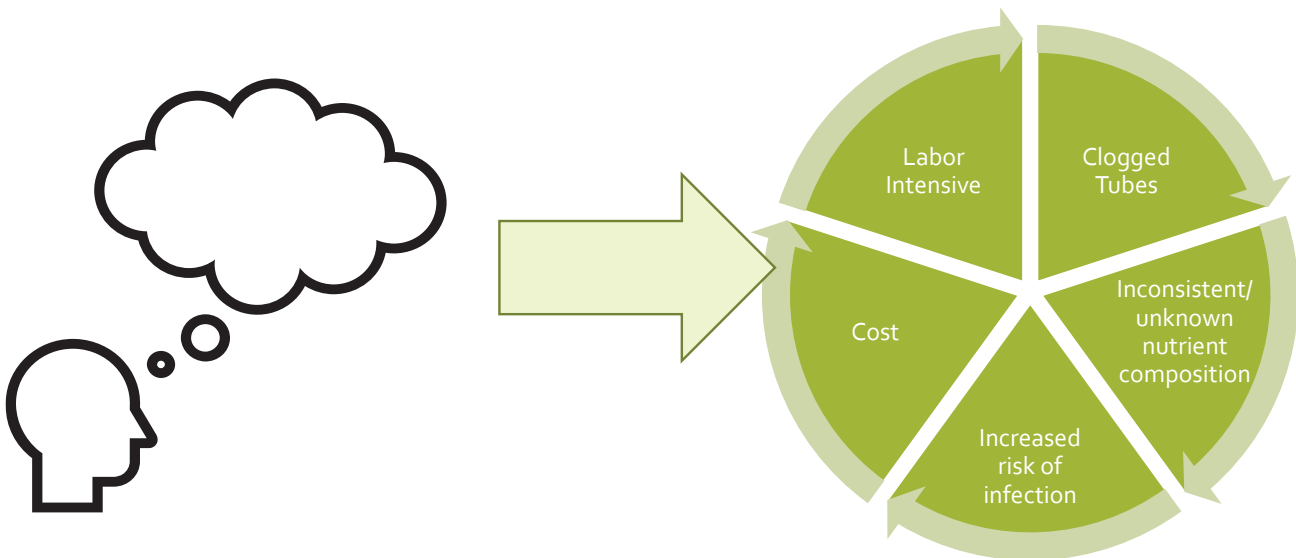
## Poll Question:

Do your patients ever reuse formula administration devices even though they may be labeled for daily use?

- a) Yes, and I discourage
- b) Yes, and I encourage to clean thoroughly
- c) I am not aware if my patient's reuse



## Thoughts on BTF: What is our role as a clinician?



Johnson TW, Spurlock A, Pierce L. Survey study assessing attitudes and experiences of pediatric registered dietitians regarding blended food by gastrostomy tube feeding. *Nutr Clin Pract.* 2015;30(3):402-405.

Armstrong J, Buchanan E, Duncan H, Ross K, Gerasimidis K. Dietitians' perceptions and experience of blenderised feeds for paediatric tube-feeding. *Arch Dis Child.* 2017;102(2):152-156.



## Thoughts on BTF – Bacterial Contamination



Literature reporting high bacterial contamination of BTF

Conducted in countries/conditions where food handling practices are quite different than those expected in the US

## Thoughts on BTF – Bacterial Contamination



Literature reporting high bacterial contamination of BTF

Conducted in countries/conditions where food handling practices are quite different than those expected in the US

Two in-vitro studies conducted in the US  
100% and 88% of BTF samples met USDA criteria for safe tube feeding formula respectively.



Insistence that all tube fed patients receive sterile CF prohibits patients from benefits of :

Diverse diet  
Foodborne non-pathogenic bacteria



## Comparison of microbial growth between commercial formula and blenderized food for tube feeding.

Johnson TW, Milton DL, Johnson K, Carter H, Hurt RT, Mundi MS, Epp L, Spurlock A. *Nutr Clin Prac.* 2019;34(2):257-263.



## Evidence Supporting Safe BTF Practices

**Accepted safe food-handling practices  
minimizes microbial contamination of home-  
prepared blenderized tube feeding.**

Milton D, Johnson T, Johnson K, Murphy B, Carter H, Hurt R, Mundi M, Epp L,  
Spurlock A, Hussey J.  
*Nutrition in Clinical Practice.* 2020;35:479-486.

