

Ketogenic Diet: What is it?

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What is the Ketogenic Diet?

The ketogenic diet premiered in the medical setting in 1921 by Dr. Russel Wilder [1]. The diet was originally intended to treat children diagnosed with epilepsy. The anti-seizure effects were first noticed in response to fasting. However, the ketogenic diet was crafted to support growth and development in children without long periods of not eating.

Recently the ketogenic diet (also known as the keto diet) has risen to fame as a fad diet that claims to treat obesity [2]. Calories in food come from three different sources: fats, carbohydrates and proteins. These three sources are called macronutrients. According to the United States Department of Agriculture, the standard American diet follows a macronutrient composition of 40 percent fat, 11 percent protein and 48 percent carbohydrate [2]. The ketogenic diet requires eating your macronutrients at a ratio of 60 percent fat, 30-35 percent protein and 5-10 percent carbohydrates. For someone consuming 2,000 calories a day, they would only be allowed to consume 20-25 grams of carbohydrates. Eating carbs at such low levels requires staying away from foods such as rice, pasta, bread, fruit and potatoes. However, you can eat foods high in dietary fat such as meats, nuts, cheese, avocados and eggs.

Each year, *U.S. News & World Report* evaluates and ranks the most popular diets using strict criteria related to safety, weight loss effectiveness and protection against disease. In 2017 the ketogenic diet was ranked last but close behind other popular fad diets including the vegan diet, Biggest Loser diet,

Slim Fast® diet and the raw food diet [4]. The keto diet was ranked low due to its difficulty and lack of long-term research.

Despite intense criticism from health care professionals, interest in the ketogenic diet has boomed in recent years as shown by a 300 percent increase in Google searches, according to data from Google Trends [5]. As worldwide obesity and cardiovascular risk continues to rise, individuals are becoming desperate to regain health by ditching carbohydrates for fat.

How does the Ketogenic Diet Work?

Avoiding eating carbohydrates and increasing the amount of dietary fats you

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KETOGENIC DIET MEAL PLAN

- Breakfast: Cheese Omelet**
- Shredded sharp cheddar cheese - Cheese, 0.25 cup
- Egg - Egg, 3 large
- Lunch: BLT Salad**
- Hellman's - Mayo, 2 tbsp
- Shredded sharp cheddar cheese - Cheese, 0.25 cup
- Romaine lettuce - Chopped romaine, 1 cup
- Walmart - Tomato, 1 tomato
- Bacon - Bacon, 4 pieces
- Dinner: Bunless Burger with Melted Cheese and Avocado**
- Asparagus - Steamed, 4 oz
- Avocado - Avocado, 1 medium
- Lucerne - Cheese slice cheddar, 1 slice
- Kroger - Burger, 1 patty
- Snacks:**
- Cheese stick - Cheese stick, 1 stick
- Nuts, almonds, 0.5 cup, whole
- Based on a 2000 calorie diet
- Data collected from Myfitnesspal.com

Figure 1. Example of Ketogenic Diet Plan

eat for a long period of time (1-2 weeks) causes your body to change its metabolism and enter a condition called ketosis. Ketosis mimics the effects of prolonged fasting and starvation.

We use fuel (e.g., the calories we eat) in a way that can be compared to hybrid cars. If one fuel source is used up, the backup fuel source will kick in. Normally our bodies, especially our brains, rely heavily on a steady supply of glucose for fuel. Glucose is provided in the diet from foods containing carbohydrates. When we eat more carbohydrates than we need, our body stores them for later use. Stored glucose is packed tightly into molecules called glycogen which can be used to maintain our body in case we go too long without eating a meal. However, these reserves can only last about one day; and once depleted, the body must switch to a different fuel source called ketones.

Ketones are produced in the liver. In response to low levels of glucose, the body begins breaking down fat tissue for fuel in the form of free fatty acids [6]. Free fatty acids can be used as a fuel source throughout the body except for in the brain. Collectively, this causes the brain to hit the metabolic panic button in demand for a source of fuel [7]. In response, the liver begins to repackage fatty acids into ketones, which are allowed access into the brain for fuel.

