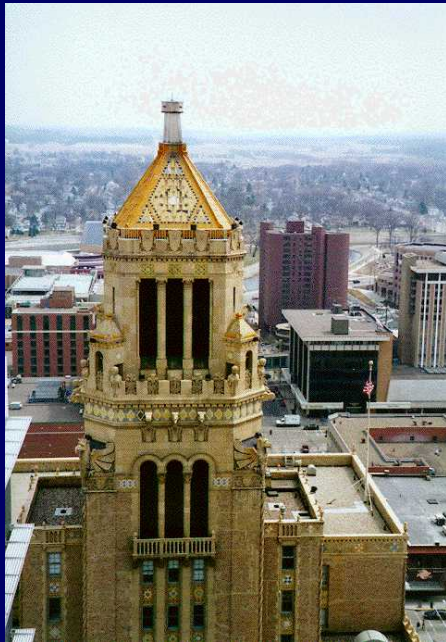


Dietary Treatments for Epilepsy

From Minnesota to Scotland...and beyond!

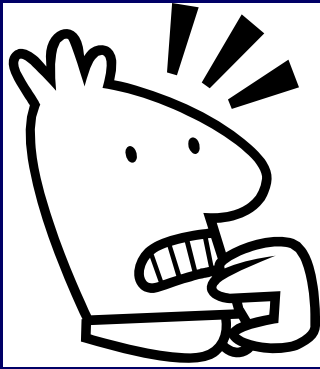


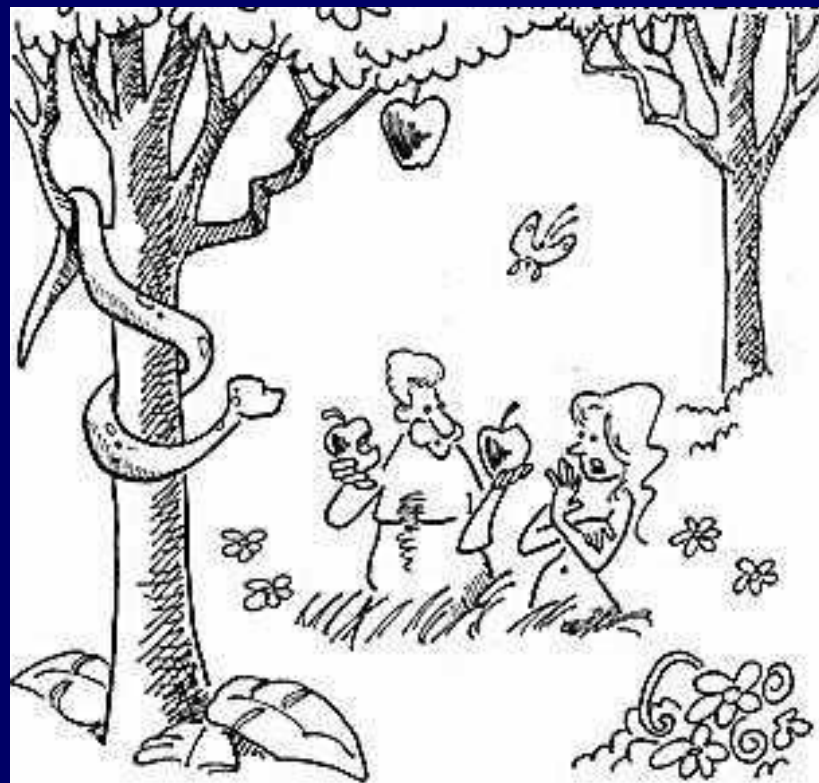
Eric H. Kossoff, MD

Associate Professor, Neurology & Pediatrics

Medical Director, Ketogenic Diet Program

Johns Hopkins Hospital





THOMAS

"No thanks, I'm on a low carb diet."

1921



FASTING AS EPILEPSY CURE.

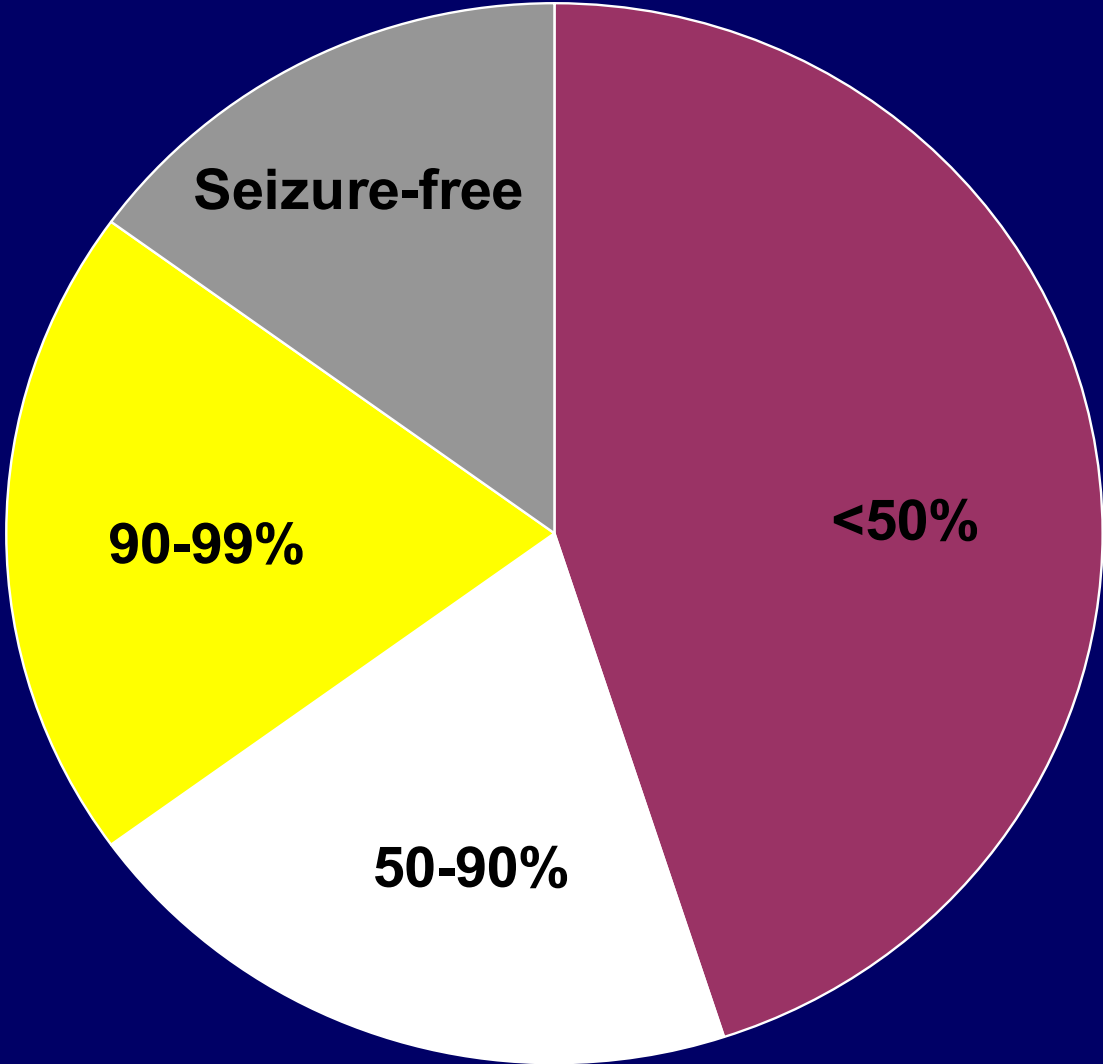
Osteopaths Hear That 22 Days on Water Usually End Fits.

