

The Keto Diet, Diabetes & CKD

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Objectives

- Define the keto diet
 - History
 - Research
 - Health effect
 - Goals
- Effects on on Diabetes
- Effects on CKD
- Recommendations
- Future



Before we go any further

- ▶ No matter what weight loss diet our clients follow, weight loss cannot occur without a calorie deficit!

Keto History

- ▶ Fasting-The precursor the the ketogenic diet for people with epilepsy
 - ▶ Used as a treatment 2500 years ago
 - ▶ Harvard University Medical School,1921- Dr. Lennox and Dr. Cobb found decreases in epileptic episodes after 2-3 days of fasting
- ▶ Keto Diet
 - ▶ Mayo Clinic 1921- Dr. Wilder discovered the benefits of fasting can be reproduced with a ketogenic diet
 - ▶ Starving the body of carbohydrates instead of macronutrients
 - ▶ Today-used as a last resort for controlling seizures due to the difficulty in maintaining the diet

Keto Diet in the modern era

- ▶ 1972-Robert Atkins published his first diet book
 - ▶ Centered on eating fat and very little carb to induce ketosis...[with] minimum deprivation
- ▶ 1976-Robert Linn, D.O. & Dr. Stephen Phinney-Last Chance diet
 - ▶ Drink a protein-rich concoction to lose weight
 - ▶ Under a physicians supervision to prevent malnutrition
 - ▶ 60 people died as a result of heart problems.
 - ▶ Despite the lawsuits Phinney went on to create the more nutritionally complete Optifast

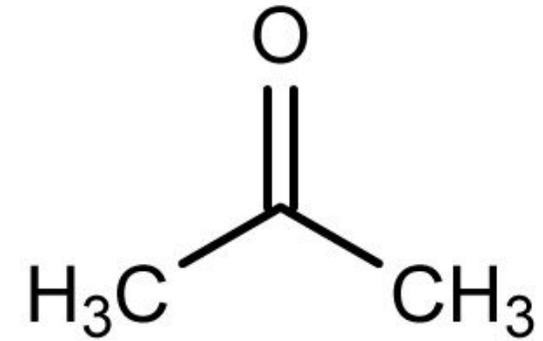


Keto History cont...

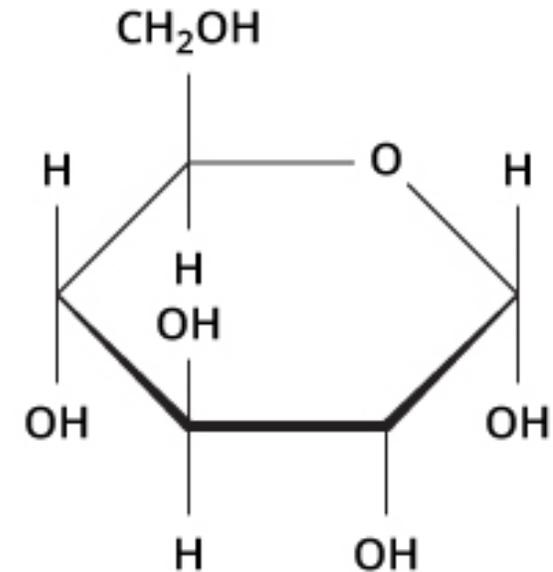
- ▶ 1990s-Dan Duchaine-responsible for introducing diet to bodybuilders to “drop fat quickly
- ▶ 2000-rediscovery of Atkins diet
- ▶ 2013-Article published showing
 - ▶ Antioxidant and anti inflammatory genes were activated by beta-hydroxybuterate
 - ▶ Claiming KD could slow the aging process and prevent
 - ▶ Heart disease
 - ▶ Alzheimers
 - ▶ Cancer
 - ▶ Starving cancer cells prevented growth and reduced size of tumors

Ketones

- ▶ What are they?
 - ▶ Acetone, acetoacetic acid and beta-hydroxybutyric acid from normal metabolic products of lipid metabolism in the liver and oxidized in the muscle
- ▶ Carbohydrates
 - ▶ Sugars, starches and fibers broken down in the small intestine



Ketone (Acetone)



Carbohydrate (glucose)

