Advantages and Disadvantages of theKetogenic Diet:

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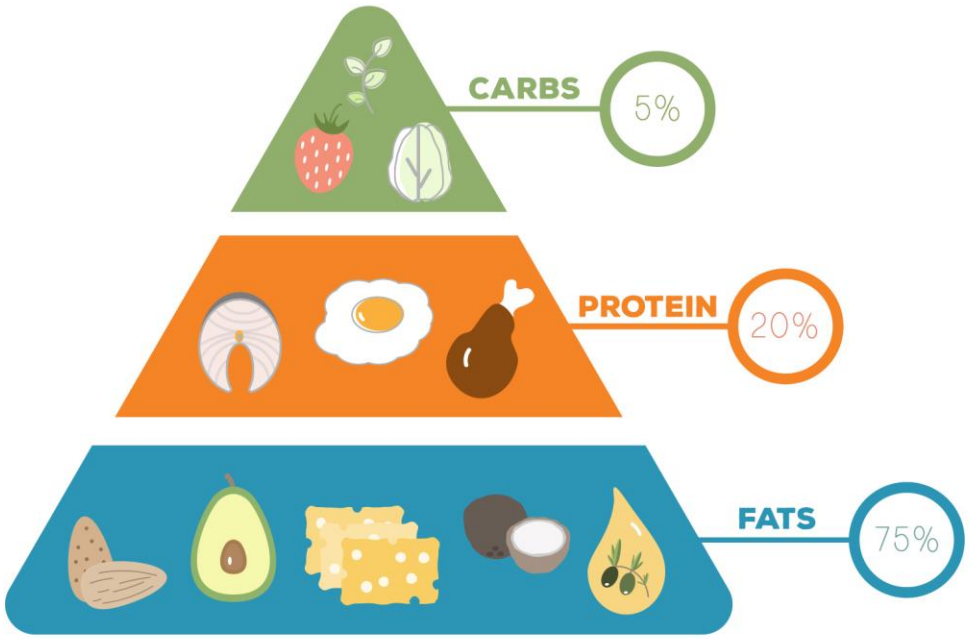
Ketogenic diet

- Very-low-carbohydrate (ketogenic) diets have been promoted for weight loss and, less commonly, for other health reasons.

- The term “ketogenic diet” generally refers to a diet that is very low in carbohydrate, modest in protein, and high in fat.

KETO DIET
FOOD PYRAMID



History of the Ketogenic Diet

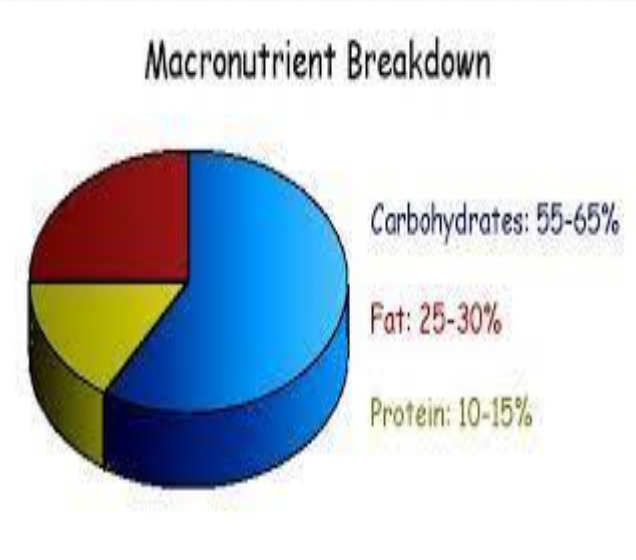
- Originated in the 1920.
- Was initially used to treat epilepsy.
- Diet lost popularity with the discovery of anticonvulsants.

