

# Low Carbohydrate Diets and The Brain



Eric H. Kossoff, MD

Medical Director, Ketogenic Diet Center

Associate Professor, Neurology and Pediatrics

Johns Hopkins Hospital

Baltimore, Maryland

July 9, 2010

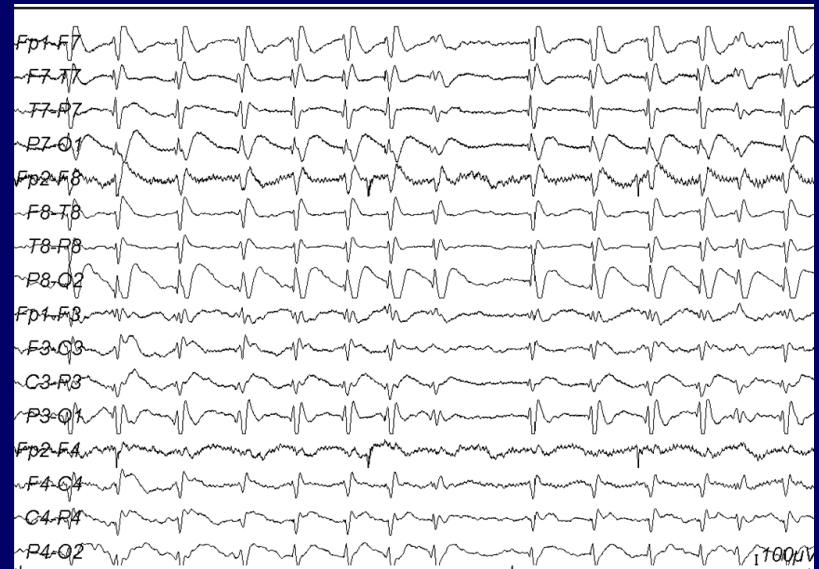


# Topics

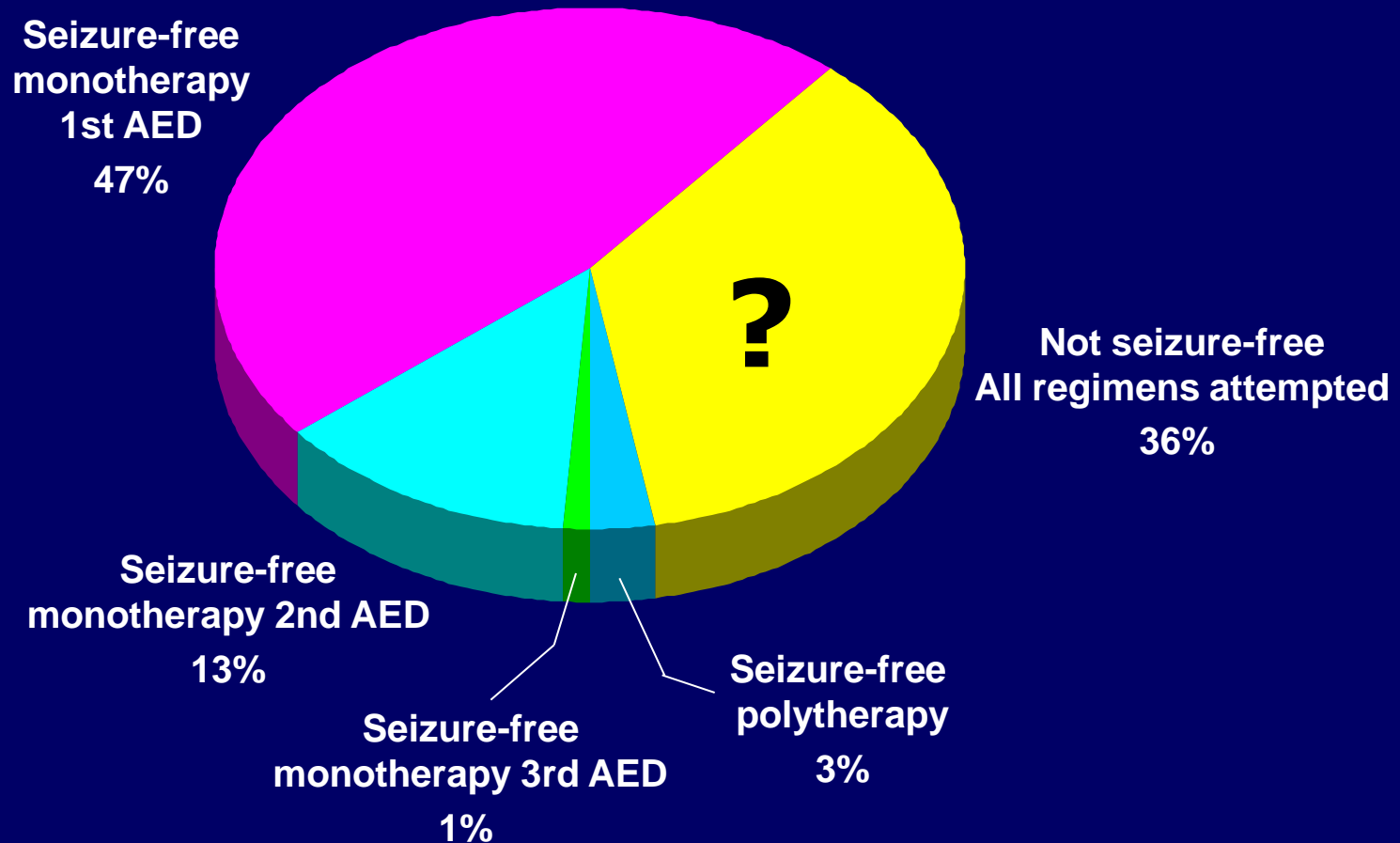
- The Ketogenic Diet for Epilepsy
- What is the “Modified” Atkins Diet?
- Other neurological disorders and low carbohydrate diets?

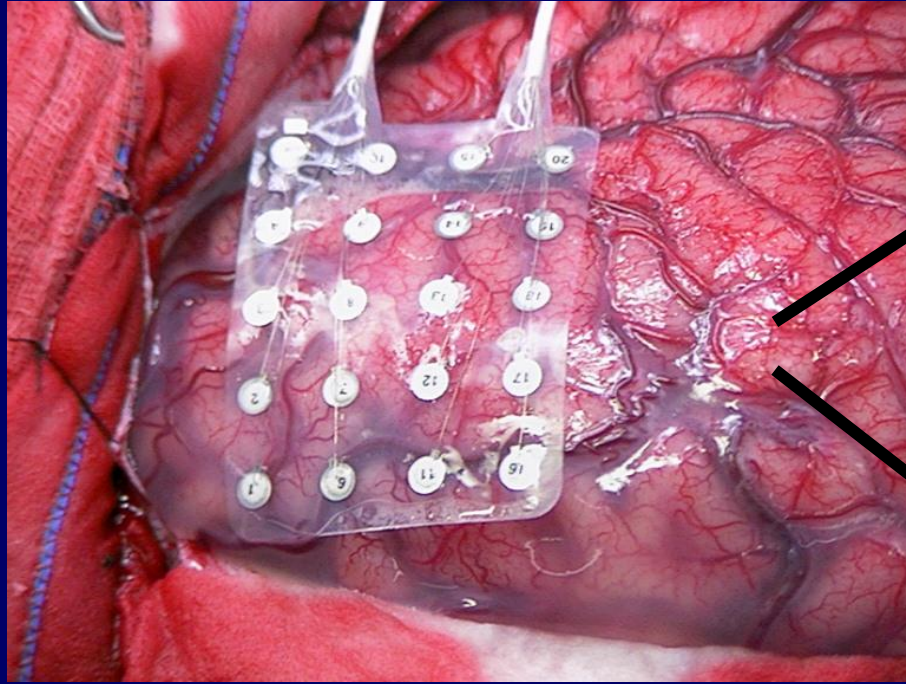
# What is Epilepsy?

- Repeated seizures
- Electrical abnormality of the brain
  - Can be genetic or a structural cause
- Unpredictable and terrifying
- Medications started in most cases



# Seizure-Free Rates With Different Strategies



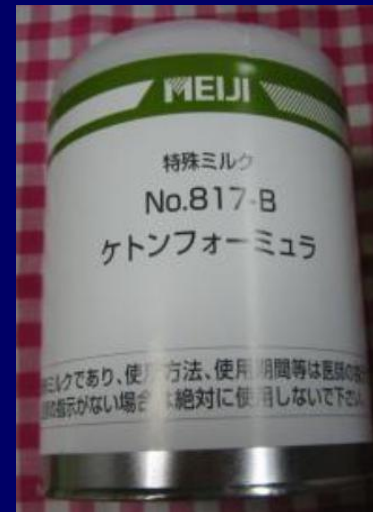


# The Ketogenic Diet: Basics

- 90% calories are fat
  - 4:1 ratio of fat: carb+protein (grams) most common
- Fluid and calorie-limited
- Foods weighed on gram scales
- Typically started in the hospital over 4 days
  - 24-hour fasting period optional
- Children continued for about 2 years if effective

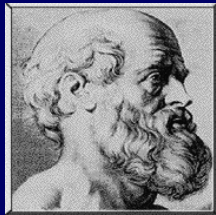








~400 BC 0



### FASTING AS EPILEPSY CURE.

**Osteopaths Hear That 22 Days on Water Usually End Fits.**

LOS ANGELES, July 5.—Epilepsy may be cured by fasting. Dr. Hugh Conklin told the twenty-sixth annual convention of the American Osteopathic Association, now in session here. Epilepsy, according to Dr. Conklin, is caused by the improper functioning of certain glands in the bowels. By fasting for twenty-two days, taking only water, a cure may be effected, he said. "Many people," added Dr. Conklin, "fast thirty days and are never afflicted by fits again. The longest fast which any patient ever took under my direction lasted sixty days. Out of thirty-seven tests in which children were used as patients, only two still are affected by the disease. The children all were under the age of 11 years, but we effect cures in older patients in from 50 to 60 per cent. of the cases we undertake."



