



Ketogenic Diet

Nikolas Hedberg, D.C., D.A.B.C.I., D.A.C.B.N.

© 2017 Hedberg Institute

What is Ketosis?

- Glycogen stores are depleted from the liver and skeletal muscle.
- The body produces ketones from fatty acids.
- The body is able to burn ketones for energy rather than glucose.
- This bypasses insulin resistance because the body is no longer producing energy from glucose.
- Normal adaptation when food was scarce or when there was a famine.

© 2017 Hedberg Institute

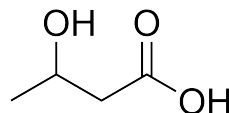
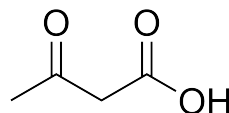
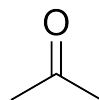
History

- Hippocrates used fasting to treat epileptics.
- Mentioned in the Bible to treat epilepsy.
- Dr. Wilder in 1921 introduced it for epileptics.
- Continues to gain popularity because it mimics fasting but patients can still eat healthy foods.

© 2017 Hedberg Institute

Ketone bodies

- acetone
- acetoacetic acid
- beta-hydroxybutyric acid



© 2017 Hedberg Institute

When to use it?

- Type 2 diabetes
- Polycystic ovarian syndrome (PCOS)
- Acne (often caused by growth hormone in milk, excess androgens and too much sugar in the diet)
- Insomnia
- Fatigue
- Difficulty losing weight
- Headaches
- Insulin resistance
- Metabolic syndrome
- Alzheimer's
- Parkinson's
- Restore mitochondrial function
- GERD
- Neuropathy
- Lowers cholesterol and triglycerides
- Increases HDL
- Increases the size of LDL particles making them less prone to stick to blood vessels
- Heart disease prevention
- Obesity
- Cancer
- Improves fasting glucose and hemoglobin A1c levels
- Autism
- Multiple sclerosis
- Brain trauma
- ALS (Lou Gehrig's disease)
- Anti-aging

