The Trend to Blend
Pediatric Blenderized Tube Feeding

Katherine Bennett RD MPH CLEC

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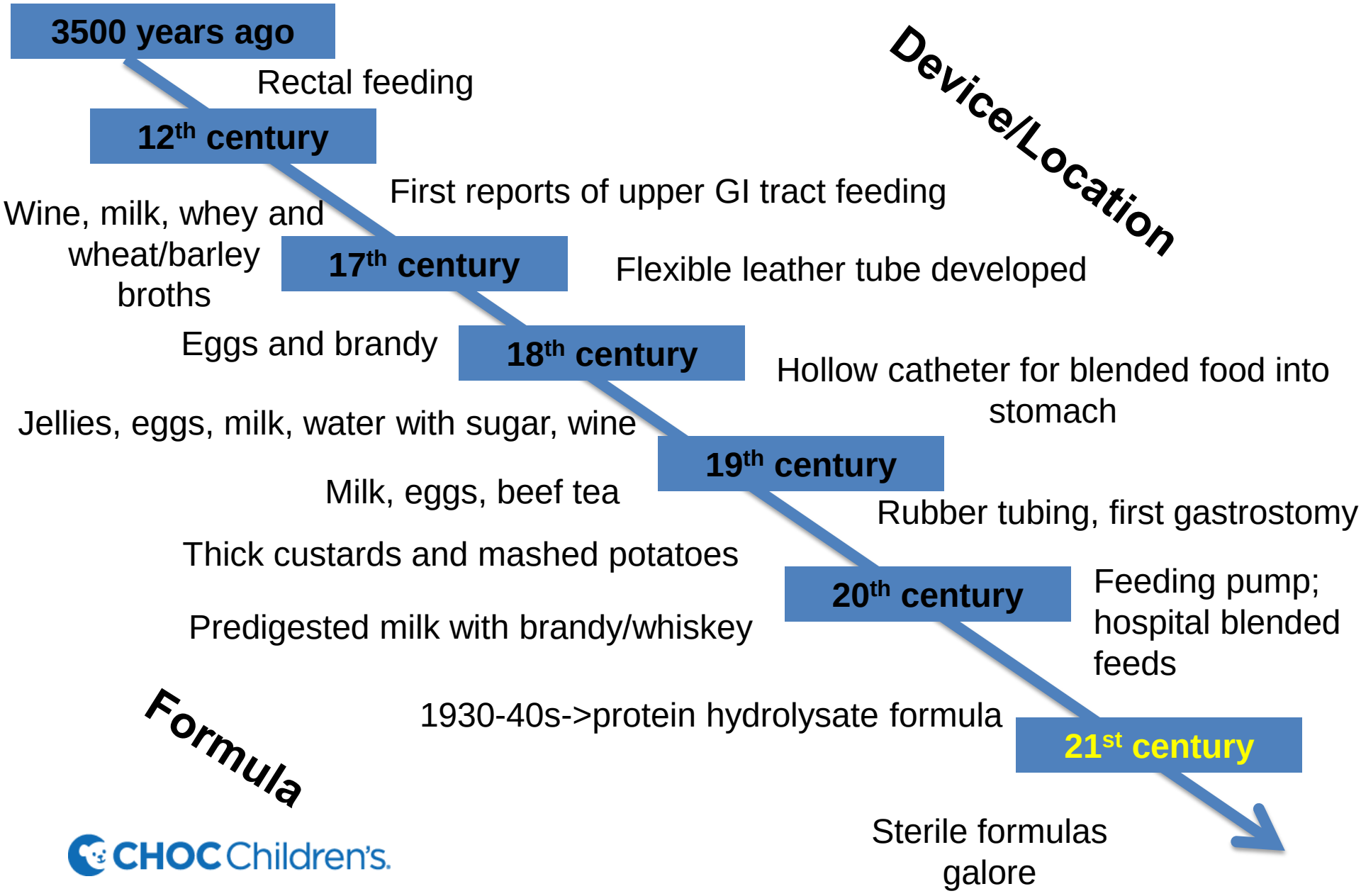
Objectives

- Understand indications for use of a blenderized tube feeding diet
- Understand how to formulate a blenderized tube feeding recipe
- Learn risks associated with a blenderized tube feeding diet
- Learn how to monitor a patient on a blenderized tube feeding diet

Feeding Throughout the Centuries



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Commercial Formulas

- Developed out of need for sterile, nutritionally complete, tube feeding consistency appropriate formula
  - < 3 dozen in 1974
  - > 200 in 1989
  - > 350 in 2006

Campbell 2006

BTF?