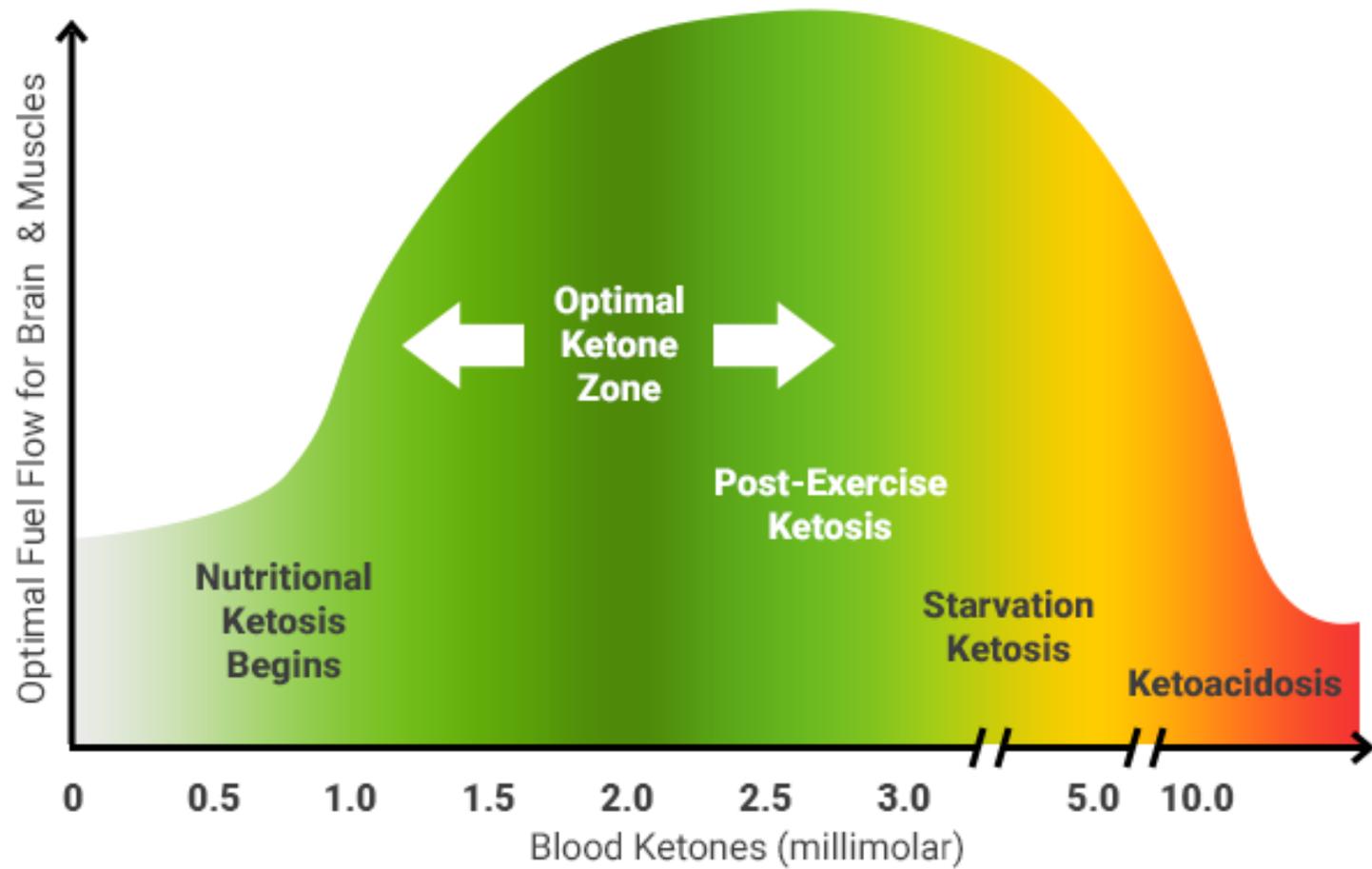
Nutritional Ketosis vs Diabetic Ketoacidosis