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."

- Anecdotal reports by Dr. Hugh Conklin of benefits of fasting on seizure control 1910s
- Dr. Wilder at Mayo Clinic, Rochester, MN creates a high fat, low carbohydrate diet to mimic fasting state
- Highly popular in children and adults

6-month Seizure Reduction from the Ketogenic Diet



17 November 1993



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...](#)

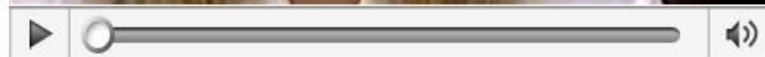


Table 1. Included Studies

Study	Study Type	Year	Subjects (Total)	Duration (mo)*	Males	Age (yr) Mean (Range)	Diet Type	Strength of Evidence†
Hopkins and Lynch ⁷	Prospective	1970	34	24	—	(1.0–12.0)	CD	IV
Sills et al ⁸	Prospective	1986	50	24	—	—	MCT	IV
Woody et al ⁹	Prospective	1988	15	24	—	2.4 (1.7–8.0)	MCT	IV
Vining et al ¹⁰	Prospective	1998	51	6	34	4.7 (1.3–8.6)	CD	III
Freeman et al ¹¹	Prospective	1998	150	48	85	(0.3–16.0)	CD	III
MacCracken and Scalisi ¹²	Prospective	1999	11	36	—	4.8 (1.0–12.6)	CD	IV
Kankirawatana et al ¹³	Prospective	2001	35	12	16	5.4 (0.2–12.0)	CD/MCT	III
Lightstone et al ¹⁴	Prospective	2001	46	6	26	5.3 (0.4–16.5)	CD	IV
Vining et al ¹⁵	Prospective	2002	237	12	130	3.7 (0.2–9.8)	CD	III
Coppola et al ¹⁶	Prospective	2002	56	18	36	10.4 (1.0–23.0)	CD	III
Trauner ¹⁷	Retrospective	1985	17	—	10	(1.0–13.0)	MCT	IV
Hassan et al ¹⁸	Retrospective	1999	52	—	27	5.5	CD/MCT	III
Couch et al ¹⁹	Retrospective	1999	26	—	11	4.4 (2.0–11.0)	CD	III
Maydell et al ²⁰	Retrospective	2001	143	12	87	7.5 (0.3–29.0)	CD	III
Nordli et al ²¹	Retrospective	2001	31	—	18	1.2	CD	III
Wirrell et al ²²	Retrospective	2002	14	—	—	7.3 (1.0–16.8)	CD	IV
DiMario and Holland ²³	Retrospective	2002	48	12	16	6.5 (1.0–15.0)	CD	III
Kossoff et al ²⁴	Retrospective	2002	23	—	17	1.1 (0.4–2.0)	CD	III
Mady et al ²⁵	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).⁵

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



INTERNATIONAL SYMPOSIUM

ON DIETARY THERAPIES FOR EPILEPSY
AND OTHER NEUROLOGICAL DISORDERS

April 2-5, 2008
The Ritz-Carlton Phoenix

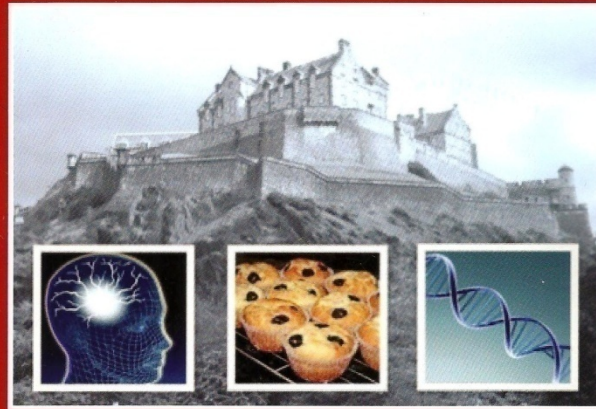


Sponsored by The Charlie Foundation, CURE and Nutricia N.A.
Hosted by the Barrow Neurological Institute at St. Joseph's Hospital & Medical Center

GLOBAL SYMPOSIUM ON THE DIETARY TREATMENTS FOR EPILEPSY AND OTHER NEUROLOGICAL DISORDERS

The Sheraton Hotel, Edinburgh, Scotland, UK

5th – 8th OCTOBER 2010



NUTRICIA
Advanced Medical Nutrition

WATSON'S KITCHEN
Dietary Treatments for Epilepsy
Information - Training - Research - Support

THE CHARLIE
FOUNDATION
FOR EPILEPSY RESEARCH

ERIC KOSSOFF

Dietary Treatments: 2011

1. Less restrictive diets to expand usage
2. Adults
3. Basic science collaborations
4. First-line use
5. Non-epilepsy indications

The "Classic" Ketogenic Diet

- 90% calories are fat
- Fluid and calorie-limited
- Foods weighed on gram scales
- Typically started in the hospital gradually over 4-5 days
 - Brief fasting period optional
- Children continued for approximately 2 years if effective





FOOD FOR THOUGHT: THE KETOGENIC DIET AND ADVERSE EFFECTS IN CHILDREN

- Constipation
- Diminished weight gain
- Acidosis

- Kidney stones
- Growth slowing
- Hyperlipidemia
- Bone density changes

THE EPILEPSY DIET TREATMENT



An Introduction to
The Ketogenic Diet

John M. Freeman, M.D.
Millicent T. Kelly, R.D., L.D.
Jennifer B. Freeman

1994

Eric H. Kossoff, MD
John M. Freeman, MD
Zahava Turner, RD
James E. Rubenstein, MD

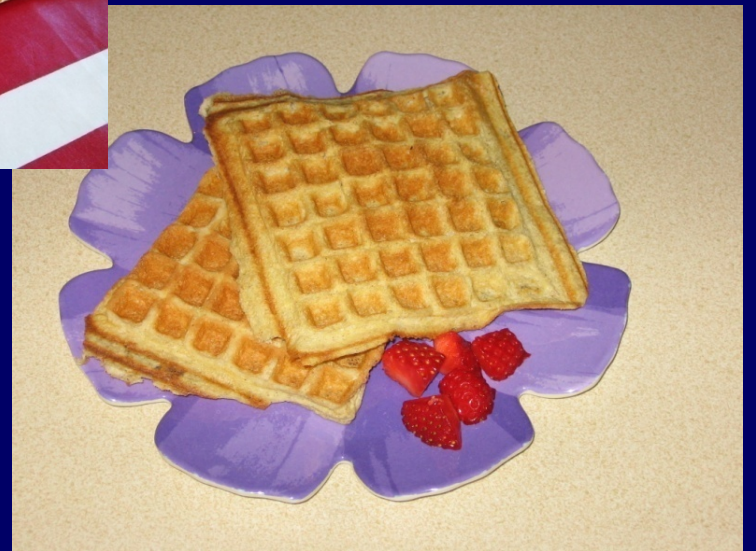
Ketogenic DIETS

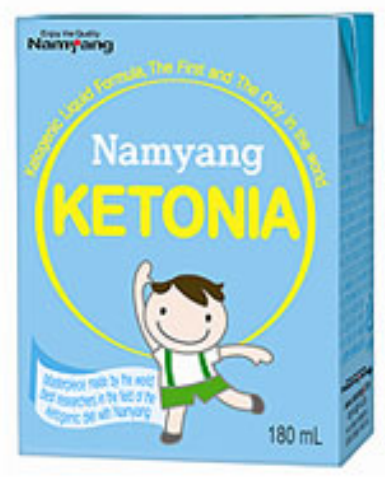


Treatments for
Epilepsy and
Other Disorders

FIFTH EDITION

2011







Kossoff et al., *Epilepsia* 2005 (updated 2011)



2011: A "Gentler" Ketogenic Diet

- Fasting not required
- Less reliance on ketones, labs
- Adjust calories, ratio, fluids for growth and satiety
- www.ketocalculator.com
- Let the parents help decide when to stop
- Start whichever diet you want (or is available)...