- Blenderized Tube Feeding
  - Using pureed/blended food and liquids as a nutrition source via a gastrostomy tube
  - NOT juicing
  - NOT just blending up slice of pizza
  - NOT purees for oral diet

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A Formula Company's Opinion on BTF

Beyond risk of contamina… …oblems too **(Table 1)**. It is
difficult to maintain batch- … foods.[6] It is also difficult to
make blenderized feeds fo … ures with high caloric density).[5]
Further, fully pureed mixtu … lerized mixtures do not flow
well through feeding tubes … benefits of pharmaconutrients,
which are now included in … as (e.g., short-chain fats
and small peptides to help … cids for suppression of
inflammation, and immune … inine and antioxidants).[4]

Limited
Studies funded by
Study population in Philippines and Iran!

In some parts of the world, for economic and cultural reasons, hospital staff members still blenderize foods to make tube-feeding mixtures in some hospitals. Such feedings are thought to be naturally healthy and economical; study results reveal that neither belief is true.

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Why Families Choose BTF

- More natural, organic
- Tired of formula
- Give more fiber
- Give what family is eating
- Allergies

Water, Sugar, Corn Maltodextrin, Milk Protein Concentrate, High Oleic Safflower Oil, Canola Oil, Soy Protein Isolate. Less than 0.5% of the Following: Short-Chain Fructooligosaccharides, Natural & Artificial Flavor, Cellulose Gel, Potassium Chloride, Magnesium Phosphate, Potassium Citrate, Calcium Phosphate, Tuna Oil, Calcium Carbonate, Potassium Phosphate, Salt, Cellulose Gum, Choline Chloride, Ascorbic Acid, Soy Lecithin, Monoglycerides, Potassium Hydroxide, m-Inositol, Carrageenan, Taurine, Ferrous Sulfate, dl-Alpha-Tocopheryl Acetate, L-

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For every 10 people….

- 9 have given some thought to the ingredients in their food/beverages in the past year (2 out of 5 have given a lot of thought)
- 5 make an effort to avoid sugars/salts
- 6 try to consume fiber and whole grains
- 6 check ingredient list on foods/beverages they purchase
- 6 read nutrition facts panel on foods/beverages they purchase

International Food Information Council Foundation 2014 Food and Health Survey

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Most often…..