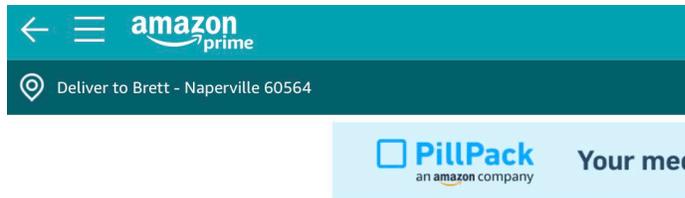
▶ Nutritional Ketosis

- ▶ Important state allowing body to run on fat for energy
- ▶ Happens when
- ▶ Fat is broken down by the liver
- ▶ Ketone levels between 0.5 and 3 mmol/L

▶ Diabetic Ketoacidosis

- ▶ Dangerous and potentially fatal
- ▶ Happens mostly in T1 diabetics when not enough insulin is administered to bring glucose into cells
- ▶ Body thinks it is starving so it releases ketones at an alarming rate
- ▶ Happens when there is high ketones and high blood glucose
- ▶ Ketone Levels between >5.0 mmol/L





Ketosis testing

- ▶ Signs and symptoms
 - ▶ Increased Ketones
 - ▶ Urine, breath or blood tests- performed by a physician, or home testing kits are available
 - ▶ Weight Loss
 - ▶ During the first few days, usually water weight
 - ▶ Thirst
 - ▶ Side effect of water loss
 - ▶ Can Lead to dehydration & electrolyte imbalance
 - ▶ Increases Risk of Kidney Stones



Ketosis signs and symptoms

- ▶ Muscle cramps and spasms
 - ▶ Dehydration & electrolyte imbalances
- ▶ Headaches
 - ▶ Related to decrease in sugar & dehydration
- ▶ Fatigue and weakness
 - ▶ CHO provides quicker bursts of energy
- ▶ Stomach complaints
 - ▶ Indigestion and constipation
- ▶ Changes in sleep
 - ▶ May experience difficulty falling asleep or nighttime walking
- ▶ Bad Breath
 - ▶ Ketones leave the body through breath and urine. Breath may smell sweet/fruity

Keto Recommendations

▶ Macros

▶ 70-80% of calories from fat

▶ 20-25% Protein 

▶ 15-20 net carbs per day 

▶ Net Carbs

▶ Total Carbohydrate per serving minus # grams of fiber

KETO COBB BOWL



CALORIES

557

FAT	CARBS	FIBER	SUGAR	PROTEIN
49G	7G	4.5G	2G	21G

KETO SHRIMP SCAMPI

+ 2 tablespoons grated parmesan



CALORIES

420

FAT	CARBS	FIBER	SUGAR	PROTEIN
18G	8G	2G	4G	54G

LEMON BAR FAT BOMBS



CALORIES

330

FAT	CARBS	FIBER	SUGAR	PROTEIN
32G	10G	4G	2G	4G

SAVORY CHICKEN SAUSAGE EGG MUFFIN

+ 1 medium avocado + 3 strawberries



CALORIES

389

FAT	CARBS	FIBER	SUGAR	PROTEIN
30G	20.5G	12G	4G	13G

1800 kcal Keto Diet meal plan

Keto Recommendations

▶ Snacks

- ▶ high-fat snack such as a bacon strip or some cucumber with avocado mayo

▶ General Recommendations

- ▶ Instead of lean meats,
- ▶ skin-on poultry
- ▶ fattier parts like chicken thighs
- ▶ rib-eye steaks
- ▶ grass-fed ground beef
- ▶ fattier fish like salmon
- ▶ beef brisket or pork shoulder
- ▶ Bacon ☐

Vegetables (non starchy)

- Leafy greens
- spinach, kale and lettuce,
- Broccoli
- Cauliflower
- cucumbers

Ketogenic diet and diabetes

- ▶ Review of literature shows
 - ▶ Weight loss is on par with Low Calorie Diets in those with T2DM
 - ▶ Reduction of HbA1C levels
 - ▶ Benefits can be achieved in absence of weight loss
 - ▶ Reversing Nephropathy
 - ▶ By raising blood levels of 3-beta-hydroxybuteric acid and reducing glucose metabolism in the kidneys
 - ▶ Cardiac benefits
 - ▶ Improved cardiac efficiency by 25%
 - ▶ Lipid Profile
 - ▶ Decrease in LDL, TG and increase in HDL

Disadvantages for diabetics

- ▶ Patients with T2DM on oral hypoglycemic agents we're at an increased risk for developing hypoglycemia
 - ▶ May need to reevaluate hypoglycemic agents
- ▶ Diet could be too extreme
 - ▶ May cause unwanted iatrogenic effects
- ▶ Bariatric surgery
 - ▶ Patients scheduled for bariatric surgery who were put on low carbohydrate ketogenic had increased catabolic state and increased oxidative stress
 - ▶ Can have a negative effect on surgical outcomes.

