# Ketogenic Diet and Cancer

Can the ketogenic diet cure cancer?

May 19, 2019 By Danielle Penick

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Suddenly, the ketogenic diet caught national attention in 1994, when NBCs Dateline covered a story on a 2-year-old named Charlie who suffered from intractable seizures. All of Charlie's prior medical therapies were unsuccessful and his father Jim got desperate. Jim took his son to Johns Hopkins Hospital, where his son was prescribed the ketogenic diet that was managed by a team of two doctors and a dietician. He saw the quick success of this diet for his son's refractory seizures. Charlie's father, Jim Abrahams, was a Hollywood producer so he used his resources to make a short documentary about the ketogenic diet as a guide for others. That same year, a multi-center prospective study started with the results presented a few years later to the American Epilepsy Society and then were published in 1998. Shortly thereafter, scientific interest in the diet skyrocketed.

*Keto revival—what's old is new*

Because of recent national attention, we often think of the ketogenic (or keto for short) diet as relatively new, but the diet was actually developed in the early 1920s. It was created as a therapy to help suppress seizures in children with a certain type of epilepsy that were not responsive to medications, which is what made Charlie a good candidate for the diet. But how did it originate?

The idea of the keto diet actually stemmed from fasting. In Greece, since at least 500 BC physicians began using fasting to treat epilepsy. It was speculated that over eating might be a cause of seizures. But it wasn't until 1911 when the first modern study of fasting as a treatment for epilepsy was conducted in France. Eventually fasting was adopted by neurologists in standard medical practice. Physicians and researchers continued to adjust fasting into different diets and researching the outcomes, as humans by default are pretty averse to starvation. They were hopeful there was another way to eat that would mimic fasting. Researchers found that when carbs aren't readily available, two types of chemicals produced in the liver (called ketones) are used as energy sources — β-hydroxybutyrate, and acetoacetate. These were found to be produced when healthy people were starved or when they were eating an extremely low carb diet. Eventually the ketogenic diet was born.

Dr. Russell Morse Wilder was the first to trial the use of the keto diet at the Mayo Clinic as a potential treatment for epilepsy. The diet demonstrated to be incredibly successful for children and some adults even seemed to benefit. Eventually it made it to medical textbooks by 1940. The diet was used for over two decades, but then was largely abandoned with the advancement of

anti-epileptic drugs. Surprisingly, the keto diet was largely not studied again until after NBCs Dateline coverage in the 1990s.

As of today, it is still an accepted medical treatment and prescription for some types of seizures in children. All of the hospitals I have worked at include this diet in their medical nutrition therapy protocols for patients that met the criteria, which included a team to manage patients who are appropriate for the diet. Typically it included a registered dietitian, a neurologist (doctor that treats brain and nervous system disorders), a nurse, and a pharmacist (to evaluate the carb content of medications) who are all familiar with childhood epilepsy. Because of the complexity of the diet and risks of complications during the start of the keto diet, most hospitals monitor patients under close medical supervision in the hospital. Adjustments to the diet can be made accordingly. Additionally, now we know there is a diet connection with many other brain disorders, including brain cancer.

*What is the Keto diet exactly?*

Simply put, it's an extreme version of the Atkins or Paleo diet. It is incredibly low in carbohydrates (about 5%), has a moderate amount of protein (about 15%), and extremely high in fat (about 80%). But there are also different versions of the diet you will see online. To put the carb amount into perspective, someone on a 2000 calorie diet would only be able to eat about 25 grams of carbs per day—this is equivalent to the carbs in an average sized apple! Conversely, most American's eat about 50% of calories from carbs, 30% fat, and 20% protein.

Low carb foods mostly include meat, seafood, eggs, most fats and oils, high-fat diary products, some nuts, non-starchy veggies, minimal fruits (mostly berries), artificial sweeteners, and unsweetened beverages. Grains, starches, legumes, most fruits, starchy veggies, sugar, and most alcohol are not allowed.

When we eat carbs, our bodies convert them into glucose (sugar), which is delivered to our cells from the blood. The healthy cells in our body take in the glucose and used it for reactions in the body with oxygen, in order to produce energy. Our body—especially our brain—prefer glucose for its fuel or energy source. But if you cut carbohydrates from the diet, your body will convert fat stores into fatty acids and then into ketone bodies. Ketone bodies are acids made by your liver and then sent to your bloodstream. These pass into your brain as an energy source when glucose is not available (also called ketogenesis). When ketone bodies are present at elevated levels in the blood this is referred to ketosis and this usually happens in a relatively short time—after 72 hours. Our brains are very energy demanding organs and use about 20% of the calories we eat. During times of starvation, ketogenesis has been an energy backup system in humans.

*The idea behind the Keto diet as a potential therapy with cancer?*

Almost 100 years ago, during the 1920s, a Nobel laureate scientist named Otto Warburg (known as the father of modern biochemistry) discovered that cancer cells promote their growth by metabolizing large quantities of glucose. He found that cancer cells—unlike healthy cells—appeared to be turning glucose into energy without the use of oxygen, even when oxygen

was abundant. It was observed in about 80% of cancers and this process was later termed the Warburg Effect. The cancer cells that use this oxygen free pathway need to obtain energy, they require more glucose to produce the same energy as an oxygen using cell. He firmly believed that he found the primary cause of cancer.