Vomiting
Retching
Gagging
Constipation

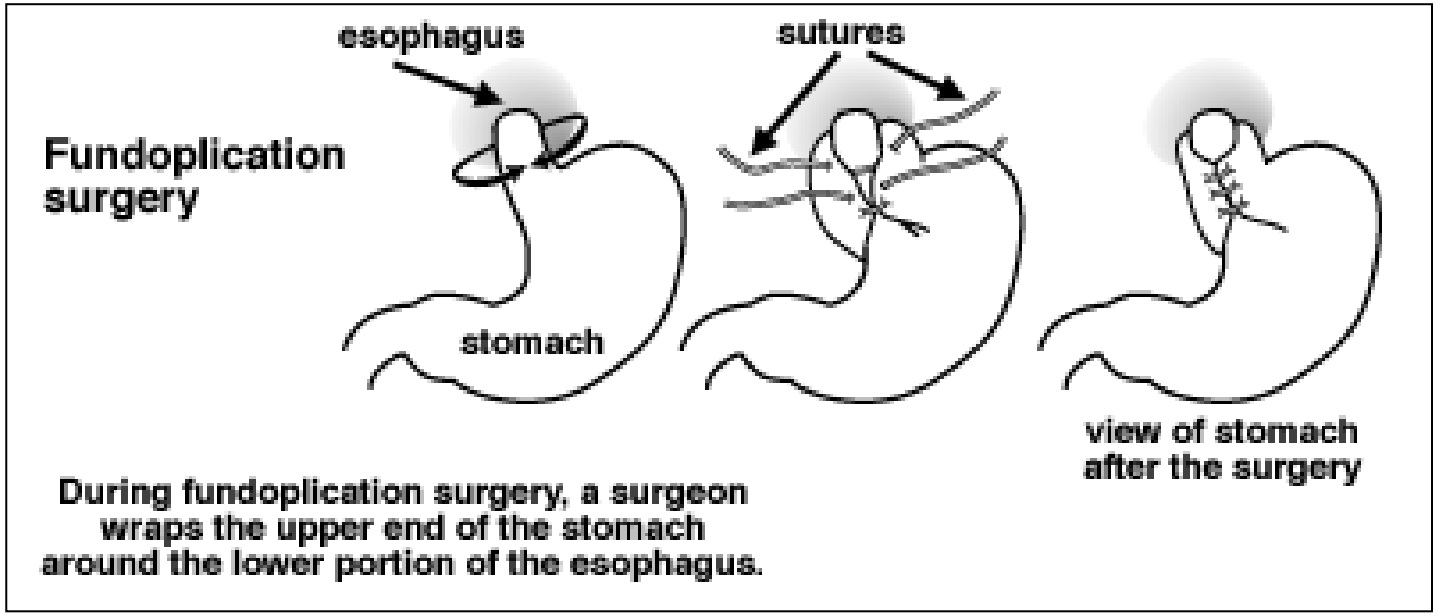
Nissen Fundoplication

Feeding problems

Dumping

Gas/bloating

Abnormal gastric motility



Children with G-tubes may have gagging and retching during or after their tube feeds

venting, slow rate of feeding, change to continuous, feed into intestine, dilate if suspect tight fundo

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Pentiuk 2010; Cleveland Clinic

Literature Review of BTF

- Limited
- Many case reports and anecdotal findings
- Clinical experience is positive!

My daughter stopped vomiting after 1 month on the blenderized feeding diet. The nutritionist and I started her blenderized feeding slowly; we started with 4 oz. and moved up by one ounce weekly. I think this made a big difference in building her tolerance. Her life completely changed and she is happier and healthier. Her hospitalizations dramatically decreased.

Original Communication

Journal of Parenteral and Enteral Nutrition
Volume 35 Number 3
May 2011 375-379

10.1177/0148607110377797
http://jpen.sagepub.com
hosted at
http://online.sagepub.com

Pureed by Gastrostomy Tube Diet Improves Gagging and Retching in Children With Fundoplication

Scott Pentiuk, MD[1,2]; Therese O'Flaherty, RD[1,3]; Kathleen Santoro, RD[1,3]; Paul Willging, MD[1,4]; and Ajay Kaul, MD[1,2]

Financial disclosure: none declared.

Background: Children with feeding disorders requiring Nissen fundoplication may develop gagging and retching following gastrostomy feedings. We developed a "pureed by gastrostomy tube" (PBGT) diet in an attempt to treat these symptoms and provide adequate nutrition and hydration. *Methods:* Children post–fundoplication surgery with symptoms of gagging and retching with gastrostomy feedings were selected from our interdisciplinary feeding team. An individualized PBGT diet was designed to meet the child's nutrition goals. The child's weight gain was recorded at each follow-up visit. A telephone survey was performed to determine parents' perceptions of the child's symptoms and oral feeding tolerance. *Results:* Thirty-three children (mean age, 34.2 months) participated in the trial. Average weight gain on the PBGT diet was 6.2 g/d. Seventeen children (52%) were reported to have a 76%–100% reduction in gagging and retching. Twenty-four children (73%) were reported to have a ≥50% decrease in symptoms. No child had worsened symptoms on the PBGT diet. Nineteen children (57%) were reported to have an increase in oral intake on the PBGT diet. *Conclusions:* A PBGT diet is an effective means of providing nutrition to children with feeding disorders. In children post–fundoplication surgery, a PBGT diet may decrease gagging and retching behaviors. (*JPEN J Parenter Enteral Nutr.* 2011;35:375-379)

Keywords: gagging; retching; fundoplication; pureed; diet; gastrostomy tube

Use of Blenderized Tube Feeding (BTF) in Patients on Home Enteral Nutrition – CNW 2015 Abstract-

- Pattinson et al at Mayo Clinic
- Prospective cross sectional survey
- N = 54
- ADULTS
- To understand BTF prevalence and use

- 55.5% used in past
- Median of 4 days/week
- Reasons include more natural, like eating what family eats, tolerate it better
- Up to 50% of feeds
- 79% maintained weight
- 67% no adverse symptoms; less symptoms compared with formula

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Must Haves

Health care provider

- Be okay with giving up a little “control”
- Time for close follow up
- Meal planning ideas
- Comfortable using recipe analysis program

Patient

- Medically stable
- Team support
- Fed into stomach
- Mature GT site
- ≥ 10F diameter
  - (14F preferred)
- Motivated
- Willing to be followed by RD closely
- Afford foods & equipment
- Understand importance of safe food prep & handling