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. Antiepileptics 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.”

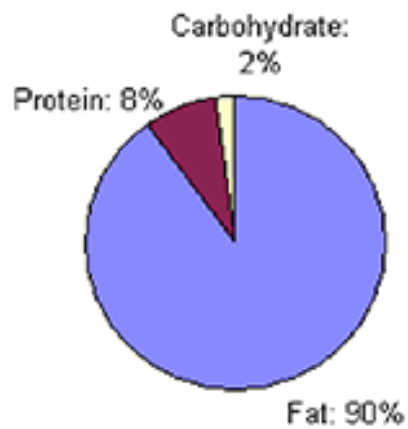
In Kossoff’s study, presented at a Hopkins neurology conference and a meeting of the American Epilepsy Society last December, 13 of 20 patients had a greater than 50 percent improvement in seizures, and seven had a greater than



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.”

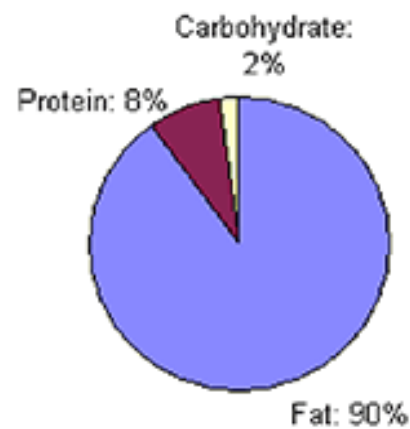
Schwanke couldn’t agree more: “The meds wore her out. Now she’s active, goes to school, plays with her friends. It’s like we turned a page and got our child back.” For more information, call 410-614-6054. [A](#)



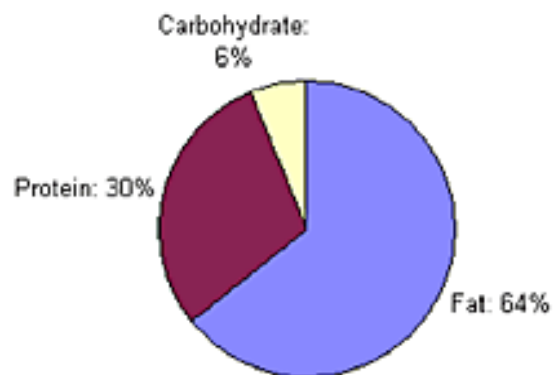
Ketogenic diet



Standard, "normal" diet



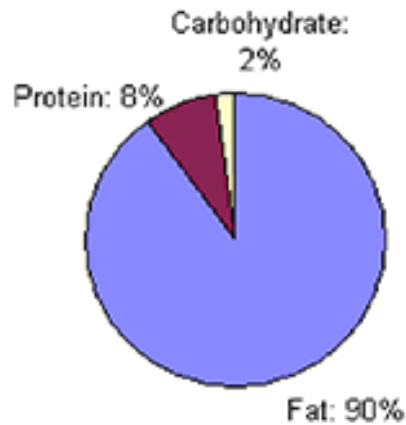
Ketogenic diet



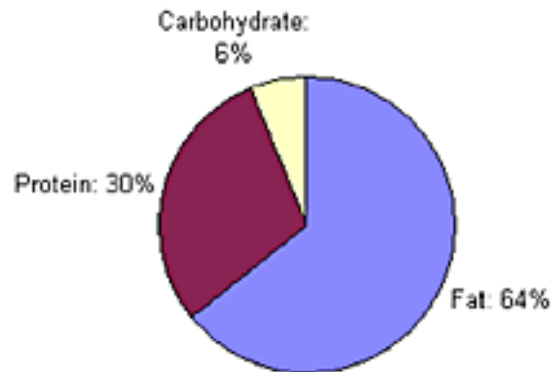
Modified Atkins diet



Standard, "normal" diet



Ketogenic diet



Modified Atkins diet



Standard, "normal" diet

- No calorie restriction
- No fluid restriction
- No hospital admission
- No weighing of foods on gram scales
- No fasting required

“MAD”: Other Potential Advantages

- Less time needed for parent education
- Can be started urgently in the clinic
- Parents can do it along with their child
- Products available in stores

Modified Atkins Diet: April 2011

- 100 (47%) of 214 children published with >50% seizure reduction to date
 - 26 (12%) became seizure-free

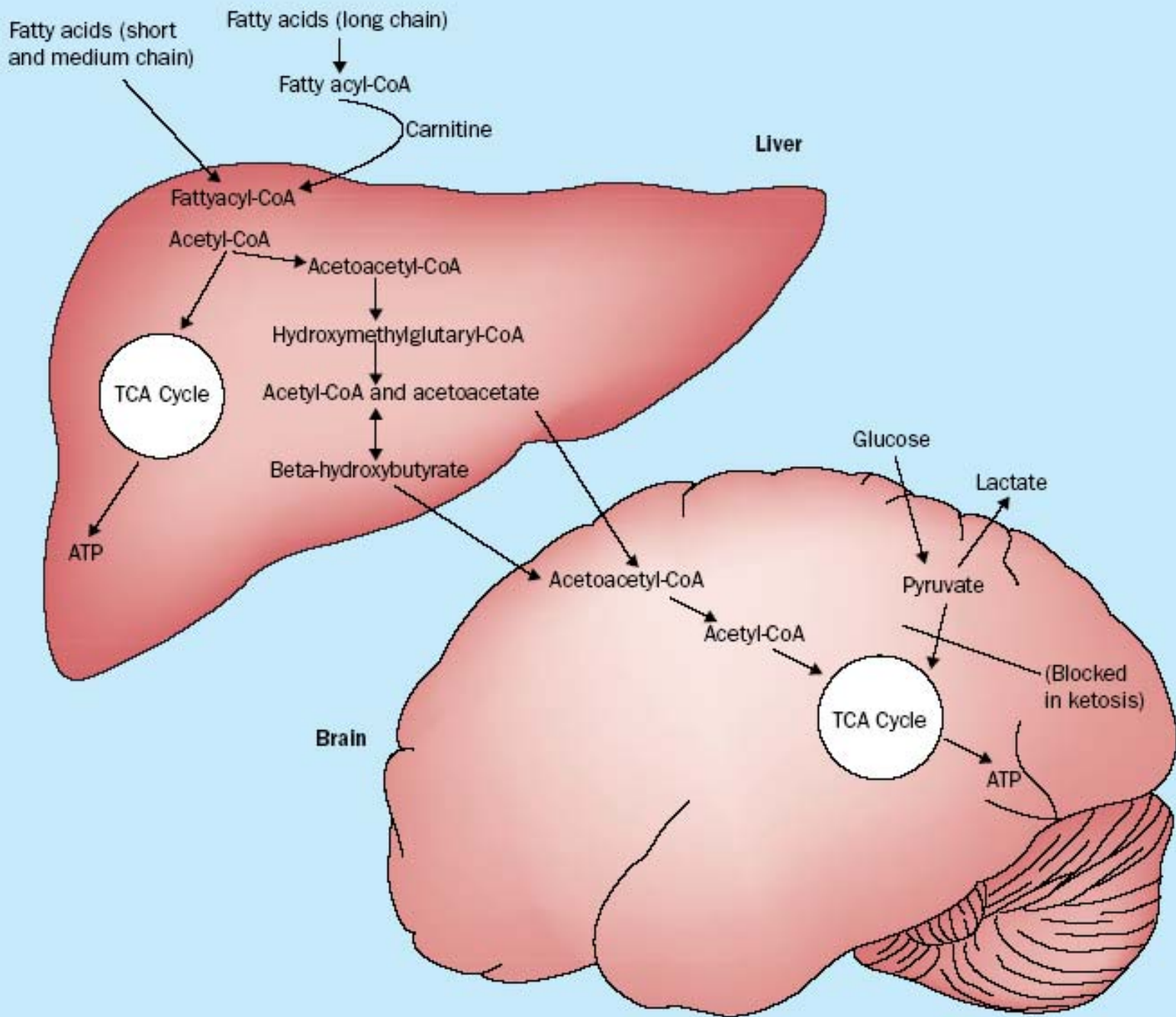
Kossoff Neurology 2003; Kossoff Epilepsia 2006; Kang Epilepsia 2007; Kossoff Epilepsy Behav 2007; Ito Brain Dev 2007; Weber Seizure 2008; Porta Seizure 2009; Kossoff J Child Neurol 2010; Tonekaboni Arch Iran Med 2010; Miranda Seizure 2010, Kumada Brain Dev 2011

