Home Blenderized Tube Feeding: A Practical Guide for Clinical Practice

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Although commercial enteral formulas have been available on the market for several decades, a cultural shift toward consuming unprocessed foods with minimally added sugar has sparked interest in the preparation of home blenderized tube feedings for enteral feeding-dependent patients. Recent surveys, however, indicate lack of clinical awareness or familiarity in the management of this method of nutrition support. This article aims to equip the gastroenterologist with a guide for initiation, monitoring, and evaluation of a blenderized tube feedings regimen, and provides insights into an opportunity for greater partnership between the gastrointestinal provider and registered dietitian.

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INTRODUCTION

While enteral feeding of whole-foods dates back to ancient times (1), risk for microbial contamination prompted the development of commercial formulas in the mid- to late 1900s to sustain the nutritional needs of chronically ill patients. Fast forward to the current generation, however, views on nutrition and wellness also prioritize whole foods and their promotion of optimal health, with many studies linking increased fruit and vegetable consumption to a diverse microbiome (2–4). One of the most profound catalysts for change in this generation's dietary philosophies are the recently published 2015 Dietary Guidelines, which deem sugar a "nutrient of concern" and state that added sugars should comprise less than 10% of total calories per day. Because of these updated recommendations, many individuals with or without chronic illness are now subscribing to a diet containing minimally processed foods and limited amounts of added sugar. With this shift comes a renaissance of home blenderized tube feedings (BTF), and clinicians are finding that patients are adamant about pursuing this feeding modality. While BTF does pose inherent risks, research shows benefits including improved gastrointestinal symptoms and an opportunity for the gastrointestinal (GI) provider to engage in multidisciplinary collaboration (5–8). Though this article focuses mainly on the pediatric population, most concepts described may be additionally translated to adults.

OPPORTUNITIES AND CHALLENGES WITH BLENDERIZED FEEDINGS

Several pros and cons to BTF are outlined in Table 1. Feasibly the biggest challenges for preparing a blended diet are cost and time. Manufacturers have responded to these challenges by developing whole-foods-based commercial products such as Kate Farms, Real Food Blends, Compleat Pediatric, and Liquid Hope (9–12). Major companies, such as Nestle and Abbott Nutrition, have even released their own blended enteral formula products in 2018 such as Compleat Organic Blends and Pediasure Harvest, respectively (13,14). For some, these may be viable alternatives, but for others, risk of vitamin or mineral toxicity is present depending on patient age. Furthermore, documentation of standard formula intolerance or allergy should be provided to obtain insurance coverage (15).

Although research is limited, there is evidence of high levels of patient satisfaction with BTF, alleviation of GI-related symptoms, and improved feeding tolerance, allowing for adequate growth and weight gain in medically complex patients (6,7). One study examined pediatric patients unable to tolerate enteral feedings post Nissen Fundoplication. After being placed on a BTF for at least 2 months, 57% of patients reported an increase in oral intake as well as 76%–100% decrease in gagging and retching. No patients reported increased gagging after switching to the blended diet (8).

In another study that surveyed 125 children, no weight loss was observed in 90% on a BTF regimen compared to 66% on a standard enteral formula (5). In addition to improved GI symptoms and weight maintenance, a final cardinal benefit of BTF is the opportunity to comply with the updated 2015 Dietary Guidelines recommendations by providing a nutrition source with less added sugar than a standard commercial formula, many of which feature sugar and corn maltodextrin as main ingredients on the nutrition label (4,16). By avoiding these food additives, it is postulated that a patient's overall immune system may be more resilient as recent studies have found parallels between maltodextrin and suppressed intestinal antibacterial defenses,

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Table 1. Pros and cons of a home-blended tube feeding regimen

Pros	Cons
• Delivery of diverse whole foods to promote a healthy microbiome (24)	• Time-consuming and costly, requiring motivation for preparation
• Reduction in total added sugar, artificial flavors, and additives compared to commercial formulas (16)	• Need for increased nutrition monitoring (18)
• Reduced instances of gagging/retching (8)	• Experienced registered dietitian involvement with access to nutrient analysis database
• Reduced symptoms of diarrhea or constipation (6)	• Increased risk of feeding tube obstruction
• Reported increased interest in food and decreased oral aversion (7)	• Infection risk
• Potential for increased fiber and protein content	• May be unavailable inpatient
• Perception of a normalized eating behavior (25)	
• Improved emotional connection between caregiver and patient	

making cells more susceptible to *Salmonella* and other harmful bacteria (17).