Starting a BTF

- Assess your patient AND parent/caregiver
  - Medical history
  - Have they ever had real food?
    - Give individual foods first
  - Allergies
  - Volume intolerance
  - Preferred foods
  - Religious/cultural beliefs
  - Schedule

Building a Recipe

- For no volume restrictions/intolerance
- Estimate calorie need
- Use exchanges/My Plate
  - Dairy
  - Grains
  - Protein
  - Fruits
  - Vegetables
  - Fats

1000 calories per day:

Grains: 1 cup oatmeal + ½ cup rice (3 servings)

Fruits: ½ cup peaches + ½ cup apple juice (1 serving)

Vegetables: ½ cup cooked carrots + ½ cup cooked pumpkin (1 servings)

Protein: 2 ounces cooked chicken (2 servings)

Milk/sub: 1 cup whole milk + 1 cup plain yogurt (2 servings)

Fats: 3 tsp olive oil

USDA Choose My Plate:
http://www.choosemyplate.gov/supertracker-toolssupertracker.html

Daily Amount of Food From Each Group												
Calorie Level[1]	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Fruits[2]	1 cup	1 cup	1.5 cups	1.5 cups	1.5 cups	2 cups	2 cups	2 cups	2 cups	2.5 cups	2.5 cups	2.5 cups
Vegetables[3]	1 cup	1.5 cups	1.5 cups	2 cups	2.5 cups	2.5 cups	3 cups	3 cups	3.5 cups	3.5 cups	4 cups	4 cups
Grains[4]	3 oz-eq	4 oz-eq	5 oz-eq	5 oz-eq	6 oz-eq	6 oz-eq	7 oz-eq	8 oz-eq	9 oz-eq	10 oz-eq	10 oz-eq	10 oz-eq
Meat and Beans[5]	2 oz-eq	3 oz-eq	4 oz-eq	5 oz-eq	5 oz-eq	5.5 oz-eq	6 oz-eq	6.5 oz-eq	6.5 oz-eq	7 oz-eq	7 oz-eq	7 oz-eq
Milk[6]	2 cups	2 cups	2 cups	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups
Oils[7]	3 tsp	4 tsp	4 tsp	5 tsp	5 tsp	6 tsp	6 tsp	7 tsp	8 tsp	8 tsp	10 tsp	11 tsp
Discretionary calorie allowance[8]	165	171	171	132	195	267	290	362	410	426	512	648

1 **Calorie Levels** are set across a wide range to accommodate the needs of different individuals. The attached table "Estimated Daily Calorie Needs" can be used to help assign individuals to the food intake pattern at a particular calorie level.

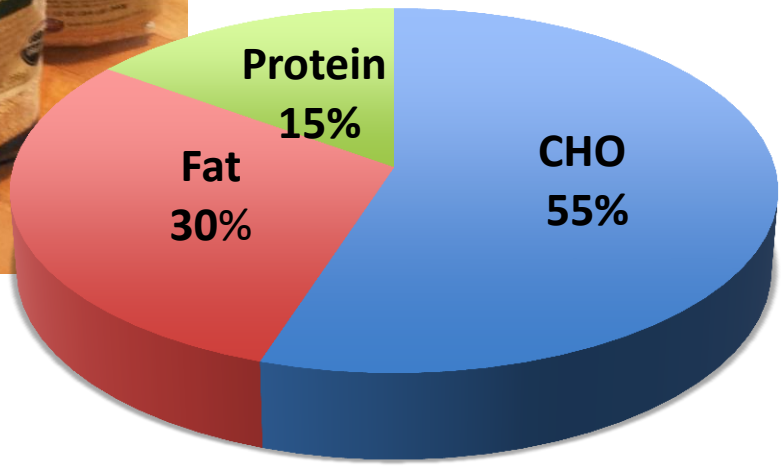
2 **Fruit Group** includes all fresh, frozen, canned, and dried fruits and fruit juices. In general, 1 cup of fruit or 100% fruit juice, or 1/2 cup of dried fruit can be considered as 1 cup from the fruit group.

3 **Vegetable Group** includes all fresh, frozen, canned, and dried vegetables and vegetable juices. In general, 1 cup of raw or cooked vegetables or vegetable juice, or 2 cups of raw leafy greens can be considered as 1 cup from the vegetable group.