Ketones and Kidneys

- ▶ Renal systems serve as a compensatory mechanism in acid base balance.
 - ▶ As Ketones increase serum pH lowers
 - ▶ Respiratory ventilation changes to accommodate the need to reduce pCO₂ (partial pressure CO₂)
 - ▶ Respirations become deep and labored (Kussmaul's respirations)
- ▶ Drop in pH increases risk of kidney stones
- ▶ Can have a blood pressure lowering effect in those with CKD
 - ▶ Loss of electrolytes

Sustaining Keto diet with Kidney failure

- ▶ Increased fluid needs with Keto Diet vs. Fluid restriction for Dialysis patients
- ▶ Further restricted diet and confusion

Suggested Keto Fruits (high fat/low carb)

- Avocados
- Apricots
- Peaches
- Berries
 - Strawberries, blueberries, raspberries
- Melons (Cantaloupe, Honeydew, watermelon)

Restricted Keto Fruits

- Bananas
- Apples
- Pears
- Grapes
- Mangoes
- Pineapples

Sustaining Keto diet cont..

▶ Suggested Keto diet vegetables

- ▶ Cauliflower
- ▶ Cabbage
- ▶ Broccoli
- ▶ Zucchini
- ▶ Spinach
- ▶ Asparagus
- ▶ Kale
- ▶ Green Beans
- ▶ Brussel Sprouts

▶ Vegetables to avoid on Keto

- ▶ Russet Potatoes
- ▶ Sweet Potatoes
- ▶ Pumpkin
- ▶ Winter Squashes
 - ▶ Butternut, Spaghetti squash
- ▶ Carrots
- ▶ Beets
- ▶ Parsnips
- ▶ Corn
- ▶ Peas

Adherence (WHO, 2013)

► Diabetic + Renal + Keto Diet?

T1DM

- SMBG-26% as recommended
- Insulin-52%-92% as recommended
- Diet-70%-75% non adherence

Dialysis diet

- Up to 75% non-adherence!
- 57% miss one phosphorus binder does per day

T2DM

- SMBG-33% as recommended
- Medication-15% to 75% took oral hypoglycemic agents as recommended
- Diet-70%-75% non adherence
 - Those with T2DM lose less weight than their non-diabetic counterparts

Conclusion & Future research

- ▶ More research is needed about the long term safety
- ▶ Few long term studies of >10 years of ketosis
 - ▶ Concerns of heart health
 - ▶ Diet is very difficult to follow in the long term for diabetics and CKD
- ▶ Short term
 - ▶ Weight loss benefits are on par with other weight loss plans
 - ▶ Shown benefits in diabetics in adherence of <1 year
 - ▶ Little evidence of iatrogenic side effects in CKD
 - ▶ Blood pressure should be monitored
 - ▶ Hydration should be monitored to prevent Kidney Stones.

Thank You!

Resources

1. <https://health.usnews.com/best-diet/keto-diet>
2. <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1528-1167.2008.01821.x>
3. <https://www.diabetes.co.uk/blood-glucose/ketosis.html>
4. <https://www.medicalnewstoday.com/articles/323544.php>
5. <http://apps.who.int/medicinedocs/en/d/Js4883e/8.4.4.html#Js4883e.8.4.4>
6. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3595318/>
7. <https://www.sciencedirect.com/science/article/pii/S0899900714003323>
8. https://www.researchgate.net/profile/Sami_Azar/publication/312362362_Benefits_of_Ketogenic_Diet_for_Management_of_Type_Two_Diabetes_A_Review/links/58d145f492851ce355c02534/Benefits-of-Ketogenic-Diet-for-Management-of-Type-Two-Diabetes-A-Review.pdf