The ketogenic diet makes your body think it is in a state of ketosis, making you burn fat for fuel instead of carbohydrates or protein.

Carbohydrates are not the only macronutrient restricted for a ketogenic diet to work. The amount of dietary protein must also be limited. As mentioned earlier, a state of dietary ketosis can only be achieved if glucose intake and production is restrained. Dietary protein can be converted to produce glucose. Too much protein intake equals too much glucose availability. To prevent this from becoming an issue, keto dieters are recommended to minimize their protein intake to one gram per kilogram body weight. This would be about 68 grams of protein for a 150-pound person unless they are participating in weight resistance training in which they are advised to eat more protein to help with muscle building.

How do you know if you have achieved ketosis?

Flipping the metabolic switch can bring about what most keto-veterans refer to as the “keto flu.” The onset of keto flu appears after three to four days of closely eating a ketogenic diet. Symptoms of the keto flu vary. Reported symptoms include nausea, fatigue, dizziness and insomnia [3]. These symptoms can last up to a week with the only cure being to maintain carbohydrate restriction or to indulge in a carbohydrate-rich meal. Individuals who reach a state of ketosis often report enhanced

cognitive function; however, there is no scientific data to support these claims. Commercial urine analysis and blood ketone monitors are available for testing the presence of ketones. A state of ketosis also causes the metabolic byproduct acetone to be exhaled in the breath at higher concentrations than normal. This causes the breath to smell similar to nail polish.

What does the research say?

In spite of thousands of online testimonials claiming the ketogenic diet to be the holy grail of weight loss, evidence backed by scientific research is still limited. However, several small scientific studies do show promising results. In a meta-analysis of 13 randomized controlled human trials, researchers concluded that the ketogenic diet was more effective at promoting weight loss and lowering risk of cardiovascular disease when compared to a low-fat diet [9]. This effect is also shown in adolescent children [10]. In addition to weight loss, overall improvements in body composition (e.g., the amount of muscle to fat in our bodies) were observed. Those assigned to a ketogenic diet lost more visceral fat around the abdomen while keeping their muscle mass [11, 12, 13].

The short-term weight loss effects of the ketogenic diet seem promising, but very little information is known on whether or not these effects continue during long-term compliance. In fact, one of the major concerns regarding the diet is its long-term feasibility. Strict dieting regimens that lead to short-term weight loss can eventually lead to increased weight gain once dieters stop following the diet.

Is the diet safe?

Research has shown that short-term adherence to a ketogenic diet leads to weight loss. However, little is known on whether or not long-term adherence is safe or if the diet is safe for everyone in the short term, especially those with pre-existing health conditions. As mentioned earlier, the majority of calories in a ketogenic diet originate from fat. This causes many to fear the risks of developing heart complications due to increased consumption of saturated fats and cholesterol. Nevertheless a recent analysis reviewing more than 20 published trials reported there is no significant evidence that consumption of saturated fat increases the risk of heart complications [14]. However, the American Heart Association recommends limiting saturated fat intake to six percent of total caloric intake. This would be about 13 grams of saturated fat for someone consuming 2,000 calories [15].

Strict avoidance of dietary carbohydrates can limit the diversity of an individual's diet, which may increase the risk of nutrient deficiency. Dietary analysis shows that those consuming a ketogenic diet lack sufficient intake of calcium, vitamin D, phosphorus and magnesium [16].

These nutrients are vital for bone health, and intake below the recommended amount can lead to osteoporosis. For this reason, it is important to focus on diet quality and consume foods high in vitamins and minerals.

Conclusion

The hallmark of the ketogenic diet is its ability to increase weight loss and improve body composition. However, due to such rigorous changes in dietary lifestyle, compliance becomes an issue. To put it into perspective, eating one apple a day keeps the ketones away. The final verdict on the safety and long-term effects of the ketogenic diet remains unclear. Current scientific research has expanded outside of the realms of weight loss and into the diet's potential in improving neurovascular and microbiome health [16]. Collectively the idea of short-term weight loss may seem like a wise strategy, but most health care experts recommend talking with your primary care provider before choosing to adopt a ketogenic diet.

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