PATIENT SELECTION CRITERIA

Appropriate patient selection is critical for the success of a home BTF regimen. In addition to medical stability, an environment conducive for safe and sanitary feeding practices is essential. Gradual introduction of BTF to supply nutritional needs can be done in tandem with reaching pediatric milestones for solid food introduction at 6 months and 12 months of age, wherein BTF can constitute 25% and 100% of total daily nutrition, respectively (18,19). To minimize risk of clogging, a larger bore gastrostomy tube (i.e., ≥14-French) at a mature and clean site is necessary (18,19). Some medical conditions such as metabolic disorders or severe multiple food allergies may be a barrier to using a BTF because elimination of entire food groups may jeopardize the supply of essential micronutrients. In these cases, enteral feeding via a specialty formula may be advised. Patients who are unable to tolerate a bolus feeding or who require a continuous feed of greater than 2 hours are unable to meet food safety requirements for a BTF due to increased infection risk (18,19). Socioeconomic factors such as environment readiness (e.g., financial situation, home sanitation, caregiver learnability, and motivation to follow preparation instructions closely) are also paramount to consider. In scenarios where this type of barrier is identified, the expertise of a social worker may be utilized to connect the patient with appropriate community resources. Barriers to using a BTF are outlined in Table 2.

GETTING STARTED

Collaboration with an experienced Registered Dietitian is crucial to mitigate the challenging aspects of BTF including safe preparation, storage, and administration. The necessary tools for getting started with blending are listed in Table 3.

Using pureed baby foods as the bulk of the recipe can be one method to cut down total preparation time; otherwise fresh, canned, or frozen whole foods may be used in portions in accordance with the United States Department of Agriculture MyPlate guidelines (20). Foods that blend easily include cooked cereals, quinoa, avocado, most fruits and vegetables, fresh meats, nut butters, eggs, and milk and should be chosen according to individualized needs and cooked to safe minimum temperatures (21). The dietitian should use a nutrient analysis program to easily track total calories and to ensure dietary reference intakes of vitamins and minerals are met (19). A sample recipe is provided in Table 4.

In many cases, age-appropriate vitamins in either liquid or crushed form should be added to the tube feeding to ensure nutritional completeness. Occasionally, supplemental nutrients may be needed when BTF-dependent patients suffer from malabsorptive conditions. Because the BTF is comprised of whole foods with limited to no processing, the amount of sodium provided by the feeding will likely be inadequate for the patient; therefore dietitian-supervised addition of iodized table salt or sodium-rich alternatives (e.g., Pedialyte, broth, bouillon cubes, vegetable juice) is necessary (22). Accurate measurement of added salt, however, is critical to minimize the risk of dehydration, and it is important to avoid adding too much to one feeding. Overall volume status should be considered by the provider and can be managed by the caregiver through the addition of water flushes or increased fluid added to the blend itself. Since viscosity and volume of the recipe may vary depending on which foods are used, water dilution facilitates optimal consistency production.

Table 2. Key barriers and solutions to a blenderized tube feeding regimen

Barriers	Solutions
Medical instability (i.e., hemodynamic instability), metabolic disorders, multiple food allergies	Appropriate medical intervention Evaluation of alternative specialized formulas (i.e., elemental formula)
Socioeconomic instability (e.g., ability to purchase groceries, unsanitary home environment)	Involvement of social worker to connect family to appropriate support services
Inability to tolerate bolus feeding	Collaboration with gastroenterologist and registered dietitian to work toward a successful bolus-feeding regimen
Limited education of caregiver	Ongoing follow-up with gastroenterologist, registered dietitian, and other interdisciplinary team members to reinforce foundational skills Provider use of teach-back to assess understanding

Table 3. Necessary tools to create a home blenderized tube feeding

• Commercial grade blender
• Large refrigerator and freezer space for batch preparation
• Airtight storage containers such as mason jars
• Bolus extension set for low-profile gastrostomy tube
• 60 mL syringe with plunger
• Feeding pump (if bolus feedings are not tolerated)

While some caregivers choose to blend each meal separately, it may prove less laborious and methodical to prepare 1 day's worth of BTF split into several bolus feedings. Once greater confidence is achieved, batches for several weeks may be prepared, frozen, and stored in air-tight glass containers in a large freezer space later thawed for use. For optimal nutrient retention, freezer temperature should be 0°F or lower with storage time ideally not exceeding 3 months (23).