Types of Ketogenic Diets

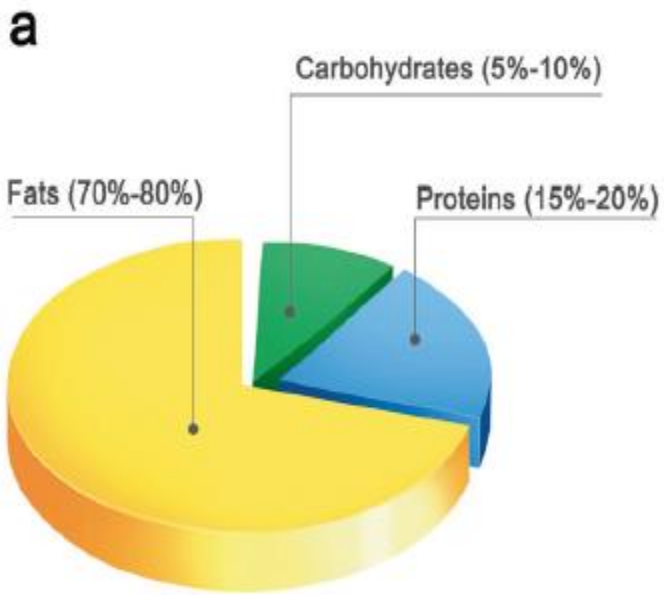
Classic KD (Long-chain triglycerides,LCT)	**4:1** (3:1-4:1)	Fat (grams) to protein + carbohydrate (grams)
MCT KD (Medium- chain triglyceride)	**30%-60%**	Energy from MCT
MAD (Modified Atkins diet)	**1:1-1.5:1**	Ketogenetic ratio
LGIT (Low glycemic index treatment)	**<50**	Glycemic indices for carbohydrates

Comparison macronutrient

Standard diet.macronutrients



Ketogenic diet.macronutrients



Effects On Nutrient Metabolism

- During prolonged fasting, some tissues, such as muscle, can directly metabolize free fatty acids released from adipose stores.

- Much of this fatty acid is converted into ketones in the liver, which can fuel otherwise-obligate glucose consumers like neurons, minimizing mobilization of body protein for gluconeogenesis.

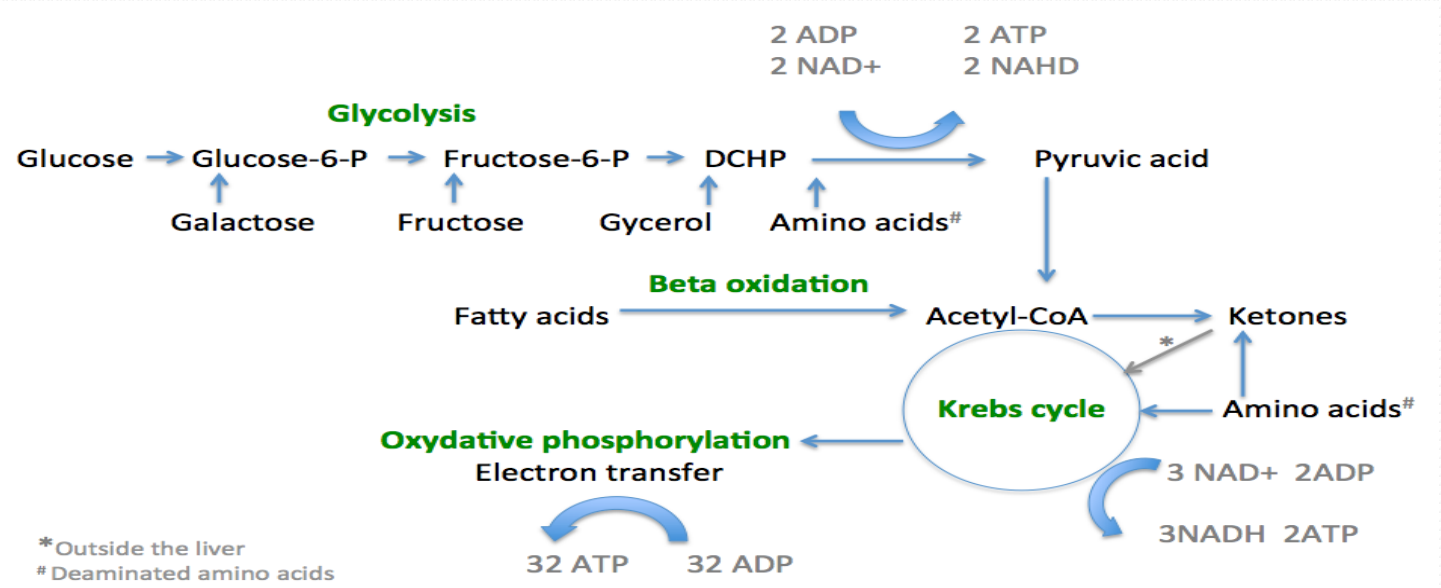
- to induce the liver to make ketones in the fed state, carbohydrate intake must be minimized and fat intake increased (after 3-4 days of fasting).

