

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

Ryan T. Hurt, MD, PhD,^{1–4} Lisa M. Epp, RDN,³ Wanda M. Duellman, RDN,³
Adele K. Pattinson, RDN,³ Lisa Lammert, RDN,³ Margaret R. Baker, RDN,³
Lisa D. Miller, RDN,³ Aravind Reddy Kuchkuntla, MBBS,⁵ and Manpreet S. Mundi, MD³

Abstract

Objective: Despite surveys indicating a high prevalence of blenderized tube feeding (BTF) as an alternative to commercial enteral nutrition (EN), there remains a paucity of data regarding use in clinical practice. The objective of the present open-label pilot study was to assess the safety and effectiveness of BTF in adult patients being given home enteral nutrition (HEN).

Design: This is an open-label pilot study, in which all participants who had been on traditional EN formulas were changed to BTF for 6 weeks.

Setting/Location: The Mayo Clinic in Rochester, Minnesota.

Participants: Twenty individuals gave their consent to participate in the study, with nine completing the 6-week BTF protocol.

Outcome Measures: Weight was measured at baseline and at 6 weeks of BTF use. Participants completed a survey regarding the frequency of BTF use and adverse effects, at baseline and then weekly for 6 weeks.

Results: Nine participants with a mean age of 60.6 ± 7.8 years completed the 6-week protocol. BTF use increased from 4.85 ± 2.44 to 6.45 ± 0.82 days per week from week 1 to week 6. The percentage of participants consuming $>50\%$ of their calorie intake from BTF increased from 23.1% (3 of 13 participants) at week 1 to 44.4% (4 of 9 participants) at week 6. Six of nine participants experienced weight gain, weight was maintained by one participant, and two participants lost weight (intentionally in one and due to an intolerance of commercial formula in the other).

Conclusions: BTF was found to be safe and effective in promoting weight gain in adult participants who required HEN for at least 6 weeks.

Keywords: blenderized tube feedings, enteral nutrition

Introduction

APPROXIMATELY 430,000 PATIENTS in the United States are given home enteral nutrition (HEN) delivered outside the hospital setting, a number that has almost tripled in the past 20 years.¹ In the practice of authors, patients receive HEN due to a number of diagnoses, including cancer (e.g., head, neck, esophageal), amyotrophic lateral sclerosis, and

motility disorders. Ordering providers typically manage only a few HEN patients and partner with private infusion companies that have nutrition specialists to help make recommendations about initial formula selection and changes.¹ Over the past 40 years, formula selection has centered on using commercially available processed products, which are viewed as safe, easy to deliver, and designed to meet nutritional requirements.²

Divisions of ¹General Internal Medicine, ²Gastroenterology and Hepatology, and ³Endocrinology, Diabetes, Metabolism, and Nutrition, Mayo Clinic, Rochester, Minnesota.

⁴Division of Gastroenterology, Hepatology and Nutrition, University of Louisville School of Medicine, Louisville, Kentucky.

⁵Mayo Clinic School of Graduate Medical Education, Mayo Clinic College of Medicine and Science, Rochester, Minnesota.

Patients and caregivers in the authors' HEN multidisciplinary practice have often voiced their preference to make meals with whole and/or organic foods that are blended and then delivered through a percutaneous endoscopic gastrostomy (PEG) tube.^{3,4} Unlike commercially available formulas, these blenderized tube feeds (BTF) lack the safety and efficacy data that are typically provided with commercially available formulas, and are considered as an alternative therapy in the mainstream clinical nutrition field; however, patients have shown a preference for BTF over prescribed commercial formulas as a source of nutrition.³⁻⁵ Few studies on BTF use in adults are available, but improved outcomes have been reported among pediatric HEN patients.⁶⁻⁸ An open-label pilot study was conducted to obtain preliminary data on the safety and effectiveness of BTF to produce weight gain or weight stabilization in HEN patients who were previously using a commercial formula.

Materials and Methods

The Mayo Clinic Institutional Review Board approved this study. Twenty patients were recruited to receive at least 25% of their nutrition intake from BTF for 6 weeks. Participants were eligible to be included if they were (1) PEG patients of the HEN program at Mayo Clinic, scheduled for follow-up appointments within 10 weeks of the initial visit; (2) willing to use BTF and complete weekly surveys to assess the patterns of use; and (3) not pregnant. Baseline weight was recorded for all participants enrolled in the study, and were provided with a blender (Magic Bullet model number MBR-1101; Homeland Housewares, Los Angeles, CA), an educational brochure for BTF, and a standardized BTF recipe designed by an HEN registered dietitian and nutritionist (RDN).