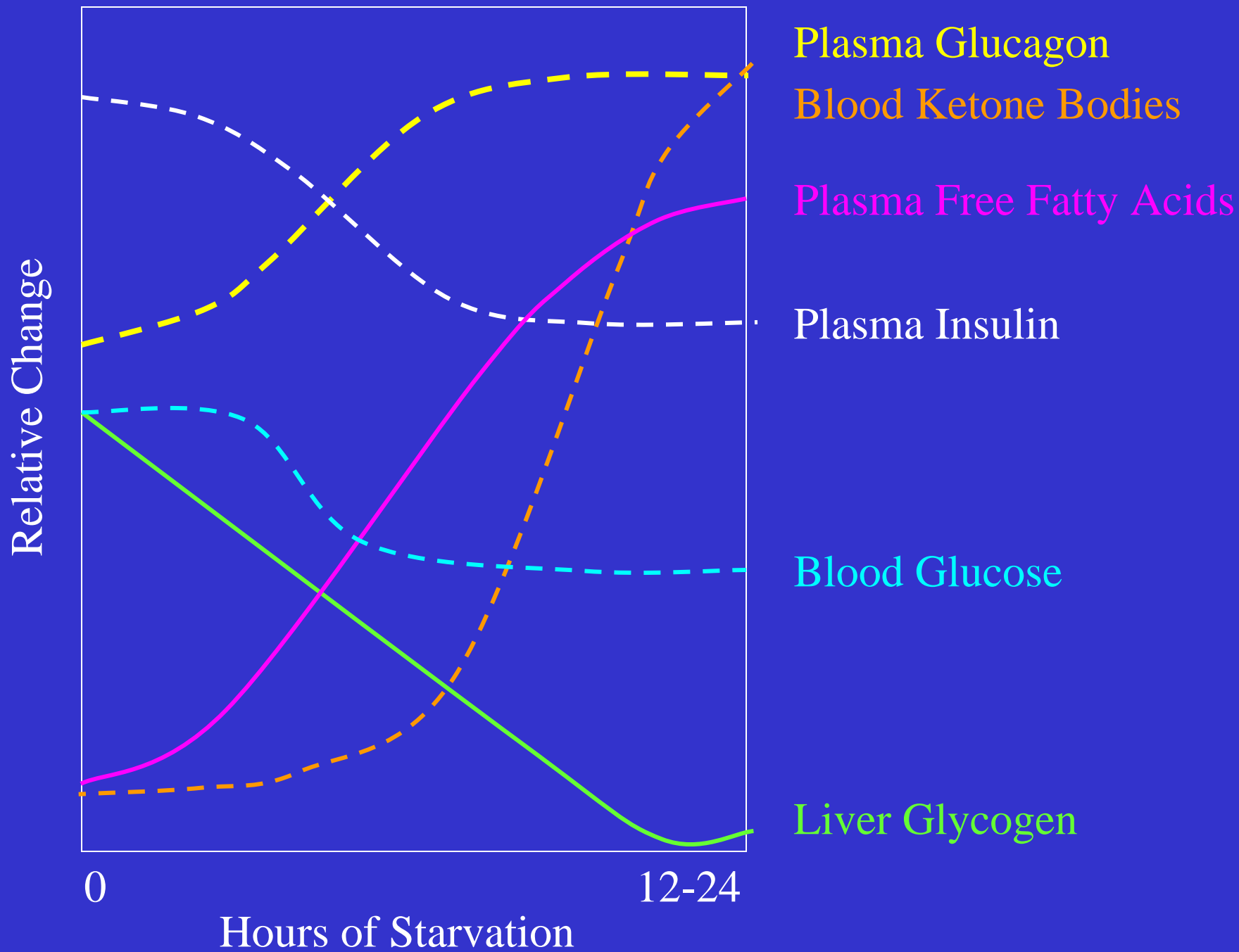
E.B.

- Started on the modified Atkins diet 3 years ago by Dr. Marco Medina
 - No dietitian or prior experience with diets
 - Information translated into Spanish
- Outcome:
 - 95% reduction in seizures and 2 medications stopped
 - Mother teaching other parents in Honduras

Dietary Treatments: 2011

1. Less restrictive diets to expand usage
2. Basic science collaborations
3. First-line use
4. Adults
5. Non-epilepsy indications





