



The Ketogenic Diet

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Objectives

- ▶ To understand how the Ketogenic diet works and give accurate advice to individuals who may ask about it
- ▶ To understand what ketosis is and the difference between ketosis and ketoacidosis
- ▶ To be able to state the negative side effects of being on ketogenic diet
- ▶ To be able to state where the diet is used medically and may provide benefits

Ketogenic Diet

- ▶ Has been around for 60 years as a treatment for Epilepsy
- ▶ Current usage if for weight loss
- ▶ Very similar and possibly identical to modified Atkins diet

What is the Ketogenic Diet?

- ▶ Very Low Carbohydrate, Moderate Protein, high fat
 - ▶ Percentages :
 - ▶ 60-75% Fat
 - ▶ 15-30% Protein
 - ▶ 5-10% Carbohydrate
 - ▶ RDA:
 - ▶ 20-35% Fat
 - ▶ 10-35% Protein
 - ▶ 50-65% Carbohydrate (CHO)

Foods Not Allowed:

- ▶ Sugar, soda, sports drinks, smoothies, sweet coffee drinks
- ▶ Sweets and savory snack foods (chips, crackers, etc.)
- ▶ Grains and flour and any food that contains it
- ▶ Legumes (beans)
- ▶ Starchy Vegetables (potatoes, corn, peas)
- ▶ Fruit, fruit juice

Foods Allowed:

- ▶ Butter, butter substitutes, cream cheese, nut butters, oils
- ▶ Nuts and Seeds
- ▶ Avocado
- ▶ Non starchy vegetables
- ▶ Meat, Fish, Poultry including fatty meats, bacon and chicken skin
- ▶ Soy Protein

How does it work?

- ▶ Induces KETOSIS = primary goal of diet
- ▶ Lack of glucose = increased mobilization of fatty acids from fat stores which are converted into ketone bodies by liver mitochondria.
- ▶ When there are enough ketone bodies in the blood, the individual is in ketosis
- ▶ Ketones are an alternative fuel source by the brain and body
- ▶ Ketosis causes loss of appetite

Protein intake and Keto

- ▶ School of Thought 1
 - ▶ Protein via gluconeogenesis most likely will not be converted to enough glucose to increase insulin and halt ketone production
 - ▶ Only tiny % of converted protein to glucose will be added to blood stream
 - ▶ Blood glucose levels will not increase

Protein Intake and Keto

- ▶ School of Thought 2
 - ▶ Amount that can be consumed to stay in ketosis varies from person to person
 - ▶ Depends on how much insulin vs glucagon is secreted
 - ▶ Type 2 Diabetes= insulin resistant = Increase in insulin
 - ▶ Healthy/Active Individuals = insulin sensitive = increase in glucagon
 - ▶ Other factors that “may” affect ketone production: genetics, gender, calorie/macronutrient intake, time in ketosis, activity

How Much Protein Allowed?

- ▶ Sedentary: 0.6-0.8gm/lb lean body mass (LBM)
- ▶ Moderately Active: 0.8-1.0gm/lb (LBM)
- ▶ Lifting Weights: 1.0-1.2gm/lb (LBM)
- ▶ Protein content of foods: 7gm/oz. of lean meat, fish, poultry, egg
- ▶ WHEN IN DOUBT: MEASURE

Ketosis: Are You in It?

- ▶ To find out person keto protein limit or to simply make sure you are in ketosis you have to measure ketones
 - ▶ Buy a blood-ketone meter with test strips
 - ▶ Eat <35gm CHO/day for one week consuming your target protein level
 - ▶ Test ketones first thing in AM, fasting
 - ▶ Ketone Goal: 1.5mmol/L or above
 - ▶ IF you meet goal you can try increasing protein gradually until ketone level falls below goal

KETOSIS VS. KETOACIDOSIS

Ketosis = lack of glucose

Ketoacidosis = lack of insulin

KETOSIS:

- ▶ Caused by lack of glucose
- ▶ Ketosis is the general term for ketone bodies being present in the blood
- ▶ CHO intake <20-40gm/day; <10gm consumed at one time
- ▶ The brain and body can use ketone bodies as an alternative “emergency” food source
 - ▶ Acetoacetate and B-hydroxybuterate (BHB)
 - ▶ Acetone is exhaled
- ▶ Being in ketosis is not life threatening
- ▶ Blood sugar remains low and there is an improvement in insulin resistance