- The three ketone bodies produced by the liver are:

1. Acetoacetate (AcAc),
2. Beta-Hydroxybutyricacid (BHB)
3. Acetone.

- The liver is unable to use these Ketone Bodies as energy:

(BHB ➡ AcAc ➡ Ac-CoA ➡ Krebs Cycle)



2 Pathways of Gluconeogenesis

- Protein utilization is also altered on a ketogenic diet; the body shunts as much protein as possible to gluconeogenesis.

- Breakdown of Protein:

  Glucogenic Amino Acids (AA), Glutamine and Alanine that are stored in the muscles can be turned into glucose.
- Breakdown of Lipids:

  Glycerol -liberated from Triacyleglycerols (TAGs)

- First few days to week of keto is fueled mainly by Glucogenic AAs.
- Once “Fat Adapted” keto is fueled mainly by Glycerol.

(60%), this is why you can preserve lean muscle mass relatively well.

Effects On Diet Quality

- Very-low-carbohydrate diets may lack vitamins, minerals, fiber, and phytochemicals found in fruits, vegetables, and whole grains.

- Ketogenic diets are typically low in fiber needed not only for healthful intestinal function but also for microbial production of beneficial colonic short-chain fatty acids.

Side Effects Of Keto

Short term effects

- "**keto flu**," includes headache, fatigue, nausea, dizziness, "brain fog,"

  gastrointestinal discomfort, decreased energy, feeling faint, and heartbeat alterations.

Longer-term effects

- decreased bone mineral density,
- nephrolithiasis,
- cardiomyopathy,
- anemia
- neuropathy of the optic nerve
- Micronutrient deficiency
- Muscle loss

Dehydration, hepatitis, pancreatitis, hypertriglyceridemia, hyperuricemia, hypercholesterolemia, hypomagnesemia, and hyponatremia can also occur.

Keto Diet Disadvantage

- Extremely restrictive
- Difficult to travel with
- Possible social isolation
- Only a temporary solution (not a long term diet)
- Potential side effects (Ie: disordered eating, false food beliefs)
- Medical complications (re-feeding syndrome)
- GI issues (constipation/diarrhea)
- Fatigue
- Possible Nutrient Deficiencies

Effects OF Ketogenic Diets By Condition

- Epilepsy
- Obesity
- Diabetes
- Cardiovascular Disease

Epilepsy

1/3 to 1/2 of people with drug-resistant epilepsy can reduce seizure frequency by at least 50% with a ketogenic diet .

The lack of glucose available to fuel neurons is a possible mechanism for action .

- Long-term adherence is challenging, as food choices are limited and adverse effects are common .
- Micronutrient supplementation is required.
- more research is needed.

Obesity and Weight Management

- Ketogenic diets can induce weight loss.
- It has been proposed that weight loss on ketogenic diets may be due to reduced appetite.(due to the higher satiety effect of proteins)by increasing the concentrations of “satiety” hormone.
- Energy expenditure has also been shown to increase on a ketogenic diet, at least in short-term studies.

- 2013: meta-analysis of randomized controlled trials testing VLCD ketogenic diets (**50 g CHO/day or 10% kcal from carbohydrates**) against diets based on modest reductions in fat intake **(<30% kcal from fat)** for at least 1 year found that:

ketogenic diets led to more weight loss than reduced-fat diets.

- In a 2016 metabolic ward study by Hall et al.

  17 overweight or obese men were provided a baseline diet **(50% carbohydrate, 35% fat, and 15% protein, as a percent of energy)** for 4 weeks, then a ketogenic diet **(5% carbohydrate, 80% fat, 15% protein)** for 4 weeks.

  For 2 weeks after switching from the baseline diet to the ketogenic diet, participants' weight loss accelerated—but fat loss slowed, may be due to body water loss.

- As a result, study participants required 4 weeks on a KD to lose the same average 0.5 kg of fat lost in the final 2 weeks on a baseline diet.

- The 2021 metabolic ward study : tested the effects of both an animal-based ketogenic diet **(76%energy from fat, 10% carbohydrate)** and a plant-based, low-fat diet **(75% carbohydrate, 10% fat)** on 20 weight-stable adults, mean age 29.9 years, mean BMI 27.8 kg/m2.
- Reported hunger and satisfaction were similar between groups.
- most of the weight lost on the ketogenic diet came from fat-free mass.

Diabetes

- **Type 1**

  Not for pediatric type I Diabetes :

  (risk of malnutrition, failure to thrive, reduced bone density, hyperlipidemia, poor sleep, amenorrhea, and hypoglycemia).