Because this led to the idea that glucose (or sugar) feeds cancer, some concluded that cutting all sugar by following a low carb diet, could treat or cure cancer. By following a very low carb diet, you will reduce the glucose that circulates in your bloodstream, induce ketosis, and by default should starve your cancer cells of energy. Your normal cells can then adapt their metabolism by using the ketones as their fuel and survive when glucose is not available. But your cancer cells might not be able to use ketones quite as well, as some cancers do not possess the ability to metabolize ketone bodies.

The sugar feeding cancer theory is rampant, however ideas around it are often inaccurate. There's a lot of misleading information online about sugar and cancer as I've written about here. Today, scientists now know that cancer is a result of cells with mutations of the cell genome or an accumulation of chromosomal changes. They also know cancer cells change their metabolism due to these genetic defects and it is not necessarily a result of why the tumors develop and increase. The Warburg Effect remains controversial.

*Research*

Everyday social media influencers, the media, personal bloggers, celebrities, TV stars, some alternative and holistic practioners, and the public proclaim that this diet can cure cancer, cure diabetes, or just about anything else you can think of. But is there any merit to this diet as a potential cancer therapy? What does the scientific evidence find?

At this time research is unclear and has conflicting findings. The majority of the research on the keto diet and cancer are lab and animal studies. As mentioned in prior posts, these studies don't always translate the same way in humans. There are some human studies, but they are limited at this time—they are mostly small, based on single case studies, short-term due to poor compliance to the diet (or don't have dietary guidance that is standardized) and don't include less advanced cancers. But despite this, some of the data from the first clinical studies does support the hypothesis of the ketogenic diet and the anti-tumor effect.

A few human studies have shown promise for those with certain types of brain tumors. It's possible that the ketogenic diet can suppress tumor growth and sensitize some cancer cells to chemotherapy and radiation therapy to aid in enhancing treatment effectiveness without requiring calorie restriction (i.e. fasting). Other researchers are investigating more clinical trials to see if this might be the case.

Thus far it appears that the use of the keto diet depends on the tumor type and the specific genetic alterations. There are numerous pre-clinical studies in those with neuroblastoma that have provided evidence for anti-tumor effects in those with or without chemotherapy. There appears to be little effect in those with astrocytoma and medulloblastoma as well. Additionally, research has

shown good evidence for prostate, pancreatic, colon, and lung cancers. There is limited evidence for stomach and liver cancers as well. It's possible it may be better for solid tumors overall. Currently there is strong evidence for use of the diet in patients with glioblastoma. But specific recommendations in patients with this type of cancer requires data outcomes from ongoing randomized control trials. Conversely, some research has revealed that very low fat diets have been found to reduce recurrence for certain types of breast cancers.

A more recent systematic review published in 2018 finds that rigorously reviewed evidence for the keto diet is lacking. Additionally, they find that some patients may experience weight loss, muscle wasting, and severe inflammation—all of which can lead to poor quality of life or morbidity. The authors find that there is not strong conclusive evidence for clinical practice now.

To date not a single major health organization has recommended the keto diet for cancer patients or for cancer prevention—this includes the American Institute of Cancer Research. There are possible applications for the diet, but currently they still lack rigorous testing. Additionally, other disease related health claims continue to be researched as well. At this time it appears that the keto diet could one day be a part of adjuvant treatment recommendations for some cancers with chemotherapy and/or radiation.

Some considerations if you're thinking about following the diet:

*Conclusions*

It’s paramount to talk with your team if you want to follow this diet. The ketogenic diet is not a benign treatment. It’s possible that it’s helpful for some people and may be harmful to others, as different diets work for different people. Some complications may result such as constipation, nausea, vomiting, low blood sugars, increased cholesterol, low grade acidosis, bone fractures, stunted growth in children, kidney stones, weight loss, and dysmenorrhea. Additionally, the keto diet strictly limits many plant based foods such as starchy veggies, whole grains, most fruits, and legumes. You could be missing out on fiber, certain vitamins, minerals, and other healthy cancer preventing compounds that are found in plant foods.

In some, this diet can result in malnutrition, which may cause treatment delays or fatigue. For those who are at risk of malnutrition or who are underweight, this diet may not be ideal. Thus far, from what we know, the metabolic effects of the keto diet can vary and the effects on cancer treatments are still largely unknown. Although, there is clear-cut evidence that eating a diet rich in plants like vegetables, fruits, whole grains, and legumes, while limiting red meat, other animal foods, and limiting alcohol will reduce the risk of cancer and other comorbidities. More variety in our diets provides us with the nutrition we need for health.

Work with your medical care team, and more specifically an oncology dietitian, to decide what your nutrition goals are. They can help determine how many calories, grams of protein, fat, and

carbs are appropriate for you. This can change with each stage of your cancer, side effects your experiencing, your labs, your past medical history, and your cancer type. There are problems with oversimplification as nutrition is not a one-size-fits-all approach. From what we know with science, ascribing one particular cause or cure for cancer is an under-generalized idea.

Because it's relatively easy to study ketosis and ketogenesis, we have known about this diet for a long time. It's safe to say there are sound reasons that this diet is not considered a "miracle cure-all." It's not about "big Pharma" trying to suppress the diet! I've written about this before here. My advice to you is don't use the ketogenic diet alone to cure cancer and don't do it without medical supervision if you choose to follow the diet. At this time there is a lack of conclusive evidence in clinical practice, but I think that there is more to come so stay tuned! Based on finding's of rigorous preclinical and clinical studies conducted, the keto diet does look like a promising option for certain types of cancers as an adjuvant therapy.

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