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# Conditions Shown to Benefit From a Ketogenic Diet

By Dr. Mercola

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Obesity and top killers such as diabetes, heart disease, Alzheimer's and cancer have something significant in common — they're all rooted in insulin and leptin resistance.

In other words, the underlying problem is metabolic dysfunction that develops as a result of consuming too many net carbohydrates (total carbs minus fiber) and/or protein. Sugars found in processed foods and grains are the primary culprits, and the standard American diet is chockfull of both.

Once you develop insulin and leptin resistance, it triggers biochemical cascades that not only make your body hold on to fat, but produce inflammation and cellular damage as well.

Hence, whether you're struggling with weight and/or chronic health issues, the treatment protocols are the same. This is good news, as it significantly simplifies your approach to improving your health. You won't need a different set of strategies to address each condition.

In short, by optimizing your metabolic and mitochondrial function, you set yourself squarely on the path to better health. So how do you correct these metabolic imbalances? Your diet is key. The timing of your meals can also play an important role.

## Nutritional Ketosis May Be Key for Optimal Health

By eating a healthy high-fat, low-carbohydrate and low- to moderate-protein diet, you enter into what is known as nutritional ketosis: a state in which your body burns fat as its primary fuel rather than glucose (sugar). Mounting research suggests nutritional ketosis is the answer to a long list of health problems, starting with obesity.

In fact, emerging scientific evidence suggests a high-fat, low-net carb and low- to moderate-protein diet (in other words, a diet that keeps you in nutritional ketosis) is ideal for most people.

In fact, endurance athletes are turning away from conventional high-carb strategies and adopting this way of eating because it boosts physical stamina and endurance.

Beyond insulin resistance and type 2 diabetes, there are a number of applications for nutritional ketosis, including as a treatment for seizures, especially in kids who are unresponsive to drugs, and in neurological conditions such as Alzheimer's and Parkinson's. Cancer is another area where ketogenic diets show great promise.

Other benefits include fewer hunger pangs and a dramatic drop in food cravings once you've made the shift from burning sugar to burning fat as your primary fuel. Being an efficient fat burner may also boost your longevity. Researchers have identified about a dozen genes associated with longevity.

According to Jeff Volek, Ph.D., a registered dietitian and professor in the Human Science Department at Ohio State University, who has done enormous work in the field of high-fat, low-carbohydrate diets and has authored several books on this topic, the primary function of one of these genes is to cripple the degradation of branched-chain amino acids (BCAAs), such as leucine.

Preventing this degradation can help preserve your muscle mass.<sup>1</sup> BCAAs have other benefits as well: In a number of studies involving middle-aged animal models, adding BCAAs increased muscle and cardiac mitochondrial biogenesis (the creation of new mitochondria), improving both health span and longevity.

Interestingly, BCAAs are very similar in structure to ketones — energy molecules created by your liver from fats — and ketones seem to be preferentially metabolized.

In other words, ketones spare those branched-chain amino acids, leaving higher levels of them in circulation while also helping you retain muscle mass and promoting longevity.

## **Ketones — A Healthy, Clean-Burning Fuel**

The primary reason that so many people are overweight and/or in poor health these days is that the Westernized diet is overloaded with non-fiber carbs as the primary fuel, which in turn inhibit your body's ability to access and burn body fat.

High-quality fats, meanwhile, are a far preferable fuel, as they are utilized far more efficiently than carbs. When you burn fat as your primary fuel, your respiratory quotient (the amount of oxygen you need) typically goes down,<sup>2</sup> which is a sign that your metabolism is running more efficiently.

## **How to Enter Into Nutritional Ketosis**

The most efficient way to train your body to use fat for fuel is to remove most of the

sugars and starches from your diet, and that's true for everyone, whether you're an elite athlete or a sedentary diabetic. At the same time, you'll want to replace those carbs with healthy fats.

A dietary intake of about 50 grams or less per day of net carbs while also keeping protein low-to-moderate is usually low enough to allow you to make the shift to nutritional ketosis (the metabolic state associated with an increased production of ketones in your liver; i.e., the biological reflection of being able to burn fat).

This is only a generalization, as each person responds to foods in a different way. Some people can enter into full ketosis while eating as much as 70 to 80 grams of non-fiber carbs. Others, especially if you're insulin resistant or have type 2 diabetes, may require less than 40 grams, or even as little as 30 grams per day, to get there.

To find your personal carb target, it's important to measure not just your blood glucose but also your ketones, which can be done either through urine, breath or blood.

This will give you an objective measure of whether or not you're truly in ketosis, rather than just relying on counting the grams of carbohydrates you consume. Nutritional ketosis is defined as blood ketones that stay in the range of 0.5 to 3.0 millimoles per liter (mmol/L).

That said, using a nutrient tracker will radically improve your ability to understand how much and what kind of foods help you to keep to your ketogenic diet nutrient targets while also helping you to assess the nutrient value of your food choices.

