



## Food Allergies and the Blenderized Diet in Patients on the Medical Ketogenic Diet

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### Disclosures

- Lindsey Thompson – Consult – Nutricia North America – Keto Ambassador
- Laura Dority – Consultant – Nutricia North America
- Jessica Brown – Consultant – Nutricia North America

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## Objectives



At the conclusion of the webinar, learners will be able to:

1. Outline various ways to implement a medical ketogenic diet for patients with food allergies or other dietary restrictions
2. Generate blenderized recipes for patients with food allergies or following a vegan or vegetarian diet
3. Develop ketogenic blenderized recipes utilizing specialized commercial products
4. Integrate “super” foods into a blenderized diet

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## 1. FOOD ALLERGIES AND MEDICAL KETOGENIC DIETS



## Allergies and a PO Ketogenic Diet



- Common food allergies/ intolerances



Milk protein / Dairy



### Keto-friendly replacers

- ✓ Unsweetened coconut milk
- ✓ Oils (coconut oil, vegetable oils)
- ✓ Ghee
- ✓ Avocado
- ✓ Lower ratio with use of emulsified MCT



Soy protein

Gluten

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## Allergies and a PO Ketogenic Diet



Common food allergies/ intolerances:

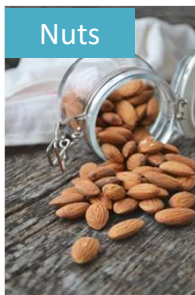


Egg



### Keto-friendly egg replacers (= to 1 egg):

- ✓ Flaxseed meal – 1 TBSP + 3 TBSP water
- ✓ 3 TBSP almond butter (or other seed butter)
- ✓ Chia seed 1 TBSP + 3 TBSP water
- ✓ Coconut milk: ¼ cup



Nuts



- Avoid almond and other nut flours
  - Flaxseed meal can be used
  - Ketodietcalculator: Oopsie Rolls and High Fiber rolls
- This may also be an issue for nut-free schools

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## Food Allergies in Tube Fed Keto Patients



- Often concomitant with GI complications (reflux, vomiting, diarrhea)
- Consider their baseline tolerated formula
- Baseline feeding regimen

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## Food Allergies in Tube Fed Keto Patients



**Milk-based  
formulas**

**Soy-based  
formula**

**Modular formula  
(i.e. build from scratch)**  
Ex. Complete Amino Acid Mix, fat  
modular, carbohydrate modular

**Peptide  
formula**  
(note: not  
hypoallergenic)

**Blenderized  
diet with  
allergens  
removed from  
recipes**

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## Food Allergy Case Study – CM



This picture is for illustration purposes only and not the actual patient.

- 2 year old with history of intractable epilepsy and milk protein allergy
- Baseline feeding regimen: 160 mL 30 kcal/fl oz Neocate® Junior with 15 mL water flush x 5 via G-Tube
  - Run over 1 hour, increased to 1.5 hours if retching
  - Tolerating fair; vomiting 1x/week
  - On reflux medications, no history of fundoplication
  - Anthropometrics WNL

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## Food Allergy Case Study – CM



### Ketogenic diet initiation

Started conservatively inpatient at 1:1 to assess tolerance, then advanced

Successfully advanced to 3.25:1 with adequate ketosis

Continued baseline feeding regimen of 160 ml formula x 5 feeds via GT

Remember vitamins and minerals

### Amino Acid-Based (27% MCT)

#### Grams

20	Formula: Neocate® JR unfld powder – Nutricia
14	Protein: Complete Amino Acid Mix – Nutricia
50	Oil emulsion – Liguigen (MCT) – Nutricia
100	Microlipid in mL (gm = mL) - Nestlé

#### Provides:

**3.25:1 ratio**

**817 kcal**

**14.7 gm protein**

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## Food Allergy Case Study – CM



- 1 month f/u
  - Parents reporting some intermittent vomiting
  - CO<sub>2</sub> 16
  - Intervention: decrease to 3:1, increase bicarbonate supplement
- 3 month f/u
  - Continued intermittent vomiting
  - CO<sub>2</sub> 20
  - Intervention: trialed blenderized feedings for 2/5 feeds (boluses decrease from 160 to 90 mL each)