# Safe Food-Handling Practices

Milton et al. Nutr Clin  
Prac, 2020

Objective: Assess microbial growth in home blenderized tube feeding when using proper food handling practices.  
Standard Preparation Procedure to minimize bacterial contamination

50 participants  
Prepared BTF  
Home Kitchen

Assess growth  
of aerobic  
microorganisms

Baseline

24 hours

48 hours

## Methods: Cleaning BTF Equipment

► Wash hands before preparing BTF



### Step 1

- Disassemble blender
- wash in warm, soapy water.



### Step 2

- Rinse all items in warm water



### Step 3

- Soaking in 7.57L of water plus
- 30mL of chlorine bleach
- 5 minutes



### Step 4

- Remove from chlorine solution
- Air dry



US Food Code guidelines for cleaning and sanitizing dishes and utensils

# Methodology: Preparing the Blend

Milton et al.  
Nutr Clin Prac,  
2020



## Step 1

Broccoli  
Cauliflower  
Blueberries

Microwave 5 minutes



## Step 2

Whole Milk  
Tap Water  
Banana  
Dry Oats  
Cooked chicken  
Salt  
Cod liver and olive oil

Place in blender



## Step 3

Blend 5 minutes

Place in reusable nutrition  
bag

## US Food Code

Milton et al. Nutr Clin  
Prac, 2020

Colony forming units, or CFUs, are **a unit of measurement used to determine the number of bacterial cells in a probiotic supplement or lab sample**

### Unacceptable for consumption:

Aerobic counts not to exceed  $10^4$  CFU/g in single sample

$10^3$  CFU/g in 3 or more samples

Coliform count  $> 3$  organisms/g

Positive for *Listeria monocytogenes* or *Salmonella*

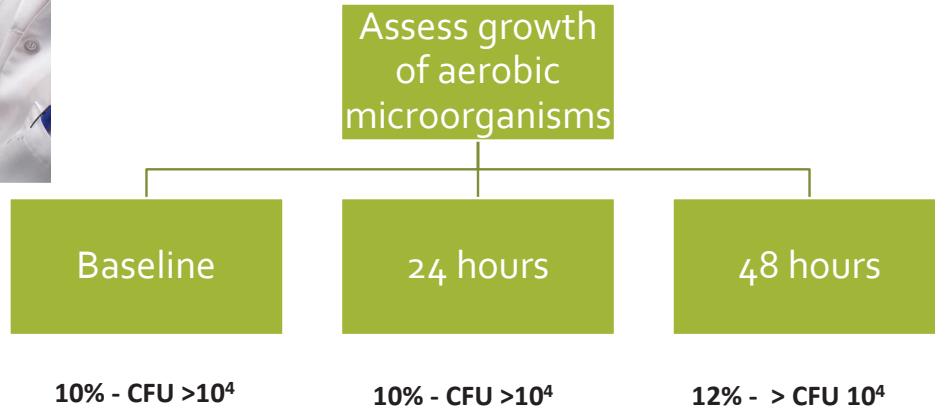


# Outcomes

Milton et al. Nutr Clin  
Prac, 2020



Photo property of speaker



Low risk for microbial contamination of syringe and tube feeding bag surfaces after multiple reuses with home blenderized tube feeding.

Milton D, Murphy B, Johnson T, Carter H, Spurlock A, Hussey J, Johnson K.  
Nutrition in Clinical Practice 2022:1-6.



# Safety when reusing enteral equipment

Many patients and caregivers reuse syringes and tube feeding bags

National regulatory agencies do not provide guidance on single use devices for enteral administration.

Safe to use equipment that is labeled for reuse. Check manufacturer's labeling.



Photo property of speaker

## Low Risk for Microbial Contamination

### Objective:

Determine aerobic microbial presence after 15 reuses of in vitro BTF feeding in syringes and collapsible feeding bags in the home environment.