KETOACIDOSIS

- ▶ Occurs from complete lack of insulin and large amounts of glucose in the blood
- ▶ Ketone production continues unchecked and may reach extreme levels
- ▶ Designation of DKA
 - ▶ Blood glucose: >250mg/dl
 - ▶ presence of serum ketones in blood or urine
 - ▶ Acidosis with bicarb level <18mq/l or pH <7.30
- ▶ Usually requires hospitalization for insulin management and could lead to death if left untreated

Comparison of Ketone Levels

- ▶ Ketogenic diet: 0.5 to 3.0 mmol/l
- ▶ Starvation: 5-10 mmol/l
- ▶ DKA (extreme): 15-25 mmol/l

Ketoacidosis vs Ketosis acid base balance:

- ▶ nutritional ketosis: IMBALANCE DOES NOT OCCUR
 - ▶ BLOOD PH REMAINS 7.35-7.45
 - ▶ No increase in anion gap* (measurement using serum chloride, bicarbonate)
- ▶ Ketoacidosis:
 - ▶ Ph <7.3
 - ▶ Anion gap can more than double
- ▶ *Anion gap = measurement of the difference between negatively charged and positively charged electrolytes in the blood

Ketoacidosis and Hydration:

- ▶ DKA: high levels of blood glucose draw water into bloodstream resulting in: polyuria, glycosuria
- ▶ Significant dehydration
- ▶ Electrolyte imbalance

Ketosis and Hydration

- ▶ Nutritional ketosis: BG remains WNL or improves
 - ▶ Any extra need for fluid is easily obtained by drinking more fluid
 - ▶ Those on ketogenic diet are encouraged to eat low carbohydrate potassium sources (nuts, seeds, dark greens, avocado) and salt is not restricted therefore electrolytes remain WNL

Hyperketosis:

- ▶ In both nutritional ketosis and ketoacidosis High levels of ketones (hyperketosis) in blood may cause nausea, fatigue and vomiting
- ▶ NOT desired
- ▶ Ketogenic diet initiation phase: sufficient food and fluid must be consumed in order for ketones to build up slowly. If hyperketosis occurs it is corrected by consuming 2gm of cho (1tb of juice)

History and Uses of Ketogenic Diet

- ▶ First developed in the 1920s for the treatment of pediatric epilepsy

Epilepsy

- ▶ Recommended for children who's seizures have not responded to several different seizure meds
- ▶ New research (2015) has shown that ketones and another chemical called decanoic acid, produced by the diet reduce seizures in some people
- ▶ Elevated ketones in the blood leads to the reduction of epileptic seizures possibly by affecting how the mitochondria function
- ▶ 50% saw seizures drop by at least half and benefits continue for some time after stopping diet
- ▶ Modified Atkins diet is also effective (less CHO than original Atkins)
- ▶ MCT Oil also used to allow for increased food variety

Ketogenic Diet and Diabetes

- ▶ Saslow et al (2014 Plos One)
- ▶ 3 month study KD compared to moderate carb counting diet (MCCR)
 - ▶ 34 subjects
 - ▶ Wt loss: Keto = 5.5kg vs MCCR = 2.6kg
 - ▶ A1c: Keto = 0.6% A1c vs MCCR = - .03%
 - ▶ Meds: Keto = 44% decrease in diabetes meds vs MCCR = 11% decrease

Ketogenic Diet and Diabetes

- ▶ In a study by Yancy, Foy and Westman (2104 nutrition and metabolism):
- ▶ 21 subjects; 16 week trial
 - ▶ 17 of 21 people were able to stop or decrease diabetes medication.
 - ▶ Lost average of 6.6% body weight
 - ▶ Reduced waist size, triglycerides (42%) and blood pressure
 - ▶ A1c decreased from 7.5 to 6.3

Ketogenic diet and Metabolic Syndrome

12 week controlled study by Volek et al (Lipids; April 2009)

40 subjects; 1500 Kcal; Low CHO (12:59:29) vs Low Fat (56:24:20)

- ▶ Cho restricted diet was more effective than low fat diet
- ▶ Weight loss: Low Carb -14% ; low fat -7%
- ▶ Fasting Insulin: Low Carb – 12% fasting glucose; no change in low fat
- ▶ More favorable responses to LDL particle distribution, increased HDL and other alternative indicators of cardiovascular risk despite the Low carb diet being higher in saturated fat

Ketogenic diet and Nonalcoholic Fatty Liver Disease

- ▶ Small study by with 14 obese men (Perez-Guisado et al, J med food jul-aug 2011)
- ▶ Followed Spanish Ketogenic Mediterranean diet for 12 weeks
- ▶ 93% had reduction in liver fat
- ▶ 21% had complete resolution of NAFLD
- ▶ 100% had normal triglycerides and HDL
- ▶ Significant weight loss of 30# however BMI was still >30

Ketogenic Diet and Weight Loss

Why is weight loss so dramatic?