### Blended Babyfood multiple food allergy – 3:1 Grams

20	Gerber® 2 <sup>nd</sup> Pear
18	Gerber® 2 <sup>nd</sup> Carrots
90	Gerber® 2 <sup>nd</sup> Chicken/Chicken Gravy
27	Oil, Olive
28	Oil emulsion – Liquigen®(MCT) – Nutricia

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## Blenderized Keto for Food Allergies



### Chicken, Fruit, and Vegetable Blend

This recipe is convenient as no blender is required. It is also free of the common food allergens: milk, egg, wheat, soy, peanuts, tree nuts, fish, and shellfish.

Ingredients (for 500 kcal)	4:1	3:1	2:1
Baby Food, Pears, g	-	20	30
Baby Food, Carrots, g	9	18	35
Baby Food, Chicken, g	90	90	115
Liquigen, g	28	28	28
Oil, Olive, g	28	27	22
Water*, mL	350	320	300

\*Indicated mL of water added yields ~ 500 mL of total volume which is 30 kcal/oz.

### Nutritional Composition

	4:1	3:1	2:1
Energy, kcal	500	500	500
Fat, g	496	486	45.8
MCT, %	30	30	30
Protein, g	8.9	9.1	11.8
Carbohydrates (net), g	3.4	7.1	10.9

### Instructions

1. Weigh each ingredient on a gram scale.
2. Combine ingredients together into a container; use a spatula to scrape as much of the ingredients into the container as possible.
3. Add water to final volume, shaking or stirring to combine. A blender can be used, if desired.
4. Add salt and other micronutrient supplements, as necessary, to meet nutrient needs.



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## Allergy-friendly Supplements



- Nano VM®
  - Allergen tested and analyzed to No Detectable Level (NDL) for egg, milk, soy, wheat, tree nuts, and peanut.
- Kirkman® Products
  - Has a hypoallergenic line of products
  - Per the FAQ website “Kirkman® conducts the most extensive testing for purity in the industry. Every batch of raw material used to manufacture products in Kirkman's line is tested for more than 950 environmental contaminants including 24 heavy metals, common allergens, bacteria, yeast, mold, pesticides, insecticides, fungicides, herbicides, endocrine disruptors and potentially harmful chemicals.”
- FruitiVits™
- Phlexy-Vits
  - FruitiVits and Phlexy-Vits do not contain any allergens per the companies.

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## 2. BLENDERIZED KETO DIET

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## Perceived Benefits of Blenderized Diets



Individualize

Incorporate whole foods

Avoidance of food allergens



Improve feeding tolerance

Increase variety

Provides sense of nurturing for caregiver

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Pentiuk, et al. JPEN J Parenter Enteral Nutr. 2011;35:375-9.; Gallagher, et al. JPEN J Parenter Enteral Nutr. 2018;42:1046-60.; Hron, et al. J Pediatr. 2019;211:139-45 e1.; Batsis ID, et al. NCP. 2019;35(2):282-288.

## Avocado, Avocado, Avocado

The easiest and most keto friendly food to blenderize

Naturally a 4:1 ratio

Source of vitamin C, E, K, Mg, K and B-vitamins

High in fiber & antioxidants



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## Blenderized Trial Run



Avocado allows an easy trial to a thicker formula because 30 grams (about 1 ounce) = 50 calories which is very close to a 4:1 - 45 kcal/oz formula

### Baseline Ketogenic Plan

- 240 mL (8 fl oz) of 4:1 medical ketogenic formula - 4 times/day
- 1 feed provides a 4:1 ratio of 356 calories, 35 grams fat, 7.3 grams protein and 1.5 grams of net carbs

### Intro to Blenderized Plan

- Add 30 g (~1 oz) of avocado to every feeding
- Reduce the medical ketogenic formula to 210 mL (7 fl oz)
- Creates very similar calories, ratio and macronutrients without impacting volume or schedule

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## Commercial Ketogenic Formulas in Blend Recipes



Commercial ketogenic formula as liquid base in keto blends

Stepwise approach to initiating blends

Provides source of vitamins & minerals

Feasibility in hospital setting

Potential cost savings to the family

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## Case Study – Blends Utilizing Commercial Products



This picture is for illustration purposes only and not the actual patient.