4 **Grains Group** includes all foods made from wheat, rice, oats, cornmeal, barley, such as bread, pasta, oatmeal, breakfast cereals, tortillas, and grits. In general, 1 slice of bread, 1 cup of ready-to-eat cereal, or 1/2 cup of cooked rice, pasta, or cooked cereal can be considered as 1 ounce equivalent from the grains group. **At least half of all grains consumed should be whole grains.**

5 **Meat & Beans Group** in general, 1 ounce of lean meat, poultry, or fish, 1 egg, 1 Tbsp. peanut butter, 1/4 cup cooked dry beans, or 1/2 ounce of nuts or seeds can be considered as 1 ounce equivalent from the meat and beans group.

Macronutrient Goals



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Food Examples

- **Grains**: cooked cereal, well cooked pasta, boiled brown rice, quinoa, oats, bread, couscous
- **Fruits**: applesauce, pear, peach, banana, mango, blueberries
- **Vegetables**: white/sweet potato, pumpkin, carrots, well cooked broccoli, greens
- **Protein**: strained chicken/beef, lentils/legumes, tofu, smooth peanut butter, cooked egg, canned tuna
- **Dairy/sub**: cows milk, calcium-fortified non dairy milks, yogurt, non-fat dry milk powder
- **Fats**: oils, avocado, nut/seed butter

Other Recipe Types

- Starter/easy to blend
- Calorically dense
- Allergen Free
- 3 meals + 2 snacks
- Individualized

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Blenderized Tube Feeding Starter Recipe 30cal/oz

This recipe will help you and your child transition over to a blenderized diet.

You will not need an industrial blender to use this recipe

All proteins, vegetables and fruits need to be soft, pureed consistency before measuring.

Ingredients	Quantity	Food Examples (choose one of each)
Protein	2.5oz **OR** 1/4 cup + 1 TBSP	chicken, beef, pork, fish, legumes/beans, tofu, egg
Vegetables	4.5oz **OR** 1/2 cup + 1 TBSP	carrots, squash, sweet potatoes
Fruit	9oz **OR** 1 cup + 2 TBSP	applesauce, peaches, pears
Baby cereal	6 Tablespoons, dry	baby oat cereal
Honey (for children ≥1 year of age), Agave syrup OR blackstrap molasses	4 Tablespoons	to add calories and/or calcium without adding volume
Oil	2 Tablespoons	to add calories and a good fat source; canola, olive, corn, oil blends
Non-fat Dry Milk Powder*	¾ cup	to add calories and calcium
Water	To Be Determined	add enough water to make total of **34oz** of blend
Crushable multivitamin**	½ tab	Flintstones or per recommendation

*Discuss dairy free options with Registered Dietitian ** Discuss with Registered Dietitian

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BLENDERIZED TUBE FEEDING RECIPES

Note: Patients should be instructed in proper preparation, handling and storage of blenderized tube feeding, as well as proper cleaning of equipment used to prepare the formula to avoid foodborne illness.

	CALORIES[6]									
INGREDIENTS	**800**	**1000**	**1200**	**1500**	**1800**	**2000**	**2200**	**2400**	**2600**	**3000**
Baby Rice Cereal (Heinz) (dry)	¼ cup	¼ cup	¼ cup	¼ cup	½ cup	½ cup	½ cup	½ cup	2/3 cup	¾ cup
Baby Beef (Heinz) 2.5 oz	2 Jars	2 Jars	2 Jars	2 Jars	2 Jars	2 Jars	3 Jars	3 Jars	3 Jars	3 Jars
Baby Carrots (Heinz) 4 oz.	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar
Baby Green Beans (Heinz) 4 oz	--	--	--	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar
Baby Applesauce (Heinz) 4 oz	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	2 Jars	2 Jars	2 Jars	2 Jars	2 Jars
Baby Chicken (Heinz) 2.5 oz	--	--	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	1 Jar	2 Jars
Orange Juice	½ Cup	½ Cup	½ Cup	1 Cup	1 Cup	1 Cup	1 Cup	1 ½ Cups	1 ½ Cups	2 Cups
Whole Milk[1]	1 Cup	2 Cups	2 Cups	2 Cups	2 ¼ Cups	2 ¼ Cups	3 Cups	3 Cups	3 Cups	3 Cups
Cream, Half-and-Half	¼ Cup	¼ Cup	1/3 Cup	¾ Cup	1 ¼ Cups	1 ½ Cups	1 ¼ Cups	1 ½ Cups	1 ¾ Cups	2 Cups
Egg – Cooked[2]	1	1	1	1	1	2	2	2	2	2
Vegetable oil[3]	1 tsp	2 tsp	1 Tbsp	1 Tbsp	1 Tbsp.	1 Tbsp.	2 Tbsp.	2 Tbsp.	2 Tbsp.	3 Tbsp.
Karo Syrup[4]	1 Tbsp	1 Tbsp.	2 Tbsp.	3 Tbsp.	3 Tbsp.	3 Tbsp.	3 Tbsp.	4 Tbsp.	5 Tbsp.	5 Tbsp.
Cost/ kcal level[5]	$3.09	$3.41	$4.25	$5.11	$5.55	$5.59	$6.85	$7.15	$7.45	$8.56