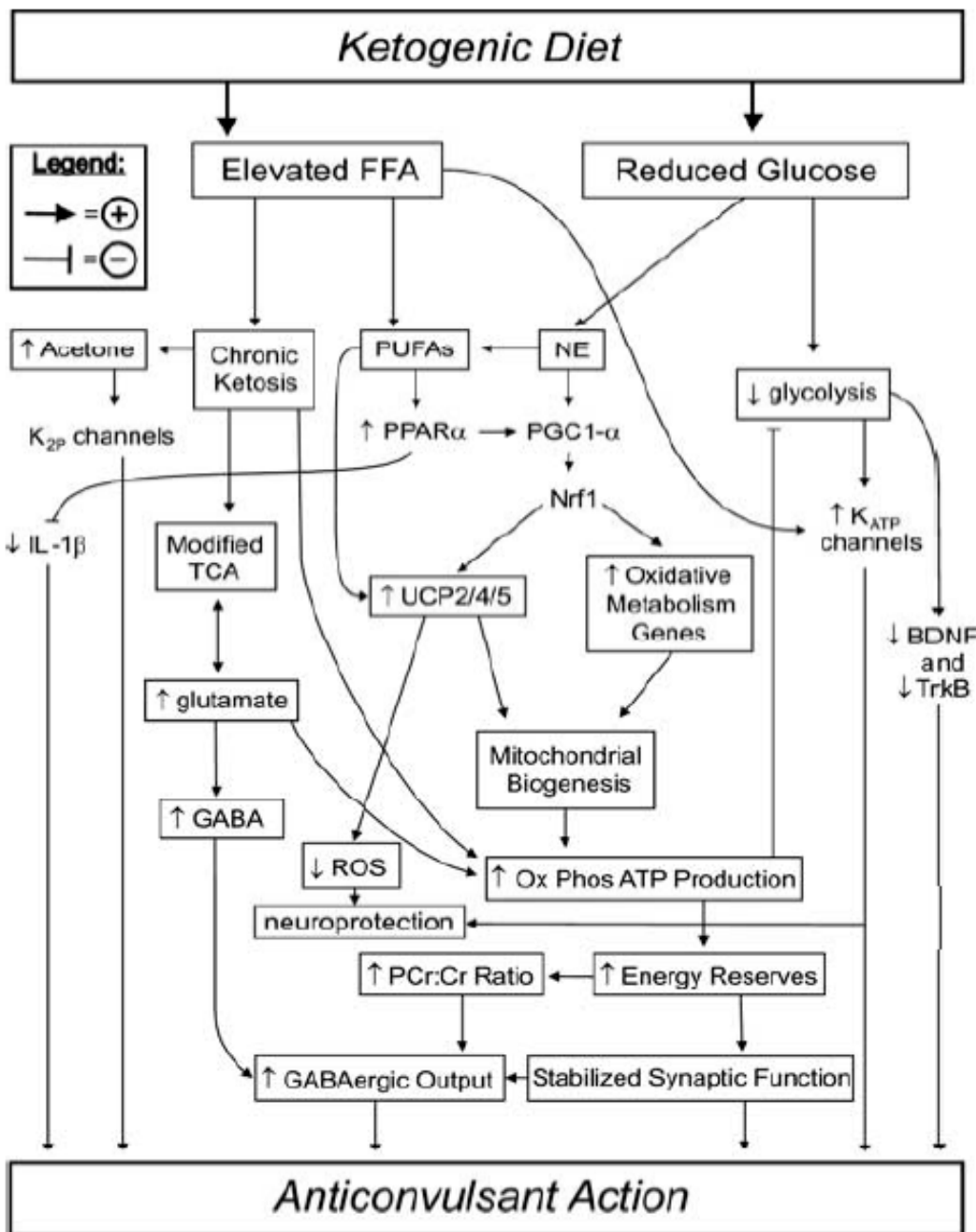
Ketogenic Diet

Elevated FFA

Chronic
Ketosis

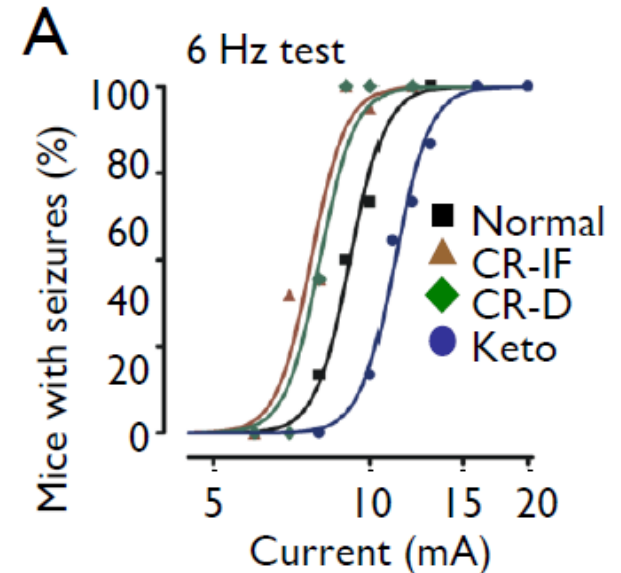


Anticonvulsant Action



Seizure test results

Diet	6 Hz	Kainic acid	MES-type	PTZ
Keto	↓	↔	↑↓†	↔‡
CR-IF	↑	↓	↑	↔
2-DG †† (acute)	↓	↑	↑	↑



Dietary Treatments: 2011

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SPECIAL REPORT

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

Table 1. Epilepsy syndromes and conditions in which the KD has been reported as particularly beneficial

Probable benefit (at least two publications)

Glucose transporter protein 1 (GLUT-1) deficiency

Pyruvate dehydrogenase deficiency (PDHD)

Myoclonic-astatic epilepsy (Doose syndrome)

Tuberous sclerosis complex

Rett syndrome

Severe myoclonic epilepsy of infancy (Dravet syndrome)

→ Infantile spasms

Children receiving only formula (infants or enterally fed patients)

Suggestion of benefit (one case report or series)

Selected mitochondrial disorders

Glycogenosis type V

Landau-Kleffner syndrome

Lafora body disease

Subacute sclerosing panencephalitis (SSPE)

KD and Infantile Spasms

- Nordli *Pediatrics* 2002
 - 23 infants
 - 72% with >50% spasm reduction
- Eun *Brain Dev* 2006
 - 43 infants
 - 70% with >50% spasm reduction; 35% spasm-free
- Hong *Epilepsia* 2010
 - 104 infants
 - 64% with >50% spasm reduction; 37% with spasm-free periods

Predictive factors for success?

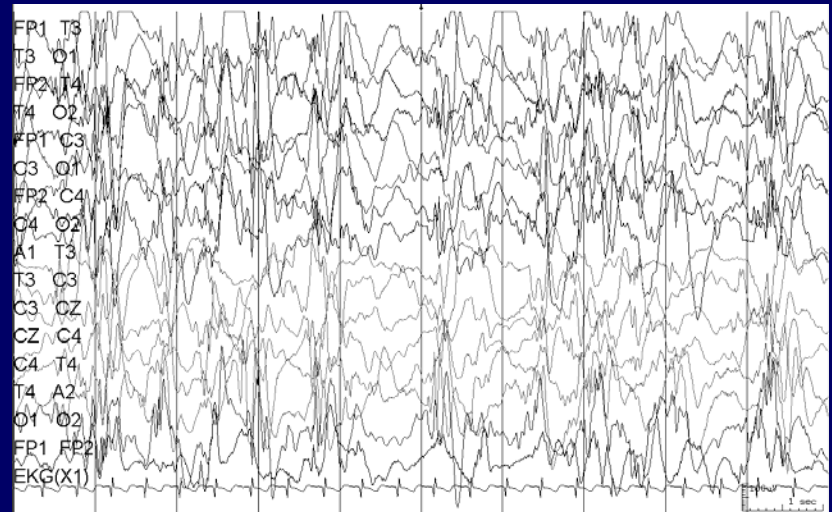
Table 3. Prognostic factors for likelihood of a >90% spasm reduction using an intent-to-treat analysis at 6 months