- 13-year-old male
- Lennox-Gastaut Syndrome
- **Seizures:** 5-7 seizures per day
- **Current Medications:** Banzel®, felbamate, clobazam
  - History of: vigabatrin, topiramate, Keppra®
- **Nutrition:** G-tube dependent; 45 kcal/fl oz formula
- **GI:** Intermittent vomiting, retching, constipation, reflux
  - Polyethylene glycol, lansoprazole, metoclopramide

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## Ketogenic Initiation



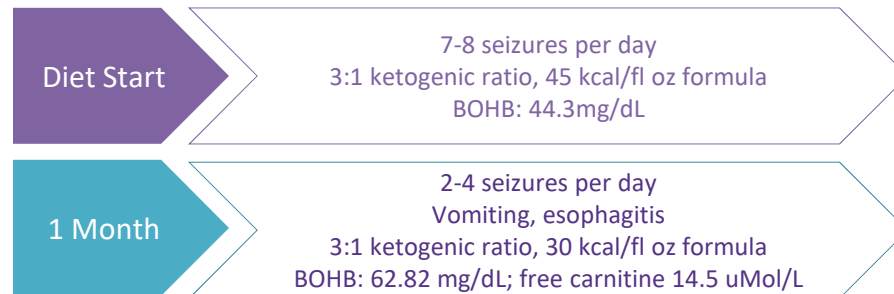
Diet Start

7-8 seizures per day  
3:1 ketogenic ratio, 45 kcal/fl oz formula  
BOHB: 44.3mg/dL

Ratio	Calories	Protein	Net CHO
3:1	1450	0.94 g/kg	5.75

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## Ketogenic 1 Month Follow-up



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## Ketogenic Partial Blends



### Daytime Feeds (prepare x2):

- 8 fl oz (240 mL) ketogenic 4:1 liquid formula
- 1 scoop protein powder
- 1 jar (4 oz) baby green beans
- 1 oz water
  - Provide 360mL @ 120 mL/hr, 2x/day

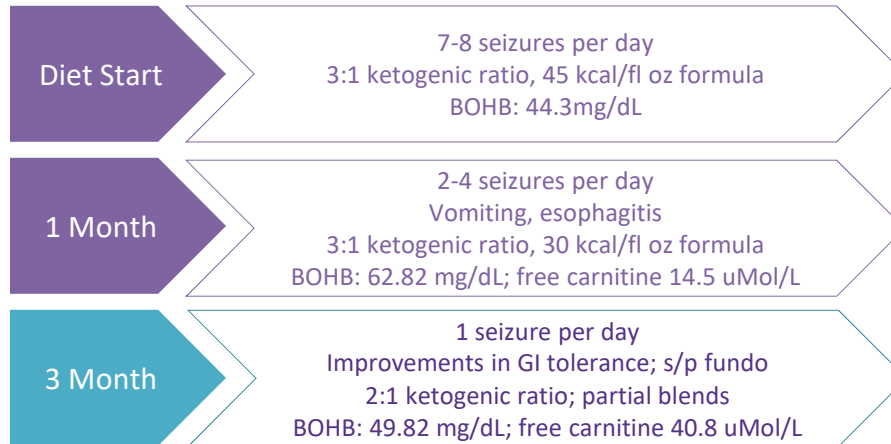
### Nighttime feeds:

- 16 fl oz (480 mL) ketogenic 4:1 liquid formula
- 1 jar (4oz) baby Green Beans
- 1 jar (4oz) baby Carrots
- 2 fl oz (60 mL) water
  - Provide 720 mL @ 60 mL/hr overnight

Ratio	Calories	Protein	Net CHO
2:1	1450	1.2 g/kg	22 g

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## Ketogenic 3 Month Follow-up



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### 3. BLENDERIZED KETO DIET WITH MCT OIL



## Commercial Specialty Products in Blend Recipes



- Commercial MCT oil products in keto blends

Increase ketosis

Allow for more whole foods

Provide lower ratios with fewer side effects

May help with bowel regularity

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## Case Study – Blends Using MCT Specialty Products



This picture is for illustration only.