[1] Substitute lactaid milk if needed
[2] Pasteurized liquid whole egg can also be used
[3] Suggest either: Sunflower, Corn or Soybean Oil (High essential fatty acid content and readily available)
[4] Polycose liquid (Ross), can be substituted if necessary; available at www.rosstore.com
[5] All items were priced at Super Wal-Mart using Gerber products 3/2005
[6] Makes 1525 mL total volume

Medicine Nutrition Support Team
University of Virginia Health System
www.GInutrition.virginia.edu

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From this…..

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To this….

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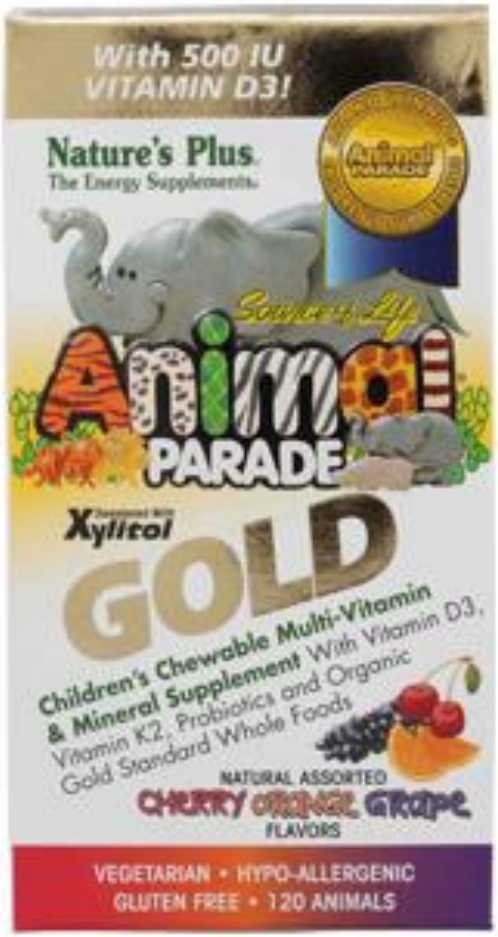
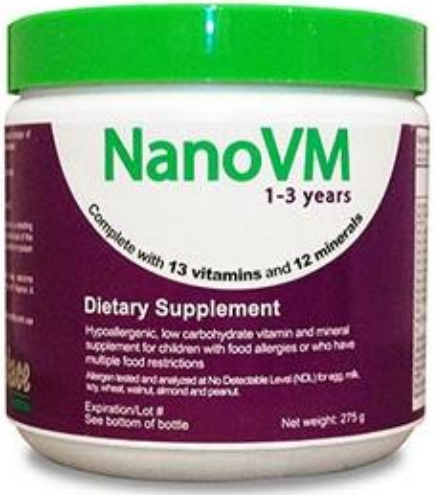
Supplementation?





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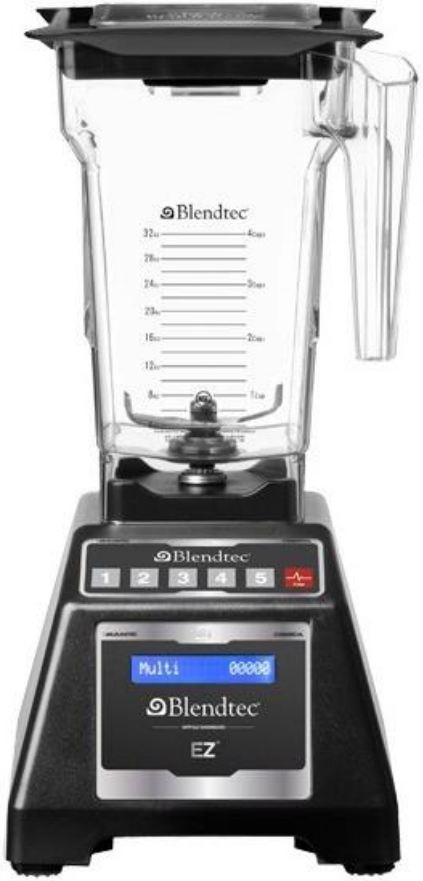
A note on equipment