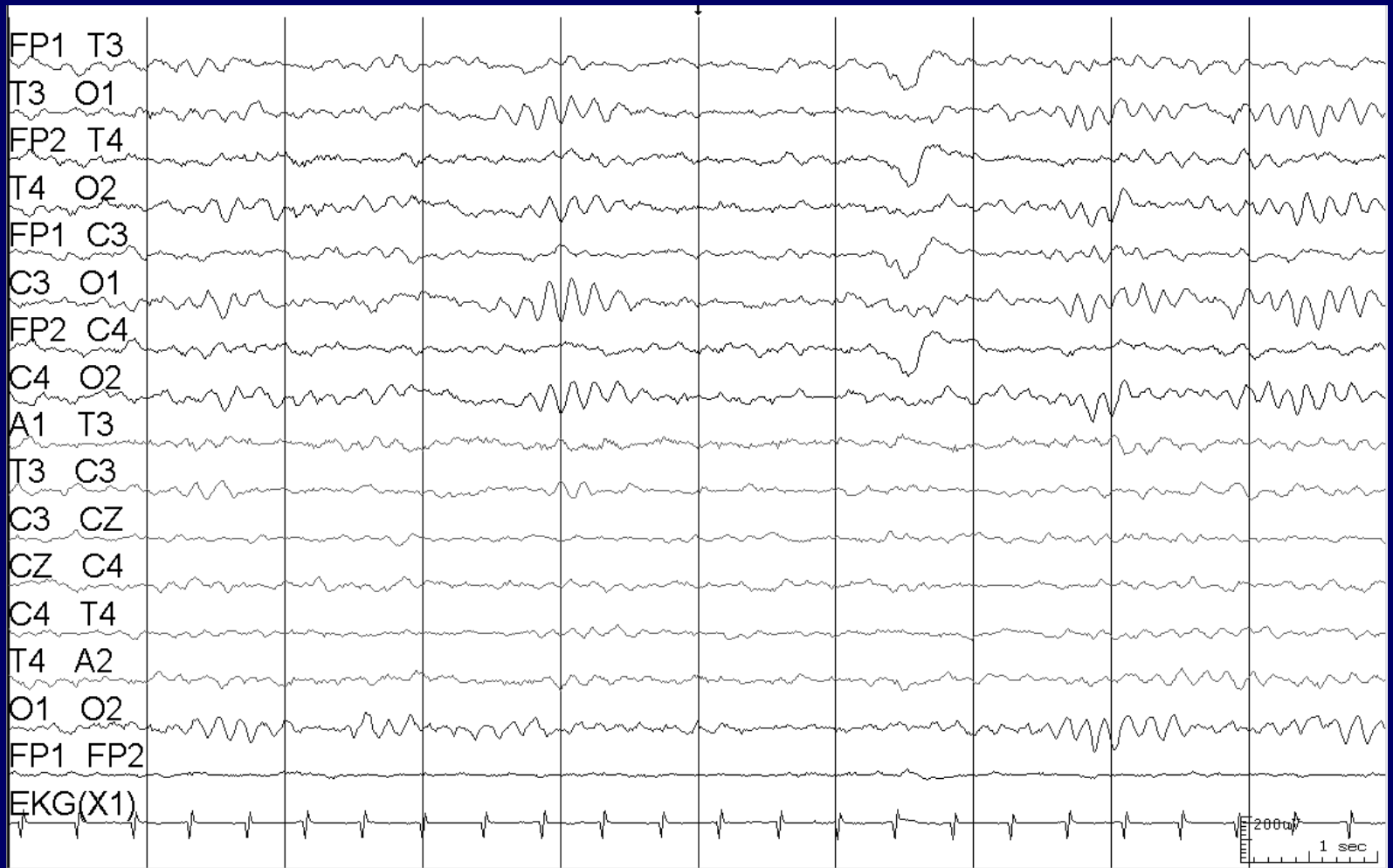
	<90% (n = 63)	>90% (n = 41)	p-Value
Male gender	37 (59%)	22 (54%)	0.61
Symptomatic etiology	46 (73%)	29 (71%)	0.81
Classic hypsarrhythmia at KD onset	52 (83%)	29 (71%)	0.16
Age at spasm onset (years)	0.4 (0.04)	0.5 (0.03)	0.03
Spasm frequency (per month)	1786 (392)	1693 (264)	0.84
Age at KD onset (years)	1.4 (0.1)	1.1 (0.1)	0.05
No. AEDs tried prior to diet	4.3 (0.3)	2.6 (0.3)	<0.01
Prior steroid use (%)	48 (76%)	20 (49%)	<0.01
No. AEDs at KD onset	1.6 (0.2)	1.1 (0.1)	0.01
4:1 Ketogenic ratio	20 (32%)	17 (41%)	0.31
Daily kilocalories	745 (23)	726 (22)	0.56
Started on KD after 9/1 2/2000	45 (71%)	32 (78%)	0.45

^aSince the previous preliminary study results (Kossoff et al., 2002).
AED, antiepileptic drug.

C.H.

- 5 month old previously healthy girl with the acute onset of infantile spasms
- Seen in ER after 3 days
 - ACTH and vigabatrin offered
- Family given another choice...





2 months later

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"Carson FEELING GOOD once again"

Our Mission

To raise funds and provide support for the John M. Freeman Pediatric Epilepsy Center at Johns Hopkins Hospital. This center provides care for children of all ages with difficult-to-control epilepsy and offers unique and exceptional treatments including surgery, diets, brain stimulation, and medications in order to help and even cure childhood-onset seizures. The Carson Harris Fund is directly involved in supporting their clinical and research efforts to achieve these goals.

The Ketogenic Diet Before Medications A Parents' Perspective



Gerry & Mike Harris
Baltimore, Maryland USA

New-onset Infantile Spasms

- Parents highly interested in the option
- Successful in 10 of 20 (50%) cases since 1996
- Ketogenic diet now routinely offered as a first line therapy for IS at Johns Hopkins

Dietary Treatments: 2011

1. Less restrictive diets to expand usage
2. Basic science collaborations
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EPILEPSY IN ADULTS
RESULTS OF TREATMENT BY KETOGENIC DIET IN
ONE HUNDRED CASES *

CLIFFORD J. BARBORKA, M.D.
ROCHESTER, MINN.

- 100 adults
 - Ages 16-51 years
- 56% “deriving benefit”
- “Worthy of future study”

70 years of disuse

- Diets seen as too restrictive for normal adults
 - Occasionally misquoted as “ineffective”
- Largest study since (26 patients) from Philadelphia shows benefit in 54%

Modified Atkins Diet?



- Hopkins 2008: 47% with >50% seizure reduction at 3 months
- Weight loss can be a bonus
- Compliance is poor long-term unless adult is seizure-free

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Epilepsy Center

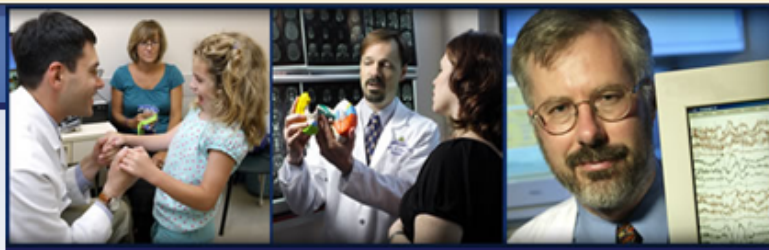
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- Who We Are
- Pediatric Care for Epilepsy
- Adult Care for Epilepsy
- Adult Epilepsy Diet Center

About the Epilepsy Diet

- What to Expect
- Epilepsy Specialists
- Ketogenic Diet Center
- First Seizure Clinic
- Epilepsy Monitoring Unit
- Diagnostic Expertise
- Comprehensive Personalized Care
- Surgical Expertise

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The Johns Hopkins Adult Epilepsy Diet Center

Dietary therapy has been used to treat children with epilepsy for almost a century. However, this valuable treatment option has not been generally available to most adults with seizures. The [modified Atkins diet](#) is a low carbohydrate, high fat alternative to the ketogenic diet for adults, created at Johns Hopkins in 2002.