### THE KETOGENIC DIET IN THE TREATMENT OF EPILEPSY\*

A PRELIMINARY REPORT

M. G. PETERMAN, M.D.  
ROCHESTER, MINN.

1911

1921

1938



**Dilantin® Kapsea**  
phenytoin sodium

1994





# THE CHARLIE FOUNDATION

## TO HELP CURE PEDIATRIC EPILEPSY

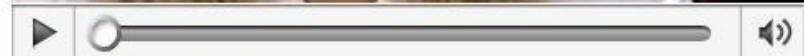


### OFFERING HOPE THROUGH THE KETOGENIC DIET

The Charlie Foundation to Help Cure Pediatric Epilepsy was founded in 1994 after twenty month old Charlie Abrahams, having endured multiple daily seizures, and failed every available anti-convulsant drug and one brain surgery, was cured of his epilepsy by the ketogenic diet at Johns Hopkins Hospital. The diet was undertaken despite resistance from the five pediatric neurologists he had seen.

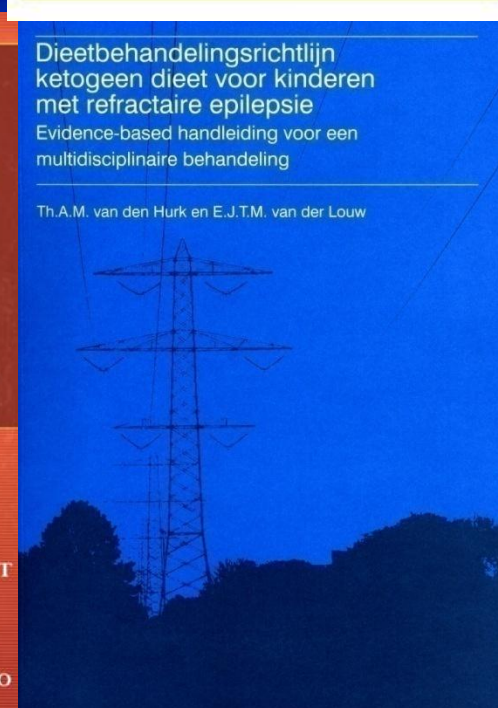
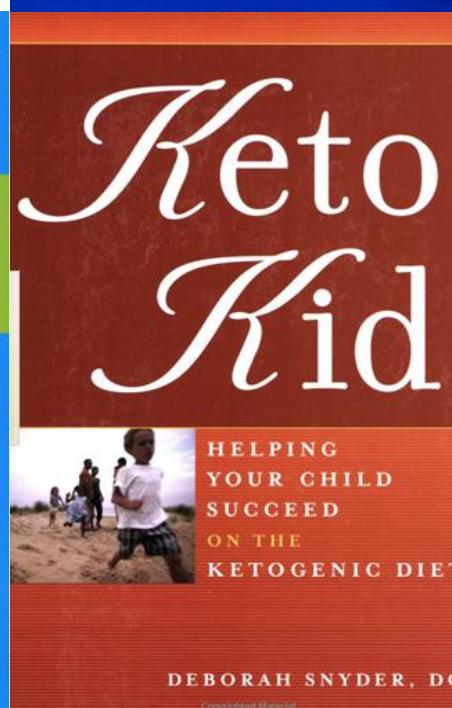
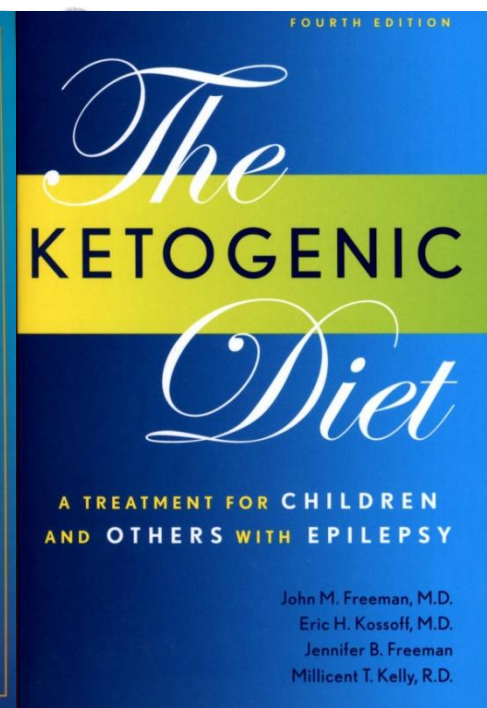
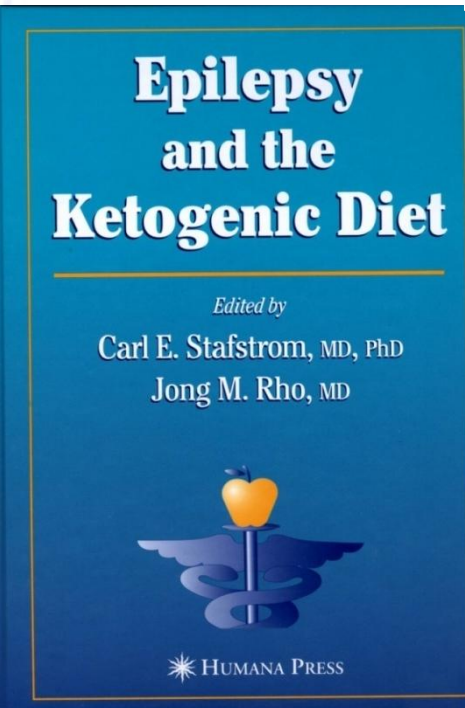
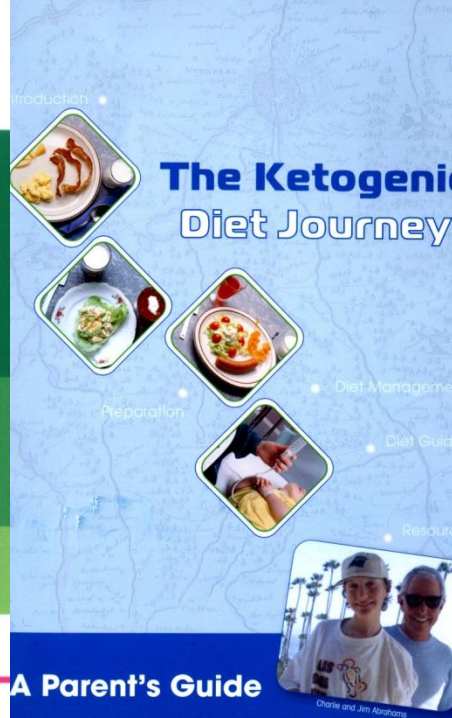
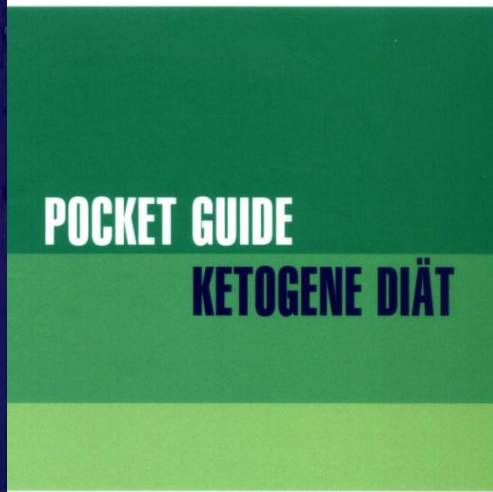
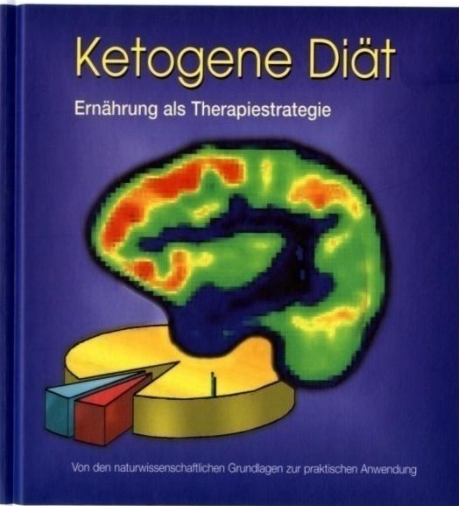
When Charlie's parents realized that Charlie was but one of hundreds of thousands of children whose families were either not being informed, or being misinformed about dietary therapy, they started The Charlie Foundation... [READ MORE...](#)