The 500-calorie recipe was ~1 calorie/mL and contained ~25 g of protein (Table 1), a macronutrient composition similar to that used in commercial formulas, and was used up to four times daily. The volume prescribed was based on each participant's estimated caloric and protein needs. Multivitamin use was not recommended unless deficiencies were noted. It is estimated that about 65%–75% of the blends were composed of water; therefore, additional water flushes were

TABLE 1. BLENDERIZED TUBE FEEDING RECIPE

Ingredient	Amount
Starch—well-cooked oatmeal, rice, pasta, or potato	½ cup
Dairy—yogurt, reduced fat (2%)	¼ cup
Dairy—milk, 1%	¾ cup (6 oz.)
Oil—canola	2 teaspoons
Fruit—canned, fresh, or frozen apple, banana, peaches, mandarin oranges	½ cup
Vegetable—canned, fresh, or frozen well-cooked broccoli, carrots, green beans, or cauliflower	½ cup
Meat—cooked tender chicken, turkey, beef, fish or smooth soft tofu	½ cup

Recipe provides 500 calories and 25 g of protein.

recommended based on each participant's individual hydration needs.

After initially providing informed consent, participants took a validated survey about their quality of life and current tube feeding program. Participants then used varying amounts (as a part of their total daily calorie intake) of BTF daily for 6 weeks. They completed symptom surveys weekly for 6 weeks, and were then followed up with an HEN RDN to assess their weight. At the final visit, participants took the same survey that was administered when they were enrolled in the study, and were given the option to either continue BTF use or return to their previous enteral nutrition (EN) formula regimen. Study data were collected and managed using the Research Electronic Data Capture tools hosted at Mayo Clinic in Rochester, Minnesota.⁹ Descriptive statistics were performed using JMP version 10.0.0 (SAS Institute, Inc., Irvine, CA). Normally distributed data are presented as mean (SD).

Results

Of the 20 participants who provided consent for the pilot study, 13 partially completed the protocol and 9 completed the whole 6-week protocol (Table 2). Of those who did not participate in the study after enrolling ($n=7$), two died of disease after signing consent but before starting the trial; one was hospitalized and admitted to a skilled nursing facility; two could not be contacted after enrollment; one believed BTF was too time consuming to implement; and one had improved oral intake after enrollment. Four participants who could not complete the 6-week survey and returned later than the 10th week were excluded from the final analysis. Of the nine participants who completed the 6-week protocol, the number of days per week BTF was used increased from 4.85 ± 2.44 to 6.45 ± 0.82 days (Table 3). The percentage of

TABLE 2. DEMOGRAPHIC CHARACTERISTICS OF PATIENTS COMPLETING THE 6-WEEK SURVEY AND POSTSURVEY FOLLOW-UP ($n=9$)

Characteristic	Value
Mean age, years	60.61 ± 7.77
Sex	
Male	5
Female	4
Indication for HEN (n)	
Head and neck cancer	6
Amyotrophic lateral sclerosis	1
Lung cancer	1
Dermatomyositis	1
Tube type	
PEG tube	9
Presurvey	
Mean weight, kg	64.81 ± 16.63
Mean BMI, kg/m^2	21.93 ± 4.86
Postsurvey	
Mean weight, kg	64.36 ± 14.72
Mean BMI, kg/m^2	21.75 ± 4.10

BMI, body mass index; HEN, home enteral nutrition; PEG, percutaneous endoscopic gastrostomy.

TABLE 3. WEEKLY PROGRESS OF BLENDERIZED TUBE FEEDING DURING 6-WEEK PILOT

Characteristic	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Consumption of BTF, days/week	4.85 ± 2.44	5.64 ± 1.50	5.73 ± 1.62	6.18 ± 1.08	6.27 ± 0.90	6.45 ± 0.82
Total calorie intake with BTF, %						
0–25	4	3	3	3	3	3
25–50	6	4	5	4	3	2
51–75	0	3	0	0	2	2
76–100	3	2	3	4	3	2

BTF, blenderized tube feeding.

participants taking in >50% of their calorie intake from BTF increased 23.1% (3/13) at week 1 and 44.4% (4/9) at week 6 (Table 3). Five out of nine returned for their final weight measurements at the end of the sixth week, and four returned between weeks 6 and 10. In these nine participants, six gained weight, one maintained the same weight, and two lost weight (one by intention and the other due to intolerance of commercial formula).