© 2017 Hedberg Institute

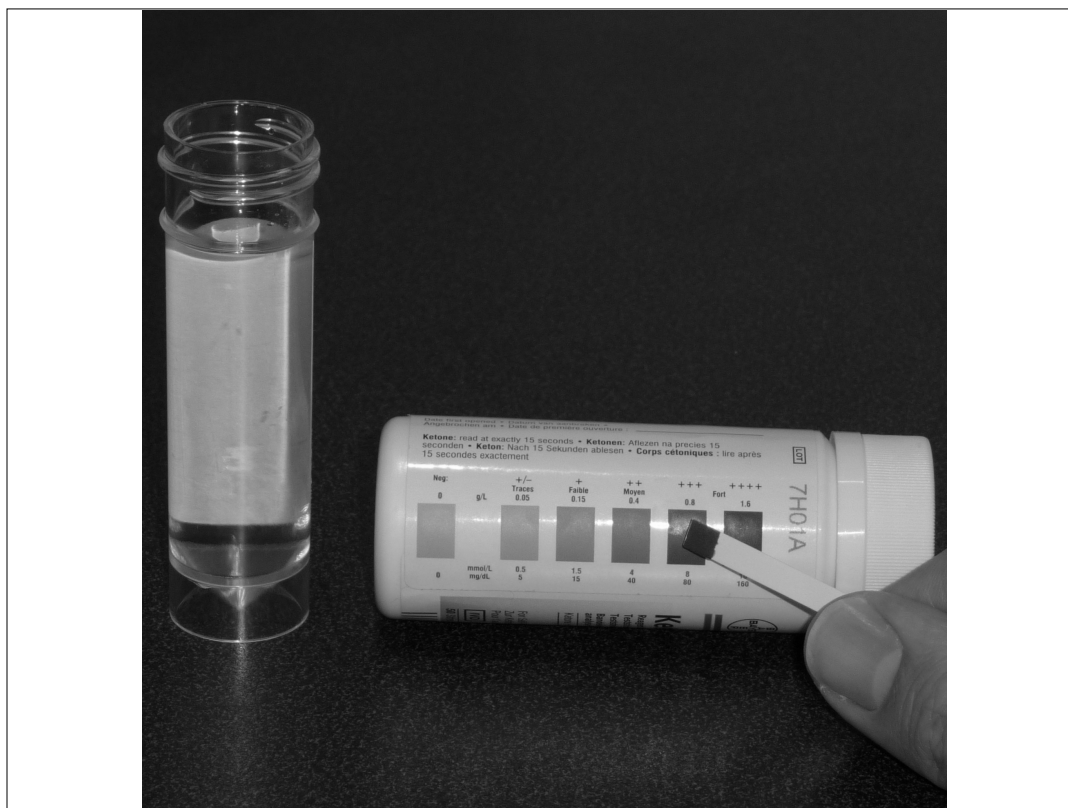
How to attain a ketogenic state

- Carbohydrate intake is less than 50 grams/day
- After ~3 days the body shifts into ketosis
- Eliminate all carbohydrate-containing foods including grains, legumes, nuts, starchy vegetables, potatoes, sugar, dairy that has carbohydrates.
- Only eat meat, fish, eggs, hard cheese, all oils, butter, ghee, salad vegetables, non-starchy vegetables, red wine, coffee, tea, heavy whipping cream.
- Patient can use urinary ketone strips to measure ketones.
- Blood monitors are also available but urine strips are usually adequate.

© 2017 Hedberg Institute



© 2017 Hedberg Institute





© 2017 Hedberg Institute

Urine value	Designation	Approximate serum concentration	
		mg/dL	mmol/l
0	Negative	Reference range: 0.5–3.0 ^[22]	0.05–0.29 ^[22]
1+		5 (interquartile range (IQR): 1–9) ^[23]	0.5 (IQR: 0.1–0.9) ^[24]
2+	Ketonuria ^[25]	7 (IQR: 2–19) ^[23]	0.7 (IQR: 0.2–1.8) ^[24]
3+		30 (IQR: 14–54) ^[23]	3 (IQR: 1.4–5.2) ^[24]
4+	Severe ketonuria ^[26]	–	–

blood concentration (millimolar)	Condition
< 0.2	not in ketosis
0.2 - 0.5	slight/mild ketosis
0.5 - 3.0	induced/nutritional ketosis
2.5 - 3.5	post-exercise ketosis
3.0 - 6.0	starvation ketosis
15 - 25	ketoacidosis

© 2017 Hedberg Institute

Why does it work?

- Decreased appetite. Patients won't really feel all that hungry in ketosis.
- Increased fat-burning and decreased fat storage.
- Greater efficiency in burning fat.
- Increased thermic effect from protein consumption.
- Preserves lean body mass.
- Inherently anti-inflammatory.
- An insulin resistant brain may function much better burning ketones.

© 2017 Hedberg Institute

Supplements for Ketosis

- Multivitamin
- Magnesium glycinate
- Potassium bicarbonate
- Carnitine supplementation may be helpful
- Fish oil
- MCT oil: Medium chain triglycerides are more ketogenic than long-chain-triglycerides (coconut oil)
- Fiber supplement if the patient becomes constipated. (1-2 tablespoons of ground flax seed)
- 5-HTP can help with suppressed mood initially at about 50-200mg/day on empty stomach.
- If using protein powders, be sure the carbohydrate intake is low enough.

© 2017 Hedberg Institute

Ideal Fatty Acid Ratios

- 1/3 saturated fat (6-10% of fat calories)
- 1/3 monounsaturated fat mainly from olive oil, avocado, macadamia nut
- 1/3 omega-3 fatty acids from fish, vegetables, grass-fed beef, fish oil supplements, krill etc.

© 2017 Hedberg Institute

Spanish Ketogenic Mediterranean Diet

- Emphasizes fish, olive oil, red wine and salad vegetables.
- Lower in saturated fat than most ketogenic diets
- Too much saturated fat contributes to insulin resistance so this version works better for some individuals.

© 2017 Hedberg Institute

Long-Term Biphaseic Ketogenic/Mediterranean Diet

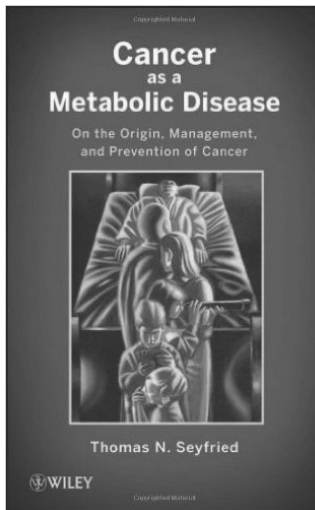
- 20 days on ketogenic diet.
- 20 days on low carb, non-ketogenic diet
- 4 months on Mediterranean diet.
- A second 20 day ketogenic diet.
- Finally a 6 month Mediterranean diet.
- Significant weight loss was achieved at the end.
- Additional benefits were found in lipids and fasting glucose

© 2017 Hedberg Institute

Hemoglobin A1c Deception

- A1c levels may not change over the first few months on a ketogenic diet because red blood cells live longer in ketosis.
- Use fasting glucose, lipids, body composition and fructosamine as better markers of progress with insulin resistance.