Table 4. Sample blended diet recipe for a 2-year-old child providing 1,000 calories per day

Recipe	
2 cups whole milk	
1 cup oatmeal, cooked	
½ cup quinoa, cooked	
½ cup green beans	
½ cup sweet potato	
½ cup blueberries	
½ cup peaches	
2 oz meat	
2 teaspoons flaxseed oil	
1 teaspoon olive oil	
Nutrient	**Value**
Calories	1,013
Protein	45 g
Linoleic acid	6 g
Linolenic acid	5.5 g
Dietary fiber	16 g
Calcium	675 mg
Vitamin D	6 μg
Sodium	489 mg
Potassium	1857 mg
Iron	7 mg
Zinc	6 mg
Recommend adding	Age appropriate vitamin, table salt, and vitamin D3

[a]Nutrient analysis taken from the United States Department of Agriculture Food Composition Database (26).

MONITORING AND EVALUATION

BTF administration requires close, consistent follow-up with the gastroenterologist and registered dietitian to ensure safety and success. Laboratory work-up involving basic labs such as comprehensive metabolic panel and complete blood count is recommended at baseline. If the patient is on proton-pump inhibitor therapy, consider ordering magnesium as these drugs have been shown to impact absorption, depleting serum levels. Phosphorus and 25-hydroxyvitamin D labs provide insight into overall bone health, which may be compromised if a patient is wheelchair-bound or taking a corticosteroid. Pre-albumin provides context to a patient's overall nutrition status, and if malnutrition is suspected, the gastroenterologist may consider obtaining serum zinc and a triene/tetraene ratio to evaluate for essential fatty acid deficiency. These labs may be repeated at designated intervals based on the patient's clinical response and the provider's clinical judgement.

Overall hydration status should be monitored via urine output (with the goal of 1 mL/kg/hr) and symptoms or abnormalities found upon the GI physical examination should be documented and addressed. An interdisciplinary team follow-up approach between the GI provider and registered dietitian is crucial, and visits should be frequent if the patient is failing to grow and gain weight per goal. In this scenario, the gastroenterologist may invite the patient to engage in intensive follow-up with the dietitian alone to provide additional calorie-enriching strategies. In a BTF paradigm, these may include addition of modular supplements, 2–3 teaspoons or more of honey or pure maple syrup, blackstrap molasses, or oil. It is worthy to note that blackstrap molasses will contribute a significant amount of iron, calcium, and potassium to the diet and molasses will contribute a smaller amount of fructose as compared to honey and may be better tolerated. Oils vary in composition and quality meriting a BTF that incorporates a variety of sources. Options include medium-chain triglyceride oils for more rapid absorption, a blend of eicosapentaenoic/docosahexaenoic to provide essential fatty acids, or monounsaturated fats such as olive or avocado oil. Other food groups such as fruits, vegetables, and whole grains can also be varied each week to promote a greater balance of phytonutrients in the diet.

If the patient is not tolerating the BTF, several factors may be in play, including method of administration, feeding temperature, total volume, or possibility of contamination. Prompt education on proper food handling practices should be done by the dietitian, and ongoing adjustments may be necessary to better meet the needs of the patient.

SUMMARY

Blenderized tube feeding regimen models have garnered interest and have started to permeate gastroenterology and nutrition practices as patients and caregivers seek to provide a more natural source of nourishment in the setting of chronic illness. BTF is proving to be a popular alternative to standard enteral formulas as constructed recipes are rich in phytonutrients, contain less added sugar, and can yield improvements in both GI symptoms and feeding relationships. Although this method is more involved and requires collaboration between the gastroenterologist, registered dietitian, and caregiver, these challenges can be mitigated by careful planning and appropriate follow-up. Further research is needed to examine the performance of BTF regimens compared to traditional

formulas in different disease outcomes and evaluate the safety profiles and risks of infection when such regimens are applied.

CONFLICTS OF INTEREST

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