Discussion

To the knowledge of the authors, this pilot study is one of the first to show that safe and effective use of BTF can result in positive weight gain in adult HEN patients. Although BTF is considered an alternative therapy for EN by most nutrition specialists, BTF is used by many patients who require long-term HEN.^{3,4} Two recent patient surveys showed that BTF use ranged from 50% to 80%, depending on the patient population.^{3,4} A survey of 244 pediatric registered dietitians revealed that the main reasons for recommending BTF were parent request (70.2%), followed by standard EN formula intolerance (22.9%).¹⁰ Although patient preference should not dictate medical treatment, when these choices are safe options, it is believed that they should be discussed with patients. Industry-sponsored studies have raised concerns of BTF contamination risk; however, those studies were carried out in acute care hospitals (rather than in the home setting), where temperature control was not maintained.^{11,12} Contamination is not found to be a problem when patients follow preparation instructions carefully.

One problem encountered with BTF use—both anecdotally and in the present pilot study—was the level of difficulty experienced by patients and caregivers. Preparing meals with whole foods and then blending them for PEG delivery, often in the setting of advanced age and chronic debilitating disease, can be prohibitive for many patients. Fortunately, a number of commercial products currently available for use are prepared from whole foods and/or organic ingredients that can be used with similar ease to current commercial formulas. Although there are no clinical studies regarding the use of these whole food and organic products, it is found that many HEN patients are now requesting BTF as an alternative to standard commercial EN formulas. The main limitations of this study include its small size, the single-center, open-label design, and the high dropout rate. Future studies are needed to determine the feasibility of a combination of

commercial and homemade BTF formulas against those of standard EN.

Conclusions

BTF was determined to be a safe and effective method for weight gain in adult patients who required HEN for at least 6 weeks. Larger studies evaluating BTF in adults are needed to assess the value of this common alternative feeding strategy.

Acknowledgments

The authors thank the Division of General Internal Medicine for providing the funds for the current study. They also appreciate the medical editing of John P. Hedlund, a copy editor in the Scientific Publications Division, Mayo Clinic, Rochester, Minnesota.

Author Disclosure Statement

R.T.H. and M.S.M. are consultants for Nestle Nutrition and L.M.E. is a consultant for Halyard Health. All other authors have no financial disclosures.

References

- Mundi MS, Pattinson A, McMahon MT, et al. Prevalence of home parenteral and enteral nutrition in the United States. *Nutr Clin Pract* 2017;32:799–805.
- Brown B, Roehl K, Betz M. Enteral nutrition formula selection: Current evidence and implications for practice. *Nutr Clin Pract* 2015;30:72–85.
- Epp L, Lammert L, Vallumsetla N, et al. Use of blenderized tube feeding in adult and pediatric home enteral nutrition patients. *Nutr Clin Pract* 2017;32:201–205.
- Hurt RT, Edakkanambeth Varayil J, Epp LM, et al. Blenderized tube feeding use in adult home enteral nutrition patients: A cross-sectional study. *Nutr Clin Pract* 2015;30:824–829.
- Johnson TW, Spurlock AL, Epp L, et al. Reemergence of blended tube feeding and parent's reported experiences in their tube fed children. *J Altern Complement Med* 2018;24:369–373.
- Pentiuk S, O'Flaherty T, Santoro K, et al. Pureed by gastrostomy tube diet improves gagging and retching in children with fundoplication. *JPEN J Parenter Enteral Nutr* 2011;35:375–379.
- Samela K, Mokha J, Emerick K, et al. Transition to a tube feeding formula with real food ingredients in pediatric patients with intestinal failure. *Nutr Clin Pract* 2017;32:277–281.

8. Kolacek S, Grguric J, Percl M, et al. Home-made modular diet versus semi-elemental formula in the treatment of chronic diarrhoea of infancy: A prospective randomized trial. *Eur J Pediatr* 1996;155:997–1001.
9. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42: 377–381.
10. 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;30:402–405.
11. Sullivan MM, Sorreda-Esguerra P, Santos EE, et al. Bacterial contamination of blenderized whole food and commercial enteral tube feedings in the Philippines. *J Hosp Infect* 2001;49:268–273.
12. Schroeder P, Fisher D, Volz M, Paloucek J. Microbial contamination of enteral feeding solutions in a community hospital. *J Parenter Enteral Nutr* 1983;7:364–368.

Address correspondence to:

Ryan T. Hurt, MD, PhD

Division of General Internal Medicine

Mayo Clinic

200 First Street SW

Rochester, MN 5590

E-mail: hurt.ryan@mayo.edu