### Meryl Streep Introduces The Ketogenic Diet



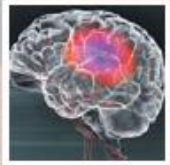












## INTERNATIONAL SYMPOSIUM

ON DIETARY THERAPIES FOR EPILEPSY  
AND OTHER NEUROLOGICAL DISORDERS

April 2-5, 2008  
The Ritz-Carlton Phoenix

**BARROW**  
Neurological  
Institute



Sponsored by The Charlie Foundation, CURE and Nutricia N.A.  
Hosted by the Barrow Neurological Institute at St. Joseph's Hospital & Medical Center





*Epilepsia*, 50(2):304–317, 2009  
doi: 10.1111/j.1528-1167.2008.01765.x

## SPECIAL REPORT

# Optimal clinical management of children receiving the ketogenic diet: Recommendations of the International Ketogenic Diet Study Group

**\*Eric H. Kossoff, †Beth A. Zupec-Kania, ‡Per E. Amark, §Karen R. Ballaban-Gil, ¶A. G. Christina Bergqvist, #Robyn Blackford, \*\*Jeffrey R. Buchhalter, ††Roberto H. Caraballo, ‡‡J. Helen Cross, ‡Maria G. Dahlin, §§Elizabeth J. Donner, ¶¶Joerg Klepper, §Rana S. Jehle, ##Heung Dong Kim, §§Y. M. Christiana Liu, \*\*\*Judy Nation, #Douglas R. Nordli, Jr., †††Heidi H. Pfeifer, ‡‡‡Jong M. Rho, §§§Carl E. Stafstrom, †††Elizabeth A. Thiele, \*Zahava Turner, ¶¶¶Elaine C. Wirrell, ####James W. Wheless, \*\*\*\*Pierangelo Veggiotti, \*Eileen P. G. Vining and The Charlie Foundation, and the Practice Committee of the Child Neurology Society**

Table 1. Included Studies

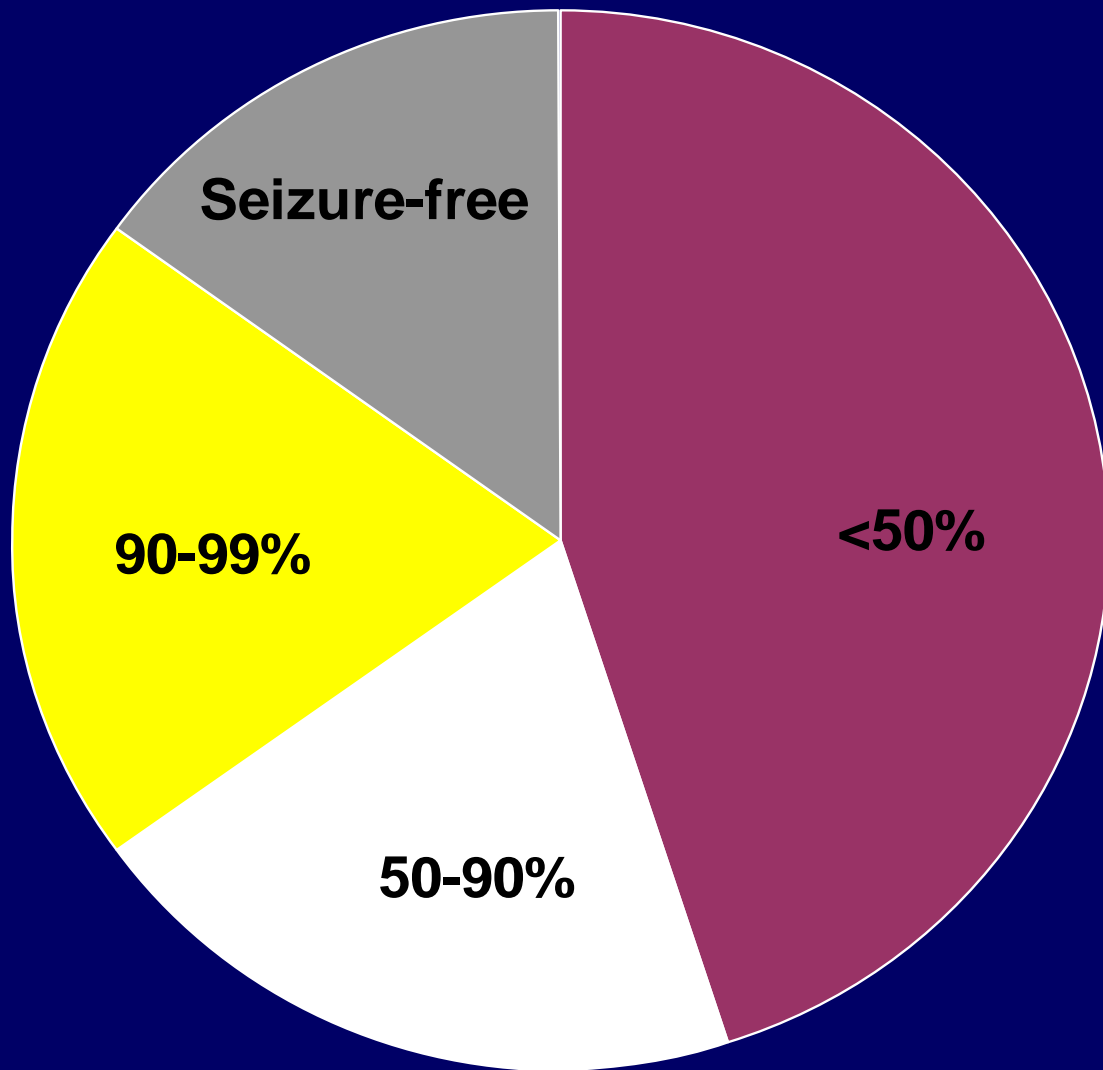
Study	Study Type	Year	Subjects (Total)	Duration (mo)*	Males	Age (yr) Mean (Range)	Diet Type	Strength of Evidence†
Hopkins and Lynch <sup>7</sup>	Prospective	1970	34	24	—	(1.0–12.0)	CD	IV
Sills et al <sup>8</sup>	Prospective	1986	50	24	—	—	MCT	IV
Woody et al <sup>9</sup>	Prospective	1988	15	24	—	2.4 (1.7–8.0)	MCT	IV
Vining et al <sup>10</sup>	Prospective	1998	51	6	34	4.7 (1.3–8.6)	CD	III
Freeman et al <sup>11</sup>	Prospective	1998	150	48	85	(0.3–16.0)	CD	III
MacCracken and Scalisi <sup>12</sup>	Prospective	1999	11	36	—	4.8 (1.0–12.6)	CD	IV
Kankirawatana et al <sup>13</sup>	Prospective	2001	35	12	16	5.4 (0.2–12.0)	CD/MCT	III
Lightstone et al <sup>14</sup>	Prospective	2001	46	6	26	5.3 (0.4–16.5)	CD	IV
Vining et al <sup>15</sup>	Prospective	2002	237	12	130	3.7 (0.2–9.8)	CD	III
Coppola et al <sup>16</sup>	Prospective	2002	56	18	36	10.4 (1.0–23.0)	CD	III
Trauner <sup>17</sup>	Retrospective	1985	17	—	10	(1.0–13.0)	MCT	IV
Hassan et al <sup>18</sup>	Retrospective	1999	52	—	27	5.5	CD/MCT	III
Couch et al <sup>19</sup>	Retrospective	1999	26	—	11	4.4 (2.0–11.0)	CD	III
Maydell et al <sup>20</sup>	Retrospective	2001	143	12	87	7.5 (0.3–29.0)	CD	III
Nordli et al <sup>21</sup>	Retrospective	2001	31	—	18	1.2	CD	III
Wirrell et al <sup>22</sup>	Retrospective	2002	14	—	—	7.3 (1.0–16.8)	CD	IV
DiMario and Holland <sup>23</sup>	Retrospective	2002	48	12	16	6.5 (1.0–15.0)	CD	III
Kossoff et al <sup>24</sup>	Retrospective	2002	23	—	17	1.1 (0.4–2.0)	CD	III
Mady et al <sup>25</sup>	Retrospective	2003	45	—	25	14.4	CD	III