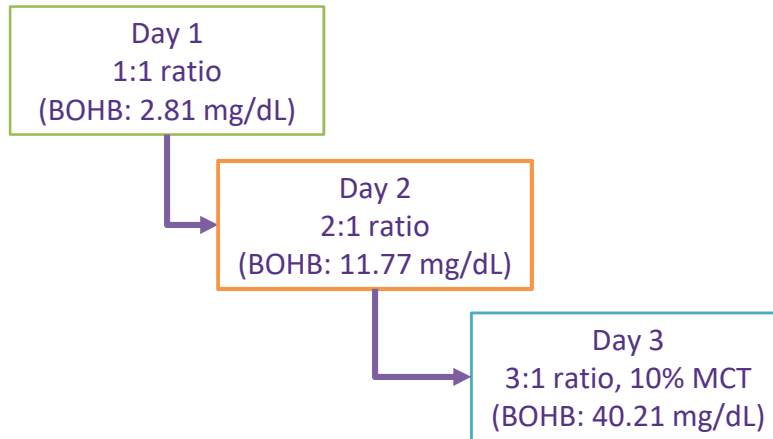
- 6-year-old girl
- History of HIE, cerebral palsy, and epilepsy
- **Seizures:** no clinical seizures; EEG showed ESES
- **Medications:** Keppra®
  - Tried steroids w/o efficacy
- **Nutrition:** Blenderized home formula via g-tube

HIE = Hypoxic Ischemic Event; EEG = Electroencephalogram; ESES = Electrical status epilepticus in sleep

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## Ketogenic Initiation – Blenderized Diet



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## Blenderized Ketogenic Recipe with MCT



### Blenderized 3:1 Ratio (10% MCT Oil)

Grams	Ingredient
75	Strawberries (raw)
30	Spinach – raw
75	Green beans, frozen – cooked
74	Beef, ground, 85% lean – cooked
100	Avocado, California or Mexico (Haas)
16	Sunflower seed butter
10	Chia seeds, ground
480	Almond milk, unsweetened
30	Emulsified MCT oil
72	Oil, olive
1.5	Salt

Instructions:  
Divide into 4 feeds

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## 4. BLENDERIZED KETO DIET WITH FOOD



### Blenderized Diet – Baby Food



#### Benefits

- Super easy
- Doesn't require a fancy blender (shaking works)
- Any brand can work
- Jars, tubs, & pouches can all work
- Pouches = variety
- No emulsifier generally needed because you can mix it easily right before the feed

#### Disadvantages

- Less variety compared to real food
- Less fiber compared to real food
- Depending on brand, there may be additives or other ingredients some families may wish to avoid
- Close label reading needed



## Blenderized Diet – Baby Food Examples



3:1 Ratio; 740 kcals; 12 g protein

### Grams

90	Gerber® 2 <sup>nd</sup> Ham
90	Gerber® 2 <sup>nd</sup> Butternut Squash
55	Olive oil
76	Avocado (Hass)

Add water to create goal volume

- Protein and vegetable sources can be adjusted for variety

- After 24 hour batch mixed, separate into individual feedings and store in fridge.

- No emulsifier = separation. Will need mixing prior to use

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## Blenderized Diet – Whole Food



### Protein source:

chicken, fish, egg, ground meats, beans/legumes

### Liquid source:

water, heavy cream, unsweetened nut-based milk

### Carbohydrate source:

vegetable, fruit

\*Use the ketogenic diet exchanges (Group B vegetables, 10% fruit) for variety



### Fiber source:

vegetables, ground flax, chia seeds, avocado

### Fat source:

MCT oil, oils, avocado, ghee/butter

\*For a variety of fat (MUFA, PUFA, saturated), choose at least 2 different fat sources