  In adults type I:

- both favorable and unfavorable outcomes have been observed.
- improved blood glucose control
- More frequent and extreme hypoglycemic episodes

- Dyslipidemi
- Increased risk for complications of the microvasculature, due to elevated ketone production, and diminish ketone clearance.
- In type I diabetes, hyperketonemia is associated with oxidative stress, inflammation, non-alcoholic fatty liver disease, and insulin resistance.

Type 2 Diabetes

- Significant decreases in HbA1C, BG, BW.
- Different lipid profile and insulin sensitivity results .
- The beneficial effects of ketogenic diets for people with type 2 diabetes are attributable primarily to weight loss, with benefits appearing to wane over time

Cardiovascular Disease

- The effect of low-carbohydrate diets on plasma lipid concentrations is a major concern.
- weight loss by any means causes a reduction in total cholesterol of about 2 mg/dL per kilogram lost.
- However, LCD are often an exception to that rule.

- In a 2002 6-month study of a VLCD "Atkins" diet by Westman et al., 12 (29%) of the 41 participants had LDL-C elevations.

- In a trial published in 2003 by Foster et al., LDL-C rose 6.2% in a group of low-carbohydrate dieters at 3 months. for comparison, LDL-C dropped by 11.1% during this same time period in participants following a conventional low-calorie diet.

- It is important to note that changes reported in group mean do not reflect the change for any given individual.
- In the 2002 study cited above, while the mean LDL-C increase was 18 mg/dL, participant's LDL-C concentration increased from 123 to 225 mg/dL.

- Some have suggested that LDL-C or LDL particle concentration elevations are of no concern if the increase is mainly in larger LDL particles.

- There are two problems with this rationale:

  First is the problem of heterogeneity noted above (i.e., individuals may have significant worsening of their lipid profiles that are not reflected by mean figures).

  Second, LDL is potentially atherogenic regardless of particle size.

- In other words, large LDL particles were strongly atherogenic, albeit less so than small LDL.

- It has also been proposed that the risk elevation associated with increased LDL-C concentrations may be neutralized to the extent that high-density lipoprotein cholesterol (HDL-C) also rises.

- Treatment-induced HDL-C elevations were examined in a meta-analysis of 108 studies including 299,310 participants, which found no associated reduction in the risk of coronary heart disease events, coronary disease mortality, or total mortality .
- The LDL-C/HDL-C ratio was not a better predictor of cardiovascular outcomes than LDL-C alone, and the authors recommended using LDL-C, rather than HDL-C or a ratio of the two, as the therapeutic target

Non-alcoholic Fatty Liver Disease

- In healthy individual hepatic triacylglycerol comes from 3 sources:

1: de novo lipogenesis,(primarily from glucose);(%5) ⇒ %26 fatty liver

2: lipolysis of stored from adipose tissue; (60–80%)

3. diet-derived fats(%15)

- The risk of NAFLD is significantly higher in individuals who have obesity or type 2 diabetes .

- Fat derived from de novo lipogenesis and adipose tissue is accelerated by insulin resistance.

- Ketogenic diets typically increase intake of:

  saturated fat, cholesterol, and animal protein, all of which are associatedwith insulin resistance, oxidative stress, and an exacerbated flow of free fatty acids to hepatocytes.

- In epidemiological studies this diet :thought to contribute to NAFLD

- On the other hand:

Lifestyle modifications, particularly diet change, weight loss, and exercise, are the primary modality for treating NAFLD.

Lifestyle interventions that promote weight loss have been found to reduce liver fat and improve aminotransferase concentrations and insulin sensitivity.

- It has been suggested that achieving ketosis may have a benefit in ameliorating fatty liver, but the studies supporting this are limited and typically also restrict energy intake.

  Long-term safety and specific clinical outcomes have not been determined.

Cancer

- Some have suggested ketogenic diets for cancer patients ,

  based on the so-called “Warburg effect,” whereby cancer cells increase glucose uptake and upregulate glycolysis even in the presence of oxygen, preferentially fermenting glucose to lactate.
- By nearly eliminating available glucose, ketogenic diets theoretically stress cancer cells.
- randomized clinical trials are needed to determine the safety and effectiveness of ketogenic diets in cancer treatment.

In Conclusion

- Long term research data is still lacking.
- Keto is not a cure all for everyone and everything, should still be considered as a "Last Resort" diet after other less restrictive nutrition interventions have been exhausted.
- There can be definite risks associated with ketogenic Diets.
- Careful monitoring by a Primary Care Physician and Dietitian is extremely important.
- Ketogenic Diets are therapeutic Diets NOT meant to be followed LONG TERM!!!!

THANK YOU