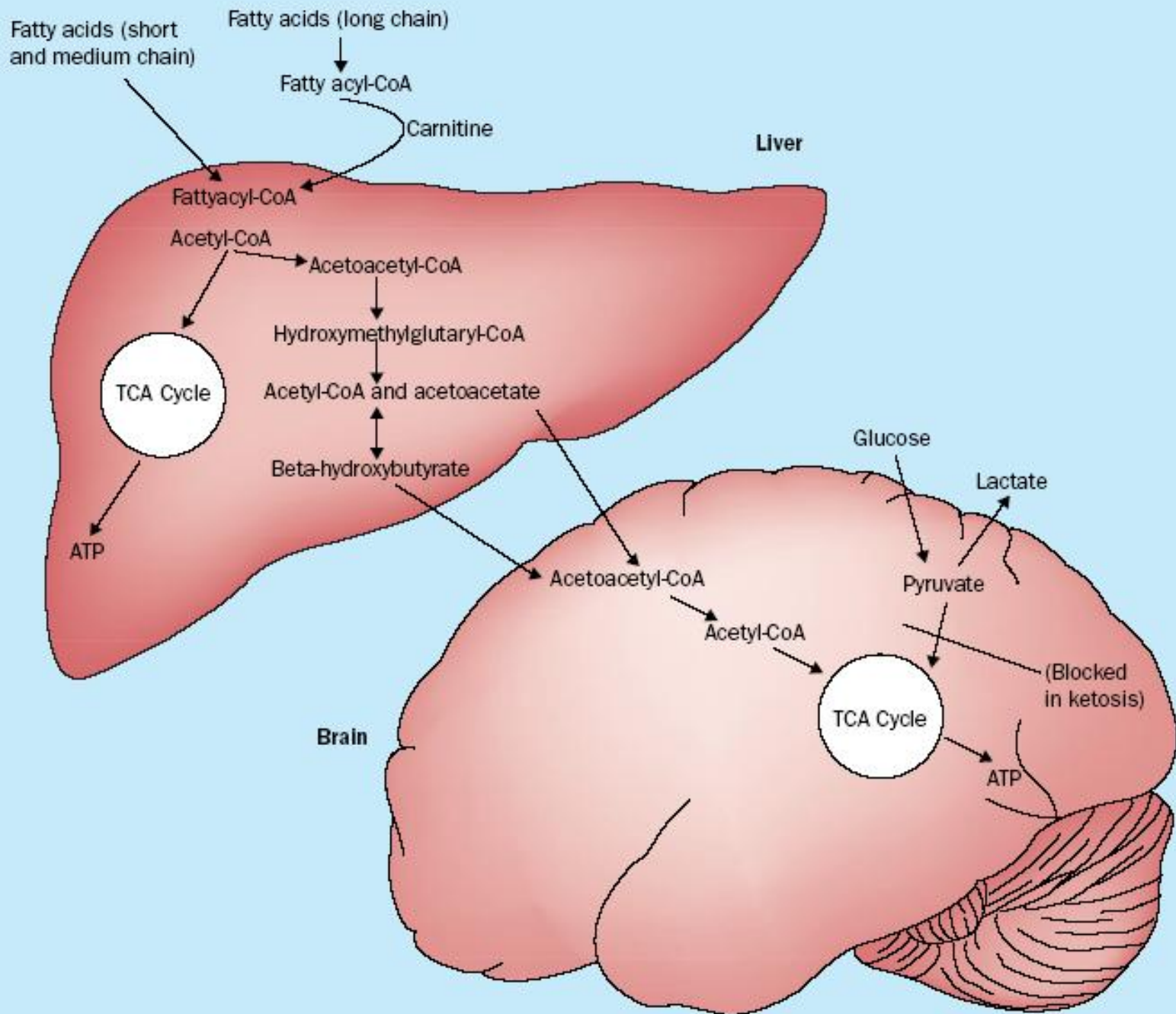
CD = classic diet; MCT = medium-chain triglyceride.

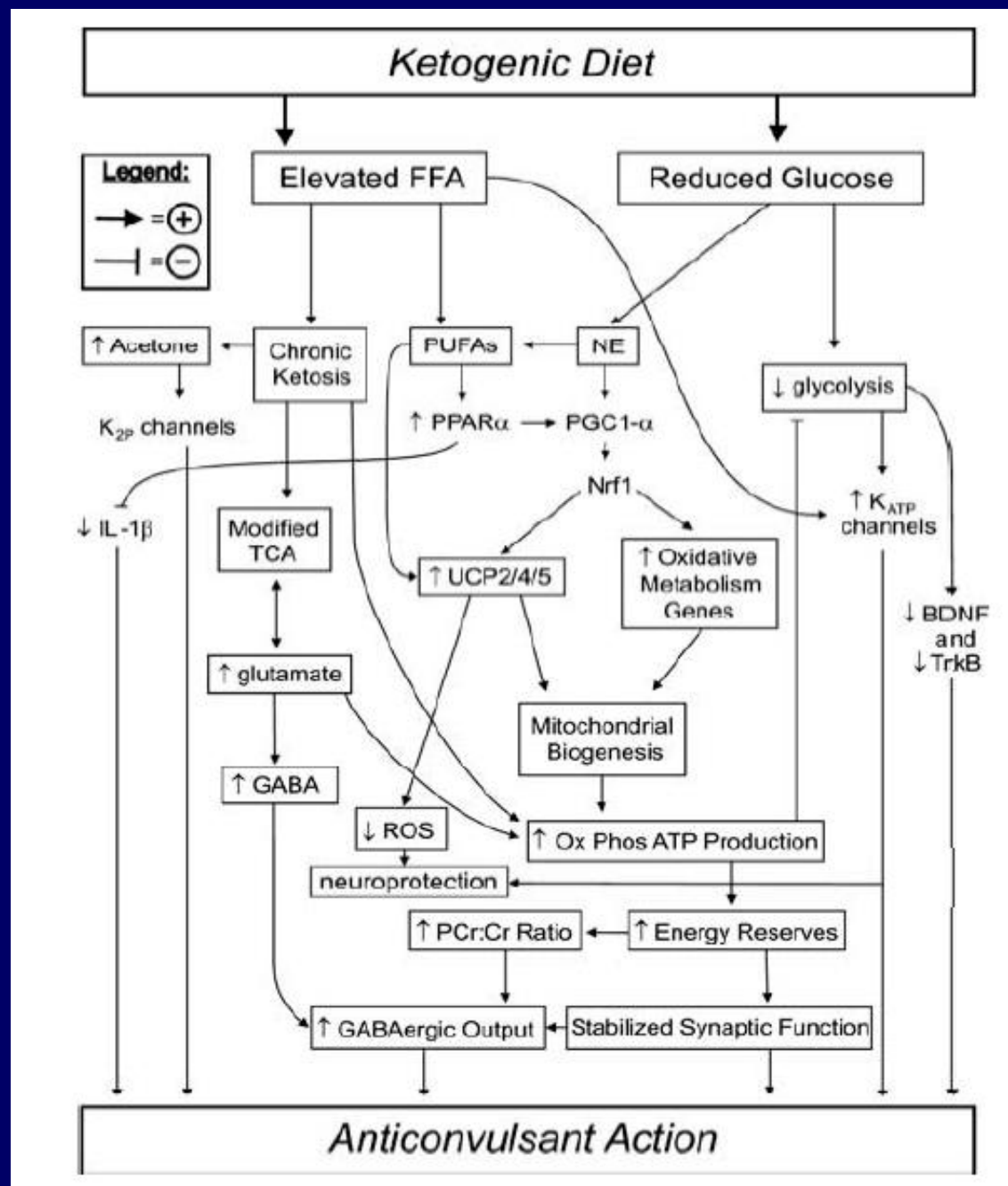
\*Total months on diet.

†Class I–IV based on a standard classification scheme for treatment studies (see Appendix).<sup>5</sup>

## 6-Month Seizure Reduction from Ketogenic Diet









# “Ideal” Diet Situations

- Glut-1 deficiency
- Pyruvate dehydrogenase deficiency
- Infantile spasms
- Doose syndrome
- Severe myoclonic epilepsy of infancy (Dravet)
- Rett syndrome
- Patients receiving formulas only
- Combination therapy with vagus nerve stimulation
- Patients on zonisamide
- Recently worsened seizures

# Ketogenic Diet: Side Effects

- Common (50%)
  - Constipation
  - Slowed weight gain
  - Acidosis
- Occasional (5%)
  - Reduced height velocity
  - Significant dyslipidemia
  - Renal stones
  - Gastrointestinal upset
- Rarely leads to diet discontinuation

## **Table 4. Supplementation recommended for children receiving the KD**

### Universal recommendations

Multivitamin with minerals (and trace minerals)

Calcium with vitamin D

### Optional extra supplementation

Oral citrates (Polycitra K)

Laxatives: Miralax, mineral oil, glycerin suppository

Additional selenium, magnesium, zinc, phosphorus, vitamin D

Carnitine (Carnitor)

MCT oil or coconut oil (source of MCT)

Salt (sodium to add to modular formulas if used for greater than age 1 year)

---

All supplements listed should be provided as carbohydrate-free preparations whenever possible.