Blendtec/Vitamix

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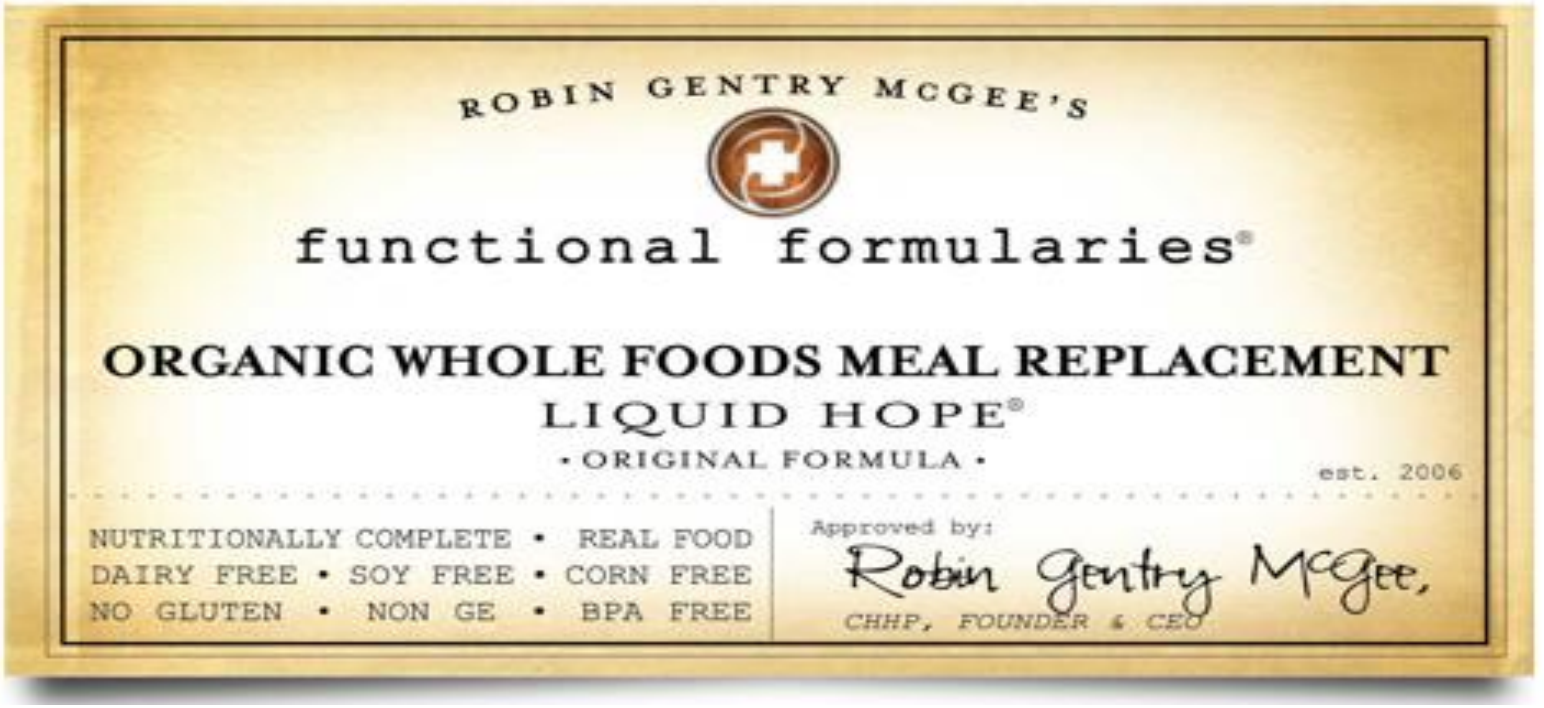
Commercial Ready to Use



$7.99 per 12oz serving
plant based, dairy free, gluten free, soy free, corn free, non-GMO and packaged in a BPA free pouch
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- 3 Meal Varieties for Kids & Adults
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Orange Chicken, Carrots & Barley

Ingredients: chicken, barley, carrots, water, orange juice concentrate, ginger, grapeseed oil and sunflower seeds.

Contains 1 serving fruits & vegetables * Excellent source of protein * Good source of Vitamin A

Meals are sold in 12 packs for $49.95.
Sample packs are available.