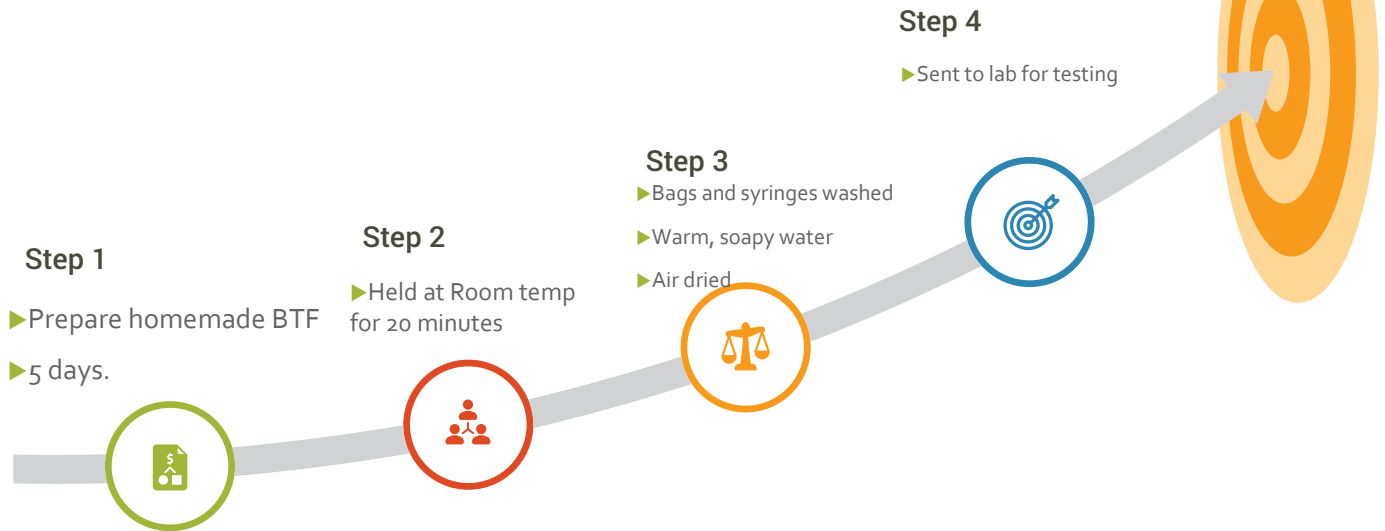
Milton et al.  
2022



Photo property of speaker

\*\*\*Reusable nutrition bags in this protocol are labeled for reuse.\*\*\*

# Methods: Preparing BTF and Reuse of Administration Devices



## Methods for BTF Prep

Milton et al.  
2022



### US Food Code guidelines for cleaning and sanitizing dishes and utensils

Disassemble blender and wash in warm, soapy water

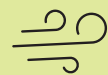


Rinse all items in warm water.



Sanitize items by soaking in 7.57L of water + 30mL of chlorine bleach, 5 minutes

Remove from chlorine solution and air dry



## RESULTS: Reuse of Enteral Supplies and Bacterial Contamination

Milton et al.  
2022

Sample number	Nutrition Bag	Syringe
1	12.5	<0.96
2	<0.2	<0.96
3	<0.2	<0.96
4	<0.34	<0.48
5	<0.2	<1.4
6	<5.3	<0.96
7	<0.9	<1.4
8	<0.45	<0.96

Reusable Nutrition bags  
designed and labeled for reuse.

### Acceptable limits for bacteria count:

<2.5 CFU/cm<sup>2</sup> – Handbook of Hygiene Control in Food Industry

<10 CFU/cm<sup>2</sup> – European Commission Recommendation

## SUMMARY

## Thoughts on BTF: Home Blending and Commercial

### Commercial Enteral Formula:

Monotonous, highly processed feeding of corn syrup solids, corn maltodextrins, casein and soy proteins, fat and oils, and a micronutrient mixture

### Differences in Commercial BTF

Ingredients

Caloric Density

Volume

Micronutrients

Additives/Preservatives

Cost

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### BTF:

Interest/use of BTF is patient and caregiver driven

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## Thoughts on BTF: Home Blending and Commercial

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### BTF:

Interest/use of BTF is patient and caregiver driven

### Industry:

More than a dozen commercial BTF products on the market.

### Differences in Commercial BTF

Ingredients

Caloric Density

Volume

Micronutrients

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Cost

## In Summary

- ✓ BTF is emerging in use due to consumer demand and published evidence.
- ✓ Administering BTF is different than administering standard formula and RDs need to be aware of administration methods.
- ✓ The thick consistency of blenderized enteral may be beneficial with tube feeding GI intolerance issues.
- ✓ Data supports the use of a safe home blenderized diet when proper safety measures are followed.
- ✓ Review product labeling on administration devices for recommendations on reuse.



*“HCPs, especially RDNs need to educate themselves on BTF and its benefits and consider the use of BTF with any enterally fed pt as part of their assessment to include all options in the development of an optimal nutrition care plan.”*



Photo property of speaker

Blenderized Tube Feeding: Health Outcomes and Review of Homemade and Commercially Prepared Products. *Nutr. Clin Pract.* June 2020, 417-431

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# Thank you for attending

This concludes the CE  
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Attendance.



## QUESTIONS

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