## High-Fat Ketogenic Diet Diminishes Seizures For Local Man With TSC

Originally published June 24, 2008

By [Susan Guynn](#)  
News-Post Staff

**New Market** -- Joedy Atkinson eats chunks of butter and drinks heavy cream at every meal.

It's part of a special diet he's followed most of his 28 years. His mother, Eva Atkinson, is certain Joedy's high-fat diet is responsible for diminishing multiple daily seizures to a total of about 25 during the past 23 years.

At 3 1/2 months, Joedy began having seizures. He was diagnosed with epilepsy.

"Around 9 months, we noticed he wasn't progressing," said Eva. "His gross motor skills were fine," but when it came to making eye contact and speech, Joedy was lagging.

Further testing showed Joedy also had a genetic disorder called tuberous sclerosis complex (TSC). It causes benign tumor-like tubers to form in different organs, primarily in the brain, eyes, heart,



Photo by Doug Koontz

Eva Atkinson measures out meals for her son Joedy, 28, who has tuberous sclerosis and epilepsy. Eva says following a strict ketogenic diet for the past 23 years has reduced Joedy's seizures from multiple daily to about 25 since he began the diet around age 5.

# What about years after the ketogenic diet is over?

- 101 families surveyed
  - Current age: 13 years (2-26)
  - Median 6 years post-KD
- Seizure control generally still good
- Labs normal
  - Mean total cholesterol: 158 mg/dl
- Height/weight/BMI normal
- No myocardial infarctions



# Is There an “Alternative” Diet?

At CME

## An Easier Diet for Epilepsy Patients

Bissett Schwanke first noticed that her 4-year-old daughter, Genevieve, was having tics in January 2004. Then, after she had scheduled an appointment with her pediatrician, she saw something new—a seizure. Visits to a local neurologist and tests confirmed her worst fears—Genevieve had childhood epilepsy.

“It was pretty devastating,” Schwanke says. “It snowballed from head nods to four to six seizures a day.”

On top of that, the prescribed drug therapy seemed to have no effect. Anti-epileptics take months to take hold therapeutically, she was told. But when Genevieve’s seizures became even more frequent and intense in the spring of 2005, Schwanke consulted with Hopkins neurologist **Eileen Vining**. But Vining saw some improvement in Genevieve’s seizure control and recommended that she stay with the drug therapy. Give it a real opportunity to work, and then consider other options.

Schwanke knew that the high fat/low carbohydrate ketogenic diet was effective in controlling epilepsy, but it had its drawbacks, including a required fast and a hospital stay during which fami-

lies are trained in the rigors of the diet. Side effects include kidney stones, constipation and stunted growth. When she returned to Hopkins, Vining told her about a less-restrictive, modified Atkins diet that also produces ketones—a chemical by-product of fat that can inhibit seizures—but requires fewer restrictions on calories, fluids and proteins, and no fast or hospitalization. Also, Hopkins pediatric neurologist **Eric Kossoff** was conducting a small pilot study of this diet. When Schwanke still saw no success with the anti-epileptics by the fall, she enrolled Genevieve in the six-month study. The results were astounding.

“Within 36 hours she did not have another seizure, and she’s remained seizure free,” Schwanke says. “It was a complete miracle. We did not expect that kind of response.”

In Kossoff’s study, presented at a Hopkins neurology conference and a meeting of the American Epilepsy Society last December, 13 of 20 patients had a greater than 50 percent improvement in seizures, and seven had a greater than



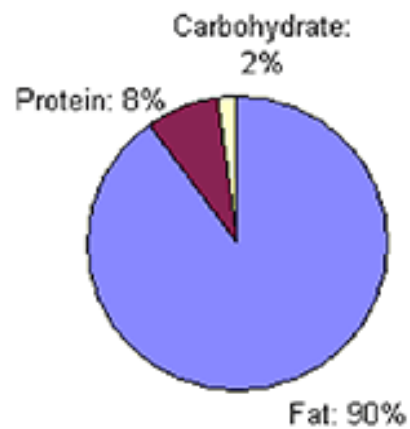
90 percent improvement. In addition to Genevieve, three other patients were seizure free. Nearly half were able to reduce or completely discontinue medications. Also, side effects were low.

“Our findings suggest relatively good efficacy compared to the ketogenic diet,” Kossoff says. “Our study wasn’t large enough to say a modified Atkins diet should replace the ketogenic diet, but the results are encouraging and intriguing.”

Schwanke couldn’t agree more: “The meds wore her out. Now she’s active, goes to school, plays with her friends. It’s like we turned a page and got our child back.” For more information, call 410-614-6054. [A](#)

# Topics

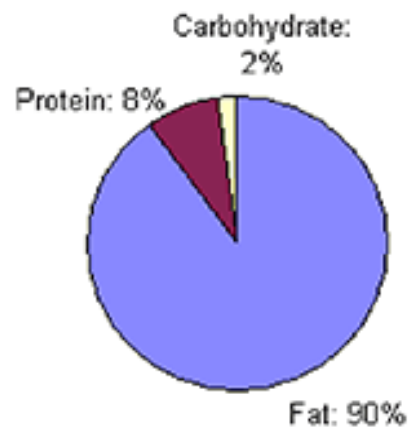
- The Ketogenic Diet for Epilepsy
- What is the “Modified” Atkins Diet?
- Other neurological disorders and low carbohydrate diets?



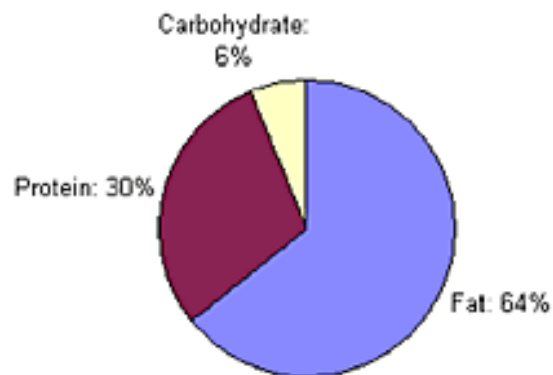
**Ketogenic diet**



**Standard, "normal" diet**



**Ketogenic diet**

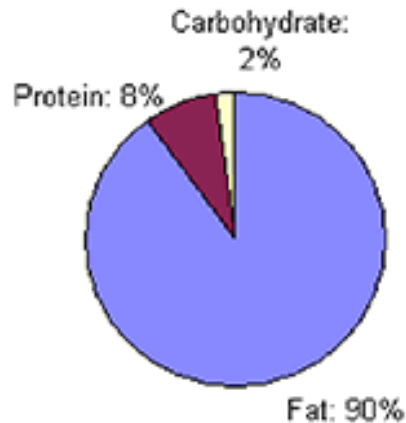


**Modified Atkins diet**

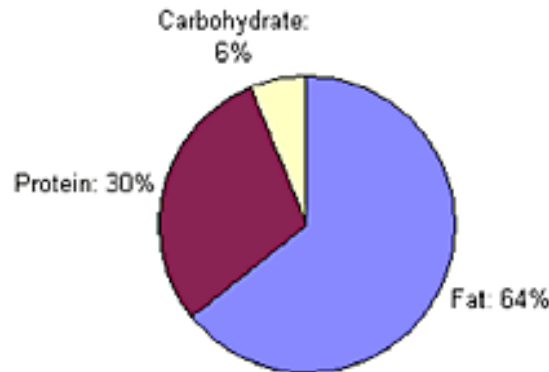


**Standard, "normal" diet**





**Ketogenic diet**



**Modified Atkins diet**



**Standard, "normal" diet**

- No calorie restriction
- No fluid restriction
- No hospital admission (clinic education)
- No weighing of foods on gram scales
- No fasting required

# How is it “modified”?

## Atkins

- High fat foods are allowed

## Modified Atkins

- High fat foods strongly encouraged

# How is it “modified”?

## Atkins

- High fat foods are allowed
- Carbs 20 grams per day induction

## Modified Atkins

- High fat foods strongly encouraged
- Carbs 10-20 grams per day indefinitely

# How is it “modified”?

## Atkins

- High fat foods are allowed
- Carbs 20 grams per day induction
- Weight loss is a goal  
– monitor calories

## Modified Atkins

- High fat foods strongly encouraged
- Carbs 10-20 grams per day indefinitely
- Weight loss not usually a goal