© 2017 Hedberg Institute



© 2017 Hedberg Institute

Contraindications

- β -oxidation defects
- primary and secondary carnitine deficiency
- carnitine cycle defects
- electron transport chain defects
- ketogenic defects
- ketolytic defects
- pyruvate carboxylate deficiency
- pyruvate dehydrogenase phosphatase deficiency
- Type 1 diabetes (results in diabetic ketoacidosis which may lead to coma and death)
- Kidney disease

© 2017 Hedberg Institute

Side Effects

- nausea
- vomiting
- constipation
- loss of appetite
- poor growth in children
- kidney stones
- abnormal heart rhythms
- It may impair white blood cell and platelet function
- Hypothyroidism

© 2017 Hedberg Institute

J Pediatr Endocrinol Metab. 2017 Apr 1;30(4):411-416. doi: 10.1515/jpem-2016-0281.

Changes of thyroid hormonal status in patients receiving ketogenic diet due to intractable epilepsy.

Kose E1, Guzel O2, Demir K3, Arslan N4.

BACKGROUND:

Ketogenic diet (KD), which is high in fat and low in carbohydrates, mimics the metabolic state of starvation and is used therapeutically for pharmaco-resistant epilepsy. It is known that generation of triiodothyronine (T3) from thyroxine (T4) decreases during fasting periods. The aim of this study was to evaluate the thyroid function of children receiving KD for at least 1 year due to drug-resistant epilepsy.

METHODS:

A total of 120 patients [63 males, 52.5%; mean age 7.3±4.3 years, median interquartile range (IQR): 7.0 (4-10 years)] treated with KD for at least 1 year were enrolled. Seizure control, side effects, and compliance with the diet were recorded, and free T3, free T4, and thyroid-stimulating hormone (TSH) levels were measured at baseline and at post-treatment months 1, 3, 6, and 12.

The Mann-Whitney U-test, repeated measures analysis of variance (ANOVA) with post-hoc Bonferroni correction, and logistic regression analysis were used for data analysis.

RESULTS:

Hypothyroidism was diagnosed and L-thyroxine medication was initiated for eight, seven and five patients (20 patients in total, 16.7%) at 1, 3, and 6 months of KD therapy, respectively. Logistic regression analysis showed that baseline TSH elevation [odds ratio (OR): 26.91, 95% confidence interval (CI) 6.48-111.76, p<0.001] and female gender (OR: 3.69, 95% CI 1.05-12.97, p=0.042) were independent risk factors for development of hypothyroidism during KD treatment in epileptic children.

CONCLUSIONS:

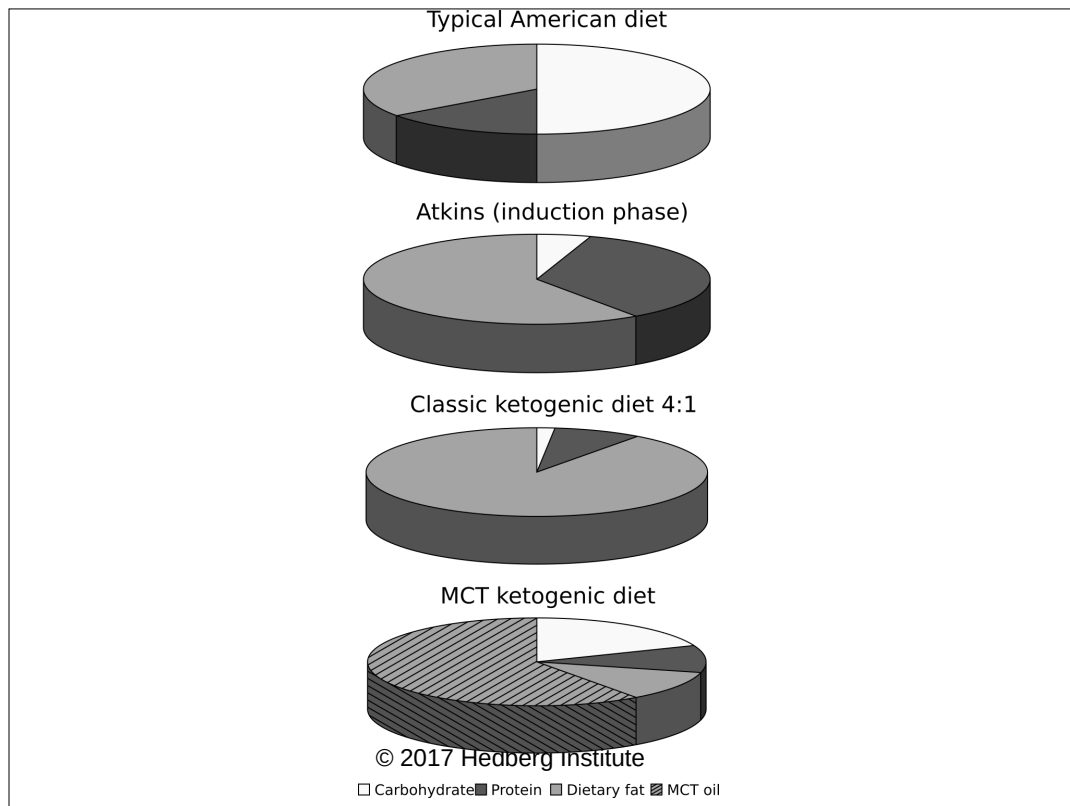
KD causes thyroid malfunction and L-thyroxine treatment may be required. This is the first report documenting the effect of KD treatment on thyroid function. Thyroid function should be monitored regularly in epileptic patients treated with KD.

© 2017 Hedberg Institute

Micronutrient Deficiencies

- Vitamin C
- B-vitamins
- Calcium
- Magnesium
- Vitamin D
- Iron

© 2017 Hedberg Institute



“Classic Ketogenic Diet”

- Breakfast: egg with bacon
- 28 g egg, 11 g bacon, 37 g of 36% heavy whipping cream, 23 g butter and 9 g apple.
- Snack: peanut butter ball
- 6 g peanut butter and 9 g butter.
- Lunch: tuna salad
- 28 g tuna fish, 30 g mayonnaise, 10 g celery, 36 g of 36% heavy whipping cream and 15 g lettuce.
- Snack: keto yogurt
- 18 g of 36% heavy whipping cream, 17 g sour cream, 4 g strawberries and artificial sweetener.
- Dinner: cheeseburger (no bun)
- 22 g minced (ground) beef, 10 g American cheese, 26 g butter, 38 g cream, 10 g lettuce and 11 g green beans.
- Snack: keto custard
- 25 g of 36% heavy whipping cream, 9 g egg and pure vanilla flavoring.

© 2017 Hedberg Institute

Basic Guidelines

- 4 ounces of meat cooked in fat-butter, beef tallow, lard, duck fat, cream, olive oil, macadamia nut oil, palm oil or coconut oil
- Salad vegetables with olive oil-based dressing, avocado
- Non-starchy vegetables
- Low-carb dairy such as butter, ghee, greek yogurt, heavy whipping cream, sour cream, hard cheeses, parmesan
- Nuts, seeds, and berries are ok but be careful as carbs add up quickly

© 2017 Hedberg Institute

How Long?

- A one week trial can be an excellent diagnostic tool.
- Typically 4 weeks is ideal for most patients.
- Recommended at least one week every year to metabolize potential cancer cells.
- Once the body has been in ketosis and the longer it has been in ketosis, the faster one can get back into ketosis.
- Combine with the low FODMAP diet for 4 weeks to significantly burn fat and heal the GI tract.

© 2017 Hedberg Institute

Additional Resources

The best online source is:

<http://www.ketogenic-diet-resource.com/>

Cancer As a Metabolic Disease by Thomas Seyfried

The Art and Science of Low Carbohydrate Living: An Expert Guide to Making the Life-Saving Benefits of Carbohydrate Restriction Sustainable and Enjoyable by Volek and Phinney

<http://www.ketonutrition.org/>

© 2017 Hedberg Institute

FMTown Special Offer

20% off any course at the Hedberg Institute except the Case Study Series.

Coupon Code: fmtown2017 (expires in 7 days)

Functional Medicine Case Study Series is only \$27.00/month for a limited time.

www.hedberginstitute.com

© 2017 Hedberg Institute