~$4.00 per 8oz serving
Not complete nutrition-more like a meal.
No corn syrup, dairy nuts.

www.realfoodblends.com

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$3.12/8oz carton

(Unflavored)

Water, Corn Syrup, Green Pea and Green Bean Puree (Water Dehydrated Peas and Green Beans), Chicken Puree (Water Dried Chicken), Peach Puree (Water Peach Puree Concentrate), Sodium Caseinate (from Milk), Cranberry Juice (Water Cranberry Juice Concentrate) and less than 2% of Canola Oil, Medium Chain Triglycerides (from Coconut and/or Palm Kernel Oil), Partially Hydrolyzed Guar Gum♦, Calcium Phosphate, Potassium Citrate, Hydroxylated Soy Lecithin, Choline Chloride, Maltodextrin, Salt, Sodium Citrate, Sodium Ascorbate (Vitamin C), Magnesium Oxide, Carrageenan, Potassium Hydroxide,Taurine, Alpha Tocopheryl Acetate (Vitamin E), M-Inositol, Ferrous Sulfate (Iron), Zinc Sulfate, L-Carnitine, Natural Flavor, Calcium Pantothenate, Niacinamide, Vitamin A Palmitate, Vitamin K_1 (Phytonadione), Vitamin D_3 (Cholecalciferol), Manganese Sulfate, Thiamine Mononitrate (Vitamin B_1), Pyridoxine Hydrochloride (Vitamin B_6), Riboflavin, Citric Acid, Copper Sulfate, Beta Carotene, Folic Acid, Biotin, Potassium Iodide, Chromium Chloride, Sodium Molybdate, Sodium Selenate, Vitamin B_{12} (Cyanocobalamin).

Family Education Needs

- Recipe
- Equipment
- Preparation details
- Sanitation, storage, safe food prep/handling
- Administration
- Additional water/fluids
- MVI
- Travel/emergency/hospital plan

Food Safety Must Dos…

- Never leave BTF at room temperature > 2 hours
- Avoid danger zone (40-140 degrees)
- Keep in refrigerator until just before feeding
- Freeze food if not going to use within 1-2 days

http://www.foodsafety.gov/

Potential Complications of BTF

Table 1. Potential Complications of HMTF

Concern	Rationale	Prevention
Clogged g-tube	Excess fiber, residue, seeds, nuts, and lumps of food can clog g-tubes. Medications can also react with foods, causing blockages to form in the tube.	Foods must be blended well and strained. Always flush tube with water before and after giving medications and feeds.
Increased wear on g-tube requiring more frequent changes	Oils can degrade the plastics from which g-tubes are made.	Minimize contact time of oils on g-tubes. Determine if oils need to be added to feeds everyday. Flush tube with water after every feeding.
Aspiration of fats (for children at risk of aspirating)	Oils and fats may separate from HMTF due to lack of emulsifying agents. Fats rising to the top of a tube feeding bag may result in the final run of feeding being mostly fat.	Identify history or risk of aspiration. Use syringe boluses versus tube feeding bags when able. Make one feeding at a time instead of refrigerating 24 hours of recipe in one container.
Food-borne illness	Canned formulas are sterile before opening; HMTF are not. Repeated exposure to contaminated foods may occur after blending batches of formula.	Educate families on food safety. Emphasize importance of preventing food borne infections as an illness may be misinterpreted as non-tolerance of HMTF.
Nutrient deficiencies	Deficiencies may arise from continued use of insufficient HMTF.	Perform ongoing recipe analysis. Alternate ingredients within food groups and select foods from every food group for a complete recipe. Request labs for any nutrients of concern.
Hyponatremia/electrolyte disturbances	Low sodium levels result from chronic low sodium ingestion or excessive fluid intake. This may cause swelling of cells as the body attempts to adjust intercellular with intracellular sodium levels. Brain cells are susceptible to damage from swelling due to limited space to expand #(vii).	Calculate sodium and other electrolyte content of HMTF. Calculate maintenance fluid needs. Include free water flushes in daily fluid totals.

Mortensen PNPG 2006

Monitoring

- Growth trend
- Routine recipe analysis is key
- Tolerance
- Fluid
- Sodium
- Calcium & Vitamin D
- Iron

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Future of BTF

- Increasing in popularity among pediatric tube feeding population (anecdotal)
- More likely put real food in their tubes than we know
- More research is needed
- More instruction/education and clinicians feeling comfortable doing BTF diets needed too.

BTF Resources

- Klein MD, Morris SE. *Homemade Blended Formula Handbook.* Tucson, AZ. Mealtime Notions; 2007.
- Escuro A. Practical Gastroenterology. *Blenderized Tube Feeding: Suggested Guidelines to Clinicians*. December 2014.
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