## CARBOHYDRATE GRAM COUNTER

FOOD	CARBOHYDRATE GRAMS	FOOD	CARBOHYDRATE GRAMS
<b>MILK PRODUCTS</b>			
Cream (light, 1 tbsp)	0.6	Pancake (using dry mix)	17.4
(sour, 2 tbsp)	1.0	Popcorn (popped, 1 cup)	5.0
(heavy, 1 tbsp)	0.5	Rice (cooked, 1 cup)	49.6
Half and Half (1 tbsp)	0.7	(puffed, 1 cup)	11.5
Milk (whole, 1 cup)	11.0	<b>SOUPS</b>	
(soy, unsweetened, 1 cup)	13.0	Chicken Consommé (1 cup)	1.9
Plain Yogurt (skim, 1 cup)	13.0	Chicken Gumbo (1 cup)	7.4
(whole, 1 cup)	12.0	Cream of Chicken (1 cup)	14.5
<b>CHEESE</b>		Cream of Mushroom (1 cup)	16.2
American (1 oz)	0.5	Turkey Rice (1 cup)	10.0
Camembert (1 oz)	0.5	<b>HERBS</b>	
Cheddar (1 oz)	0.6	Allspice (1 tsp)	1.4
Cottage (fat-free, 1 cup)	10.0	Basil (1 tsp)	0.9
(whole, 1 cup)	8.0	Caraway (1 tsp)	1.1
Cream Cheese (2 tbsp)	1.0	Celery (1 tsp)	0.6
Feta (1 oz)	1.0	Cinnamon (1 tsp)	1.8
Muenster (1 oz)	1.0	Coriander Leaf (1 tsp)	0.3
Provolone (1 oz)	1.0	Dill Seed (1 tsp)	1.2
Swiss (1 oz)	0.5	Garlic Clove (1)	0.9
<b>NUTS</b>		Ginger Root (fresh, 1 oz)	3.6
Almond Paste (1 oz)	14.5	(ground, 1 tsp)	1.3
Almonds (1 oz)	5.5	Saffron (1 tsp)	0.5
Brazil (1 oz)	3.1	Tarragon (1 tsp)	0.8
Cashews (1 oz)	8.3	Thyme (1 tsp)	0.9
Coconut (1 oz)	4.3	Vanilla (double strength, 1 tsp)	3.0
Hazelnuts (filberts) (1 oz)	4.7	<b>VEGETABLES</b>	
Macadamia (1 oz)	4.5	Asparagus (4 spears)	2.2
Peanut Butter (1 tbsp)	3.0	Beans, green (boiled, 1 cup)	6.8
Peanuts (1 oz)	5.4	Beans, yellow or wax	
Pecans (1 oz)	4.1	(boiled, 1 cup)	5.8
Pignolia (1 oz)	3.3	Broccoli (1 cup)	8.5
Pistachio (1 oz)	5.4	Brussels Sprouts (1 cup)	9.9
Pumpkin Seeds (1 oz)	4.2	Cabbage (1 cup)	6.2
Sesame Seeds (1 tbsp)	1.4	Carrot (7 in.)	7.0
Soybeans (½ cup)	6.0	Cauliflower (1 cup)	5.1
Sunflower Seeds (1 oz)	5.6	Celery (1 stalk)	1.6
Walnuts (1 oz)	4.2	Coleslaw (1 cup)	8.5
<b>GRAINS</b>		Collards (1 cup)	9.8
Bagel (1)	30.0	Corn (1 ear, 5 in.)	16.2
Bread (pumpnickel, 1 slice)	17.0	Cucumber (sliced, 1 cup)	3.6
(whole wheat, 1 slice)	11.0	Dandelion (1 cup)	6.7
Corn Muffin	20.0	Endive (1 cup)	2.1
Farina (1 cup)	22.0	Kale (1 cup)	6.7
Frozen Waffle	29.0	Kohlrabi (1 cup)	8.7
Noodles (1 cup cooked)	37.3	Lettuce (Romaine, 1 cup)	1.9
Oatmeal (1 cup cooked)	27.0	(Boston, 1 cup)	1.4
		(Iceberg, 1 cup)	1.6



## Sample Menu for Atkins Diet

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<b>Breakfast</b> 	Decaf Coffee with Half & Half Bacon Scrambled Eggs	Herbal Tea Ham & Cheddar Cheese Omelet	Decaf Coffee with Half & Half Sausage Links Fried Eggs	Decaf Coffee with Half & Half Poached Eggs Tomato with Cheddar Cheese	Water Vegetable & Mozzarella Cheese Omelet with Green Peppers and Mushrooms	Herbal Tea Grilled Ham Steak Scrambled Cheese Eggs with Cheddar Cheese	Decaf Coffee with Half & Half Steak & Eggs
<b>Lunch</b> 	Water Roast Chicken breast Salad – Romaine lettuce, cucumber, mushrooms & Italian dressing	Club Soda Fried Chicken Wings Celery Sticks Blue Cheese dressing	Water <del>Bunless</del> Double Cheeseburger Lettuce Tomato Mayonnaise Dill Pickle	Water Shrimp & Scallops Steamed Snow Peas	Club Soda Chicken Cobb Salad - Chicken Breast, Romaine lettuce, Cucumber, Boiled Egg, & Blue Cheese dressing	Diet Soda Sautéed Beef & Vegetables (Green Peppers & Mushrooms)	Water Braised Short Ribs Salad – Romaine lettuce, tomato, alfalfa sprouts & Blue Cheese dressing
<b>Dinner</b> 	Diet Soda Broiled Salmon Steamed Broccoli with Cheddar Cheese	Water Sirloin Steak Salad – Romaine lettuce, bacon bits, 1 boiled egg & Italian dressing	Diet Sprite Fried Pork Chops Buttered Green Beans	Diet Soda Roasted Turkey Breast Spinach Salad with Mushrooms & Italian dressing	Water Seared Tuna Steak Steamed Asparagus Spears	Club Soda Roast Duck Steamed Spinach	Water Grilled Sea Bass Steamed Buttered Cauliflower
<b>Total Carbs</b>	14.98 g	13.12 g	12.40 g	14.70 g	13.95 g	14.78 g	14.84 g



## Atkins Recipes - Course

### Browse Recipes

- ▾ [Browse by Course](#)
- ▾ [Browse by Cuisine](#)
- ▾ [Browse by Phase](#)
- ▾ [Browse All Recipes](#)

### Main Course



Ancho Macho Chili

GO

### Desserts



Almond Torte with Chocolate Sauce and Ch...

GO

### Appetizers



Anise and Orange Breadsticks

GO

- Anise and Orange Breadsticks
- Artichokes with Lemon-Butter
- Asian Beef Salad
- Asian Lobster Salad
- Asian Vegetable Bowl
- Asparagus and Leek Soup
- Asparagus Tarragon Cream Soup
- Asparagus with Walnuts and Vinaigrette
- Atkins Crab Cakes
- Atkins Garlic Toast Crisps
- Avocado Gazpacho Smoothie
- Avocado Zucchini Soup
- Baby Greens with Grapefruit and Red Onion
- Bacon and Goat Cheese Salad
- Bacon-Cheddar Cheese Soup
- Bagna Cauda
- Baked Artichoke-Parsley Cheese Squares
- Baked Brie with Sun-Dried Tomatoes and Pi...
- Baked Eggplant Puree
- Baked Goat Cheese and Ricotta Custards
- Baked Quesadillas
- Baked Stuffed Mushrooms with Sausage an...
- Basic Egg Salad and Egg Salad Plus
- Beef Carpaccio with Arugula and Caper Vina...
- Beef Tenderloin and Dijon Greens
- Black Olives with Lemon and Fennel
- Blanquette de Veau
- Blue Cheese and Bacon Soup
- Bouillabaisse
- Broiled Eggplant-Tomato Salad with Spicy S...
- Anise and Orange Breadsticks

GO

GO

### Beverages



Atkins Chocolate Slushies

GO



[Frequently Asked Questions](#) [MyKetoCal.com Home](#)

Sign up for the NEW quarterly e-newsletter, *myKetoCommunity*  
SUMMER EDITION NOW AVAILABLE! [Click Here](#)



[Product Info](#)

[Keto Stories](#)

[Ketogenic Resources](#)

[KetoCal® Recipes](#)

[Order Information](#)

## NEW! KetoCal® Recipes

### Breakfast



### Lunch/Dinner



### Snacks & Dessert



### Snacks and Dessert

- [Hot Cocoa](#)
- [Pudding with Heavy Cream](#)
- [Crème Brûlée](#)
- [Pudding](#)
- [Blueberry Muffins](#)
- [Almond-Coconut Cookies](#)
- [No Bake Fudge](#)
- [Chocolate Almond Bark](#)
- [Cranberry Apple Cobbler](#)
- [Crustless Pumpkin Pie](#)
- [Gingerbread Cookies](#)
- [Chocolate Cake with Chocolate Cream Frosting](#)
- [Smoothies - Strawberry, Blueberry and Banana](#)
- [Raspberry Smoothie](#)
- [Apple Crumble with Whipped Cream, 4:1 ratio](#)

The Charlie Foundation | Helping Cure Epilepsy Through The Ketogenic Diet - Microsoft Internet Explorer provided by Comcast

http://www.charliefoundation.org/recipes

Google

FileEditViewFavoritesToolsHelp

Favorites

Johns Hopkins Institutions - ...

Sign In

Suggested Sites

Facebook

MSNBC

CNN

TWC weather.com

The Charlie Foundation | Helping Cure Epilepsy Throu...

Page

Safety

Tools

F.A.Q.

RESOURCES

EVENTS

FOUNDATION

HOSPITALS

CONTACT US

THE CHARLIE FOUNDATION

TO HELP CURE PEDIATRIC EPILEPSY

DONATE

Mac-N-Cheese

The following recipe is a simple combination of heavy cream and cheese to create one of America's favorite comfort foods. The amount of cream should be about equal or a little more than the amount of cheese. Use this guide to create this tasty dish for your child's diet in KetoCalculator. Miracle Noodles are very low in carbohydrate and high in ...