- ▶ Easy
- ▶ Decreased appetite
- ▶ Gluconeogenesis
- ▶ Fluid changes
- ▶ Lower calorie diet

Keto: How Does it Work?

Its Easy!!

No calorie or carb counting!!!

No (apparent) portion control!!!

Eat as much as you want!!!

Eat foods that you never were allowed to before while dieting!!!

- ▶ Butter, Cheese, Bacon YAY!!

You don't get hungry!!!

You lose weight really fast!!!

Keto Diet: How it works

Fluid Changes

- ▶ Fluid Loss = smoke and mirrors
- ▶ Drastic change in scale is encouraging
- ▶ Glycogen depletion = water loss of 3-4gm for 1 gm glycogen
- ▶ 10-12 pounds the first two weeks (heavier people may expect more water weight loss)

Less calories are consumed

- ▶ Eliminating bread, rice, cereal, sugar, potatoes, fruit, juices, smoothies, sweets is not just eliminating CHO but CALORIES.
- ▶ Eliminating bread, flower and sugar drinks not only eliminates lots of calories from carbohydrates, but also from the fat they would have had contained
- ▶ How much fat can one really consumed without CHO or Protein as a vehicle ?

Less Calories on Keto Diet

- ▶ What has more calories in this meal at a Steak Restaurant?
- ▶ Steak (500), Caesar salad with dressing and croutons (300), roasted cauliflower (200), 3 shots of vodka on ice (300)
- Vs
- ▶ Steak (500), Caesar salad with dressing and croutons (400), roasted cauliflower (200), 2 rolls with butter (400), Fried potatoes (300), split dessert (300), 2, 6oz glasses of wine (300)

What Has More Calories?

- ▶ In n Out Double Double with fries and 12oz coke or shake
- ▶ OR
- ▶ In n Out Double Double protein style (lettuce instead of bun), diet coke?

Keto Diet Sample Menu

- ▶ Breakfast: 2 egg vegetable omelette fried in 1 Tb butter with 2 slices bacon
 - ▶ Lunch: Large Salad with 2 Tb vinaigrette, ½ avocado
 - ▶ Snack: ½ cup nuts (optional)
 - ▶ Dinner: 6 oz roasted chicken with roasted vegetables
- ▶ Above diet has between 1200-1400 Kcal NOT including optional snack. Nuts provide additional 300-400 Kcal

Can You Gain Weight on Keto?

- ▶ Most Likely
- ▶ Fat Bombs: have you heard?



Fat Bombs

- ▶ “A great way to get that extra fat into your diet by keeping it sugar free!!”
- ▶ Ingredients for Keto Strawberry Fudge:
 - ▶ 16 oz cream cheese
 - ▶ 16 oz butter
 - ▶ 1 Tb vanilla
 - ▶ 2 Tb Erythritol
 - ▶ 1oz of low carb protein powder

Fat Bomb: Chocolate Fat Bomb

“These low carb chocolate fat bombs are a great addition to your afternoon coffee break!”

100 calories each

1 serving fits into mini cupcake holder

Ingredients: cream cheese, icing mix, vanilla essence, 7oz heavy cream,



Summary

- ▶ Studies have shown that the ketogenic diet can lead to more weight loss and improvement in blood lipids and blood sugar when compared to diet higher in CHO
 - ▶ Ketogenic Diet = low calorie diet
 - ▶ If you eat enough calories doing keto you will stop losing weight or gain weight (too many "fat bombs") if excess calories are consumed
 - ▶ Composition of higher CHO diet in these studies are unknown
 - ▶ Some of the extra weight loss could be water weight
 - ▶ Comparing keto diet to "Mediterranean" Diet of same calorie level is needed (Low GI, High Fiber, High MUFA)

Summary

- ▶ Unsustainable
- ▶ May not be in Ketosis
- ▶ Rebound Weight Gain
- ▶ Risk of consuming too little fiber, Vitamin A, C, Magnesium, Vitamin D, Calcium and other nutrients unless close attention is paid

Summary

- ▶ If in Ketosis
 - ▶ Smelly Breath
 - ▶ Body odor
 - ▶ Low energy/brain fog
 - ▶ Low glycogen stores = low exercise tolerance

THANK YOU!