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## Blenderized Diet – Whole Food Examples

Food	3:1 Ratio	4:1 Ratio
Chicken breast (no skin) – cooked	43 grams	43 grams
Black beans (canned) – cooked	20 grams	12 grams
Group B vegetables	65 grams	30 grams
10% fruit	20 grams	12 grams
Olive oil	50 grams	51 grams
Coconut oil	28 grams	30 grams
<b>Total volume</b>	<b>466 grams</b>	<b>418 grams</b>

- Both recipes provide:
  - 810 calories/day
  - 16 grams protein
  - Add liquid to create desired volume

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## Blenderized Keto for Vegan/Vegetarian

### Plant-iful blend

Ingredients (for 500 kcal)

	4:1	3:1	2:1
Lentils, Cooked, g	8	20	30
10% Fruit, g	-	-	20
Group B Vegetable, g	9	20	50
Sunbutter, Natural, No Sugar Added, g	32	32	30
Oil, Olive, g	18	16	14
Liquigen, g	28	28	28
Water*, mL	410	400	360

\*Indicated mL of water added yields ~ 500 mL of total volume which is 30 kcal/oz. Some discrepancy in fluid amount needed to create 500 mL may be seen due to blender and blender speed.



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## Emulsifiers

- Sunflower lecithin provides fat, choline and can also serve as an emulsifier that will help mixes stay in suspension.
- Blends that are lower ratio (1:1/2:1) or blends that use a lot of avocado as a fat source may not need an emulsifier.
- The amount of sunflower lecithin added to the recipe should be ~ 1/3 of the combined oils.
- Sunflower lecithin is available in liquid and powder form.
  - The liquid can be very sticky so educate families to scrape as much out of the blender as possible.

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## Emulsifier Example

- Example: 4:1 ratio; 500 kcals, 10 g protein
  - 30 grams group B vegetables
  - 40 grams lean meat
  - **17 grams coconut oil**
  - **17 grams olive oil**
  - **11 grams sunflower lecithin**
  - Fluid to desired volume
- **Dosing lecithin: 17 g coconut oil + 17 g olive oil = 34 grams of fat/3 = 11.3 grams lecithin**



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## Super Foods



Carnitine*	Antioxidants	Calcium/Vitamin D
Ground lamb	Leafy greens (spinach/kale)	Fortified, unsweetened nut milks
Ground beef	Avocado	Low carb yogurts
	Berries	Unsweetened kefir
	Beets	
	Dark chocolate	
	Beans	
	Sunflower butter	

Note: Carnitine values vary widely on the cut of the meat. For reference, 100 grams of ground beef contains 87.5 mg of carnitine. Carnitine found naturally in foods is more bioavailable compared to supplements.

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\*Demarquoy, et al. Food Chemistry. 2004;86:137-42.

## “Super” Foods – Omega 3’s



- Walnut oil
- Flaxseed meal
- Chia seeds
- Spinach
- Salmon
- Soy beans



Example: 2:1 ratio; 600 kcals, 22 g protein

### Grams

- 30 10% fruit
- 50 raw spinach**
- 60 lean meat
- 30 flaxseed meal**
- 25 walnut oil**
- 45 Avocado

Fluid to desired volume

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## 5. TIPS & CONCLUSION

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### Blenderized Tube Feeding Tips



- 1 Avoid making changes to vitamin/mineral supplements at the same time as initiating or adding foods to a blenderized feed.
- 2 Review your hospital's policy on blenderized diets in case your patient is admitted or have a back-up plan.
- 3 Consider prior feeding method. Enteral feeding pumps may not work with home blenderized formulas.
- 4 Make large batches of favorite recipes and portion out into individual feeds prior to freezing.
- 5 Consider various fluid options to help meet nutrient needs.

## CONCLUSION



Assessment of food allergies and intolerances should occur before starting a medical ketogenic diet

Families are looking for more whole food-based options for their children

Work with them to incorporate foods into their feeding plan to help with various side effects

Ensure safe food handling practices are maintained

Does not have to be a one-size-fits all approach or all-or nothing approach

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