Recent studies have shown that the [modified Atkins diet](#) lowers seizure rates in nearly half of adults that try it, usually within a few months. Unlike the [ketogenic diet](#) (used mostly in children), there is no hospital stay involved, no fasting to get started, no food weighing, and no counting of calories or fluids. The diet is "modified" from the traditional Atkins diet because fats are encouraged. Adults can also lose weight on the diet if desired.



Starting in August 2010, we are excited to offer the first ever clinic specially designed for adults with epilepsy using dietary treatments at the Johns Hopkins Hospital in Baltimore, Maryland. As Johns Hopkins Hospital is one of the world leaders in dietary therapies, this is a significant advance in using diet therapy for adults. We have [highly skilled dietitians and neurologists](#) that can help customize the diet to fit your needs. Although we do not start adults on the traditional ketogenic diet, we will see adults who are already receiving the ketogenic diet but need an adult dietitian and neurologist to manage their care.

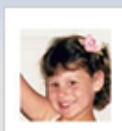
Our clinic is recommended to people:

[Request an Appointment](#)
[Refer a Patient](#)
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[Make A Gift](#)

[Learn about the history of the Johns Hopkins John M. Freeman Pediatric Epilepsy Center.](#)

A Ketogenic Success

Allie was a 3 year old girl seen by us for consultation in 2002 regarding her intractable seizures. She was having hundreds of grand mal and head drop seizures daily and had failed five different anticonvulsants, pushed to toxic doses. She was placed on the ketogenic diet and within one week became seizure-free. Medications were quickly weaned and in May 2004, after two years, Allie was taken off the ketogenic diet and remains seizure-free and doing wonderful in school to date.



About Johns Hopkins

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Out of State and International Patients

[Find Out More](#)





MATTHEW'S FRIENDSCLINICS

KETOGENIC DIETARY THERAPIES

MATTHEW'S FRIENDS CLINICS
for KETOGENIC DIETARY THERAPIES
TREATING ADULTS AND CHILDREN

BASED AT THE AWARD WINNING NEVILLE CHILDHOOD EPILEPSY CENTRE, NCYPE, LINGFIELD, SURREY.

REFERRALS NOW BEING TAKEN



Dietary Treatments: 2011

1. Less restrictive diets to expand usage
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Can a High-Fat Diet Beat Cancer?

By RICHARD FRIEBE

Monday, Sep. 17, 2007



MARTIN JEPP / 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.

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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.

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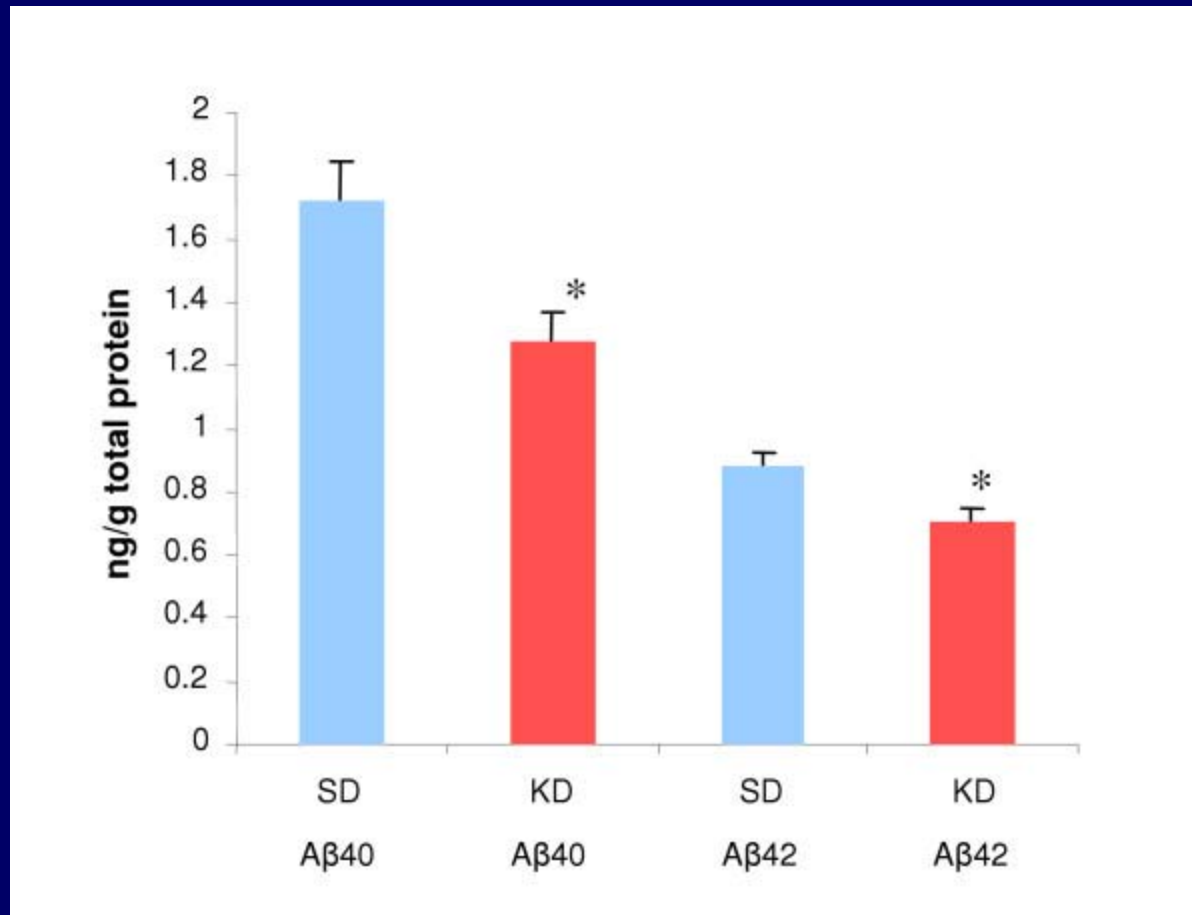
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Autism	2003
Brain tumors	2003
Depression	2004
Narcolepsy	2004
Glycogenosis Type V	2005
Alzheimer's	2005
Traumatic brain injury	2005
Parkinson's	2005
ALS	2006
Migraine	2006
Sleep disorders	2007
Post hypoxic myoclonus	2007
Post anoxic brain injury	2008
Schizophrenia	2009
Spinal cord injury	2009
Pain	2009
Sandhoff disease	2010

Ketogenic diet reduces A β 40 and A β 42



'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.