+ VIEW THIS RECIPE

Flax Bread

The low carb flax bread recipe below contains less than 2gm of carbohydrate per 30gm slice. This bread has a nutty flavor and resembles a whole grain bread. It can be thinly sliced for sandwiches. It can also be toasted. Calculate this bread into a meal or snack in KetoCalculator - Fat Category under "Flax Bread":  
www.ketocalculator.com. Flax ...

+ VIEW THIS RECIPE

Cheesecake

As a rule of thumb, calculate approximately 10g of raw, mixed egg for every 40g of cream cheese. Use up to the same amount of heavy cream as cream cheese. All of the carbohydrate remaining can be allotted to fruit (for garnish or mixed into the recipe). Canned, unsweetened pumpkin or unsweetened cocoa can also be incorporated into the recipe as the ...

+ VIEW THIS RECIPE

Stir Fry with Noodles






A stir fry dish with your choice of beef, pork, or poultry.

+ VIEW THIS RECIPE

Keto Cereal

This high-fiber cereal combination is a quick healthy alternative to typical keto meals. It makes a great snack too!

+ VIEW THIS RECIPE



Done

Internet

75%



# Modified Atkins Diet: 2010

- 78 (49%) of 160 children and adults with >50% seizure reduction to date
  - 18 (11%) became seizure-free
- Appears more effective when a ketogenic diet formula “milkshake” is used during the initial month in children\*
  - 80% with seizure reduction after 1 month
- Improvement can be very rapid

*Kossoff Neurology 2003; Kossoff Epilepsia 2006; Kang Epilepsia 2007; Kossoff Epilepsy Behav 2007; Ito Brain Dev 2007; Kossoff Epilepsia 2008; Carrette Clin Neuro Neurosurg 2008; Weber Seizure 2008; Porta Seizure 2009; \*Kossoff J Child Neurol 2010*

# Topics

- The Ketogenic Diet for Epilepsy
- What is the “Modified” Atkins Diet?
- Other neurological disorders and low carbohydrate diets?

# Neurologic Uses for Diets Other than Epilepsy

Autism	2003
Brain tumors	2003
Depression	2004
Narcolepsy	2004
Glycogenosis Type V	2005
Alzheimer's	2005
Traumatic brain injury	2005
Parkinson's	2005
ALS (Lou Gehrig's Disease)	2006
Migraine	2006
Sleep disorders	2007
Post hypoxic myoclonus	2007
Post anoxic brain injury	2008
Schizophrenia	2009

# 'Milkshake' could fight Alzheimer's

[ASSOCIATED PRESS]

WASHINGTON // Drinking a milkshake-style medicine at breakfast seems to feed brain cells starved from Alzheimer's damage, researchers reported yesterday.

The milkshake drug, called Ketasyn, is a new way to approach dementia. It hinges on recent research suggesting that diabetic-like changes in brain cells' ability to use sugar for energy play a role in at least some forms of Alzheimer's.

Special fatty acids in Ketasyn offer an alternate food source to rev up those hungry neurons, researchers told an international Alzheimer's meeting here yesterday. In a study of 150 patients, adding Ketasyn to their regular medicines produced a small but important boost in mental functioning — but only in people who don't carry an Alzheimer's gene called ApoE4. Still, that's about half of all patients.

"We see this as a co-therapy," not a way to stop Alzheimer's, cautioned Dr. Lauren Constantini, a former Harvard scientist now with the company Accera Inc.



Contents lists available at ScienceDirect

## Ageing Research Reviews

journal homepage: [www.elsevier.com/locate/arr](http://www.elsevier.com/locate/arr)



### Review

## Ketogenic diets: An historical antiepileptic therapy with promising potentialities for the aging brain

Marta Baliotti<sup>a,b,\*</sup>, Tiziana Casoli<sup>a</sup>, Giuseppina Di Stefano<sup>a</sup>, Belinda Giorgetti<sup>a</sup>,  
Giorgio Aicardi<sup>c,d</sup>, Patrizia Fattoretti<sup>a,b</sup>

<sup>a</sup> Neurobiology of Aging Laboratory, INRCA, Via Birarelli 8, 60121 Ancona, Italy

<sup>b</sup> Cellular Bioenergetics Laboratory, INRCA, Via Birarelli 8, 60121 Ancona, Italy

<sup>c</sup> Department of Human and General Physiology, University of Bologna, Via S. Donato 19/2, 40127 Bologna, Italy

<sup>d</sup> Interdepartmental Centre "Luigi Galvani" for the study of Biophysics, Bioinformatics and Biocomplexity, University of Bologna, Via S. Giacomo 12, 40126 Bologna, Italy

### ARTICLE INFO

#### Article history:

Received 17 December 2009

Received in revised form 16 February 2010

Accepted 17 February 2010

#### Keywords:

Ketogenic diets

Epilepsy

Neurodegeneration

Neuroprotection

Aging

### ABSTRACT

Ketogenic diets (KDs), successfully used in the therapy of paediatric epilepsy for nearly a century, have recently shown beneficial effects also in cancer, obesity, diabetes, GLUT 1 deficiencies, hypoxia-ischemia, traumatic brain injuries, and neurodegeneration. The latter achievement designates aged individuals as optimal recipients, but concerns derive from possible age-dependent differences in KDs effectiveness. Indeed, the main factors influencing ketone bodies utilization by the brain (blood levels, transport mechanisms, catabolic enzymes) undergo developmental changes, although several reports indicate that KDs maintain some efficacy during adulthood and even during advanced aging. Encouraging results obtained in patients affected by age-related neurodegenerative diseases have prompted new interest on KDs' effect on the aging brain, also considering the poor efficacy of therapies currently used. However, recent morphological evidence in synapses of late-adult rats indicates that KDs consequences may be even opposite in different brain regions, likely depending on neuronal vulnerability to age. Thus, further studies are needed to design KDs specifically indicated for single neurodegenerative diseases, and to ameliorate the balance between beneficial and adverse effects in aged subjects. Here we review clinical and experimental data on KDs treatments, focusing on their possible use during pathological aging. Proposed mechanisms of action are also reported and discussed.



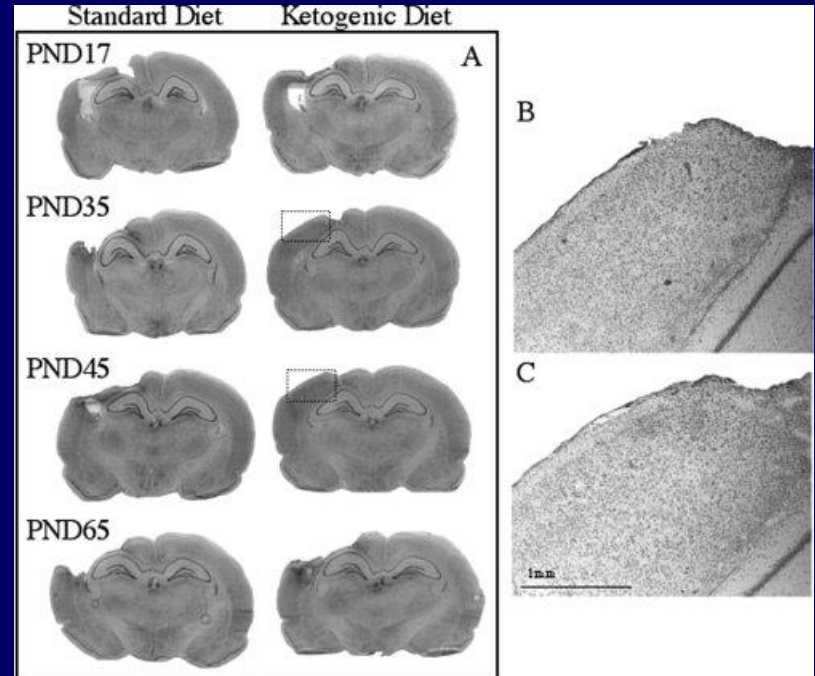
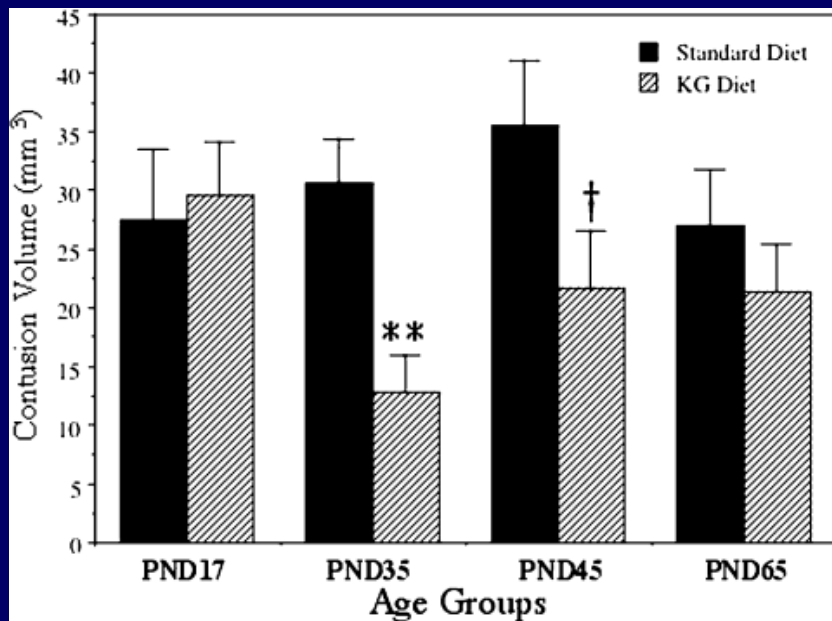
# Axona™

- Approved March 2009
- 2 studies showing benefit
  - Both sponsored and authored by Accera, Inc.
- Alzheimer's Association
  - “medical foods a subject of concern”...