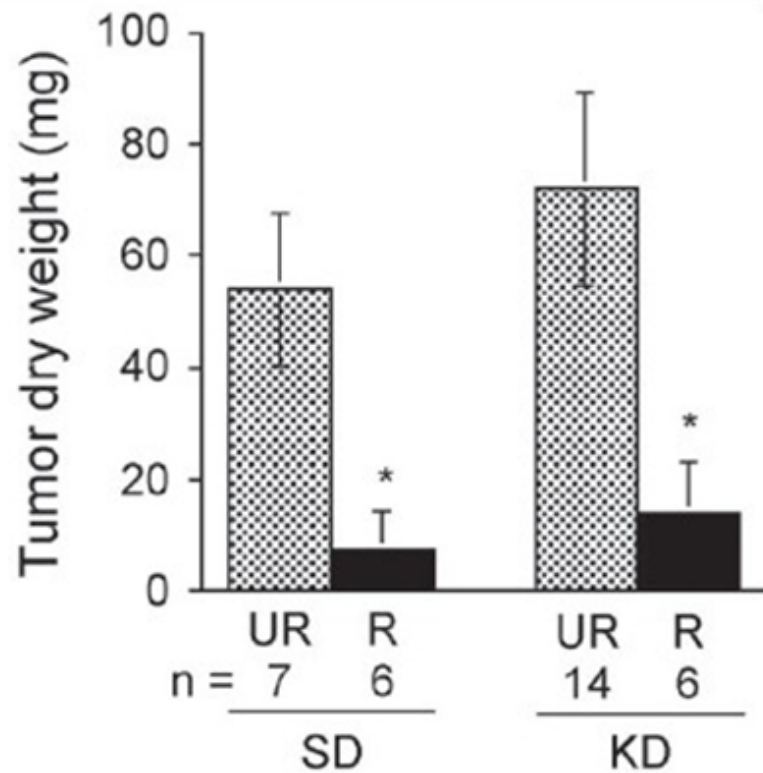
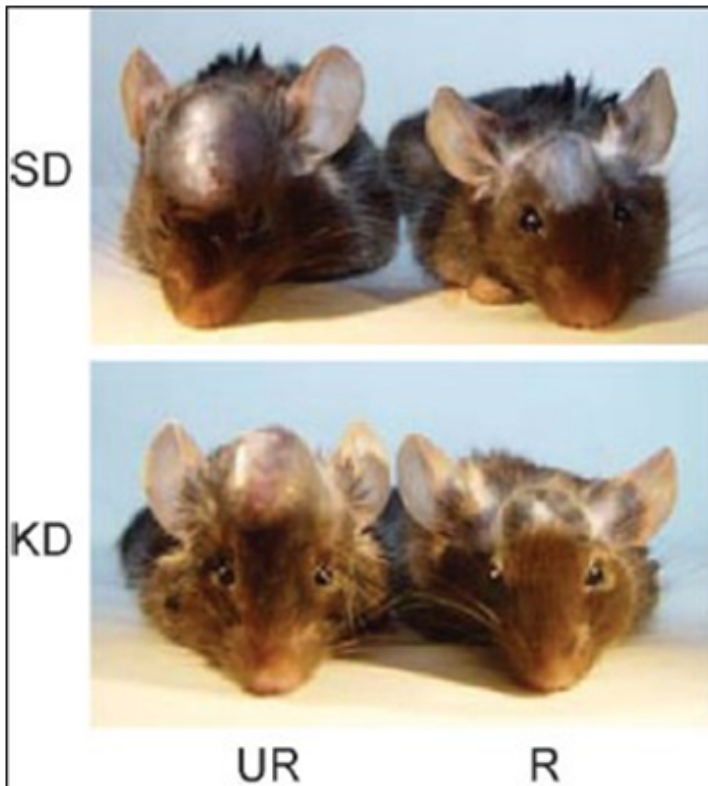
"We see this as a co-therapy," not a way to stop Alzheimer's, cautioned Dr. Lauren Constantini, a former Harvard scientist now with the company Accera Inc.

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Axona™

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







The RECHARGE TRIAL

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Fighting Cancer with Fats

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Barrow researcher explores innovative cancer treatment

For Barrow Researcher Adrienne C. Scheck, PhD, diets are far more than a health fad: Dr. Scheck is researching the potential of a therapy known as the ketogenic diet to complement traditional treatments for brain cancer such as radiation and chemotherapy.

Since the 1920s, the ketogenic diet has been used to control epilepsy, but its popularity has waxed and waned. It is now used almost exclusively in children whose seizures do not respond to conventional drug therapies. The highly regimented diet calls for nearly 80 percent of a patient's calorie intake to come from fat and less than 1 percent from carbohydrates, with the remainder coming from protein.

Researchers were spurred to investigate the ketogenic diet as a cancer therapy because cancer cells rely primarily on glucose to fuel their metabolism. The diet causes the body to enter a state called ketosis, where fat-derived chemicals called ketones are burned in response to the absence of carbohydrates. It has been theorized that because tumor cells cannot use ketones for energy, this metabolic change would starve tumor tissue, stunting its growth and improving survival rates for cancer patients.

While not ruling out the metabolic explanation, Dr. Scheck's research has uncovered other ways that the diet acts on tumors.

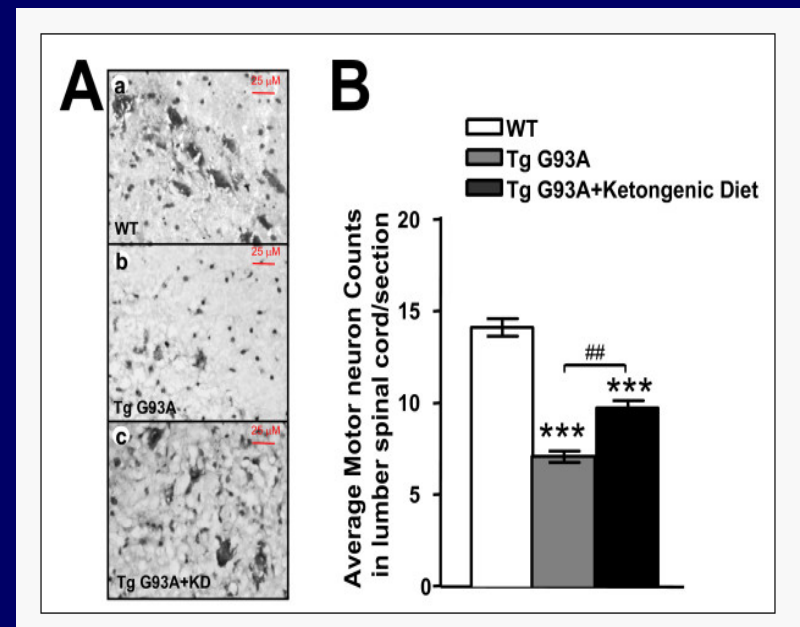
Dr. Scheck and her team in the Barrow Neuro-Oncology Research Laboratory observed that live tumor models subjected to the ketogenic diet had fewer reactive oxygen species present in and around the cancerous tissue.



"Reactive oxygen species are created during normal cellular metabolism and are important in the control of many aspects of cell growth—too many or too few are bad for the cell," says Dr. Scheck. "The metabolism of tumors is higher than that of normal tissue—a feature that may allow them to adapt to increases in reactive

ALS (Lou Gehrig's Disease)

- Transgenic mouse model of ALS used at Mt. Sinai (Zhou and Lange)
- 25 days longer until 50% loss of motor function
- More motor neurons in KD fed mice ($p=0.03$)



Safety and Tolerability of the KD for ALS

- PI: Vinay Chaudhry, Dale Lange (Cornell)
- Adults with ALS
 - Gastrostomy-tube fed
- Admitted and transitioned over to ketogenic formula
- 28 week study

Headaches

- Many preventative therapies for migraines are anticonvulsants
- Foods can trigger migraines
- Obesity is also linked to migraines



- Pilot series of 10 adolescents with chronic daily headache
 - Modified Atkins diet (15 g/day)
 - Johns Hopkins Hospital & University of Maryland



Atkins and Headaches: Results

- Only 8 patients from 2006-2009 recruited
- 3 with modest improvement in headache severity, none in frequency
- Most dropped out within 2-4 weeks



Summary

- Now is perhaps the most exciting time to date in the use of dietary therapies
- Expanding uses for children with epilepsy worldwide
 - Making the diet easier to administer
 - Not waiting until it's a last resort
- New directions: adults and non-epilepsy indications

3rd International Dietary Treatment Symposium: 2012



Johns Hopkins Ketogenic Diet Center

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