Henderson *Neurotherapeutics* 2008  
Henderson *Nutr Metab* 2009

# Head trauma



Fluid percussion model; KD started immediately after trauma.

## WE UNDERSTAND

THAT BOTH PEOPLE AND LICENSE  
PLATES CAN BE ATTACHED TO CARS.

Responsibility. What's your policy?™

Liberty  
Mutual

► ROLLOVER SCENE TO EXPLORE.

## Can a High-Fat Diet Beat Cancer?

By RICHARD FRIEBE

Monday, Sep. 17, 2007



MARTIN JEPPI / ZEFA / CORBIS

The women's hospital at the University of Würzburg used to be the biggest of its kind in Germany. Its former size is part of the historical burden it carries — countless women were involuntarily sterilized here when it stood in the geographical center of Nazi Germany.

## RELATED ARTICLES

## When Tomatoes Fight Cancer

The FDA says no to labeling tomato products as anti-cancer foods. But that's no reason to cut the veggie from your diet

Today, the capacity of the historical building overlooking the college town, where the baroque and mid-20th-century concrete stand in a jarring mix, has been downsized considerably. And the experiments within its walls are of a very different nature.

## ARTICLE TOOLS

- Print
- Email
- Sphere
- AddThis
- RSS

## TOP STORIES

- Greenspan Makes Grown Men Gush
- El-Hassan: A Mideast Marshall Plan?
- Sadr's Freeze Greeted With Skepticism

Sign-up for FREE TIME.com Newsletters

## Your Life is Worth Insuring

Free Guide

Calculator

Nationwide

This guide, as seen in TIME Magazine, will help you sort through your options and show you how to find a plan that's right for you and your family.



presented by

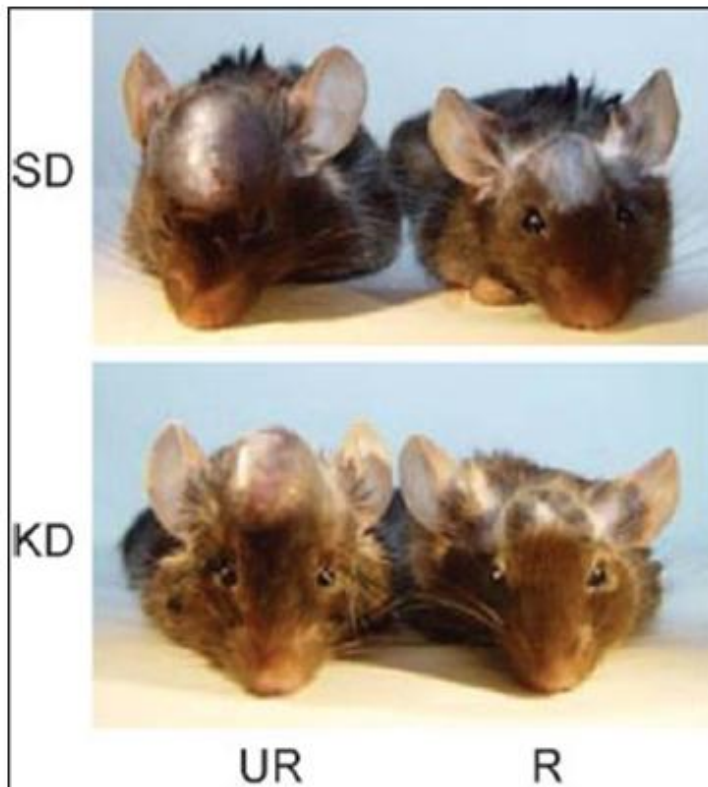
Nationwide  
On Your Side

DOWNLOAD

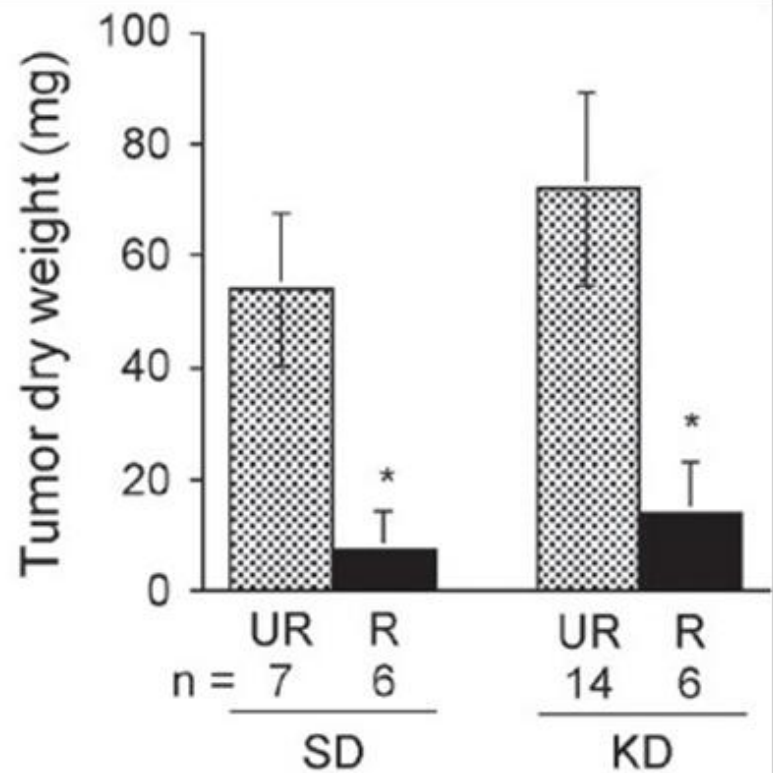
## MOST POPULAR

## MOST EMAILED

- Can a High-Fat Diet Beat Cancer?
- Washington's Trouble With Thompson
- Iraq Limits Blackwater's Operations
- Study: The Best Exercise for Diabetes
- Football's \$1,000 Helmet



(a)



(b)

Dietary Cancer Trial | University Affiliated Clinical Trial @ Einstein in New York - Microsoft Internet Explorer


File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Reload Print Mail W PDF Y Star AutoLink AutoFill Send to Settings

Address <http://www.aecom.yu.edu/recharge/clinical/page.aspx?id=4786> Go Links

Google G Go Bookmarks PageRank Check AutoLink AutoFill Send to Settings

ALBERT  
**EINSTEIN** COLLEGE OF MEDICINE  
OF YESHIVA UNIVERSITY






**The RECHARGE TRIAL**

[AECOM Home](#) | [Search & Directories](#) | [Site Map](#)

[Printable Quick Summary](#)

## Can A Low Carb Diet Help Your Cancer ?



### Join The **RECHARGE Trial**

(Reduced Carbohydrates Against Resistant Tumors)

## and find out!

(718) 904- 2639 Dr. Eugene Fine  
(718) 430-2161 Dr.C.J Segal Isaacson  
(718) 405-8545 Ms. Michelle Goggin  
(718) 920-6720 Ms. Silvia Herszkopf

**The Albert Einstein Cancer Center**

You may be eligible to participate in this one month research study if you are:

- An adult with metastatic cancer (especially breast or colon; others may qualify) who declines chemotherapy or whose cancer has resisted prior

HOME

DIET

ELIGIBILITY REQUIREMENTS

STUDY PROCEDURES

STAFF

MEDICAL REFERENCES

RESOURCES & LINKS

Done Internet



# Summary

- Low carbohydrate (and high fat) diets are becoming very widely used in epilepsy
- Other neurologic disorders under investigation

# Johns Hopkins Ketogenic Diet Center

James Rubenstein MD

Adam Hartman MD

Patti Vining MD

Mackenzie Cervenka MD

Zahava Turner RD

Jennifer Dorward RD

Bobbie Henry RD

Paula Pyzik

Gerry Harris

Jaimie Franz

Anita Charpentier, PharmD

Paula Heneberry, LCSW

Cheryl Connors, RN

Rebecca Fisher, RN



[www.hopkinsmedicine.org/neurology](http://www.hopkinsmedicine.org/neurology)

[www.epilepsy.com/ketoneews](http://www.epilepsy.com/ketoneews)