My first choice is [Cronometer.com/mercola](https://www.cronometer.com/mercola). That's my upgrade to the basic Cronometer nutrient tracker, and the default is set to macronutrient levels that will support nutritional ketosis.

## **Avoid Milk and Consider MCT Oil**

Aside from added sugars and grains, it is best to avoid milk for the time being, as it can be difficult to stay in ketosis if you eat or drink a lot of it.

The galactose in milk is a carbohydrate and you can easily exceed your net carb allotment by drinking a single glass of milk. Casein, the primary protein in milk, can also trigger or contribute to inflammation.

When you keep net carbs low, your body switches to burning fat for fuel and your liver begins to convert some of that fat into ketone bodies. This is endogenous production, meaning that they are made by your body from your fat stores or from the fats in the foods that you eat.

You can boost your level of ketones by taking them in supplement form, but these exogenous ketones (made in a lab, not in your body) are not likely to be as beneficial unless you are already “low carb.” Food oils such as medium chain triglyceride (MCT) coconut oil can also be used to mildly increase ketone levels.

## **Ketogenic Diet Has Long Track Record of Use for Epileptic Seizures**

Authority Nutrition reviews 15 health conditions shown to respond favorably to a ketogenic diet,<sup>3</sup> and that’s likely a short list.

Based on my understanding of mitochondrial health and metabolic function, a vast majority of health conditions could fall into this category. One of the conditions for which a ketogenic diet has the longest and best documented track record is epilepsy

This diet has been effectively used to treat drug resistant epileptic seizures since the 1920s,<sup>4</sup> and studies have confirmed it’s helpful for both children and adults.

In my view, it would be wise to implement a ketogenic diet as a first-line therapy, but in conventional medicine, it’s typically not considered or recommended unless the patient fails to respond to medication.

Even then, this conversation may have to be initiated by the patient, or the parent of a child with seizures. As noted in the featured article:<sup>5</sup>

*“Research shows that seizures typically improve in about 50 percent of epilepsy patients who follow the classic ketogenic diet. This is also known as a 4:1 ketogenic diet because it provides four times as much fat as protein and carbs combined.*

*The modified Atkins diet (MAD) is based on a considerably less restrictive 1:1 ratio of fat to protein and carbs. It has been shown to be equally effective for seizure control in most adults and children older than two years of age.”*

## **Nutritional Ketosis Improves Your Brain Health**

Your brain will work better in general when burning fat rather than glucose, as fat has been shown to be both neurotherapeutic and neuroprotective. While fats are unable to cross the blood brain barrier, ketones, being water-soluble fats, can cross it and feed your brain. They also appear to lower markers of systemic inflammation, such as IL-6 and others. Many times, improved cognition and mental acuity are among the first things people notice when entering nutritional ketosis.

Ketones are the preferred source of energy for your brain in general, but especially for

those affected by diabetes, Alzheimer's, Parkinson's and maybe even ALS, because in these diseases certain neurons have become insulin resistant or have lost the ability to efficiently utilize glucose, which causes the neurons to die off. When ketones are present, these neurons have a better chance of surviving and thriving.

In one study, Parkinson's patients who followed a 4-to-1 ketogenic diet experienced, on average, a 43 percent improvement in their symptoms after one month.<sup>6</sup> For Alzheimer's, supplementing with MCT oil appears to be particularly beneficial.

Studies also support the use of nutritional ketosis for autism. As noted in the featured article, "Autism shares some features with epilepsy, and many people with autism experience seizures related to the over-excitement of brain cells." Research shows nutritional ketosis helps dampen this excessive activity; in one pilot study, a majority of autistic children showed improvement after following a cyclical ketogenic diet for six months.

Unlike blood glucose, blood ketones do not stimulate an insulin surge. They also do not need insulin to help them cross cell membranes, including neuronal membranes. Instead, they use simple diffusion, so they can even enter cells that have become insulin resistant. This is likely one of the reasons nutritional ketosis works so well for a variety of neurological problems and diseases. It even shows promise for:

- **Migraine headaches:** Following a ketogenic diet for four weeks has been shown to reduce migraine frequency and lower the use of pain medication.
- **Traumatic brain injuries:** Animal studies suggest it can help reduce brain swelling, improve motor function and speed up recovery, although it appears more effective in the young than the old. Human studies still need to validate these findings.

## **Metabolic Conditions Improve on Ketogenic Diet**

Nutritional ketosis is also indicated for obesity, metabolic syndrome (prediabetes) and diabetes. This is not surprising, considering the fact that one of its beneficial effects is correcting insulin resistance. If you meet at least three of the following criteria, you may be diagnosed with metabolic syndrome: abdominal obesity, elevated triglycerides, low HDL cholesterol, high blood pressure and/or elevated fasting blood sugar. Nutritional ketosis has been shown to improve most of these.

Nonalcoholic fatty liver disease (NAFLD), which is strongly associated with obesity, type 2 diabetes and metabolic syndrome, has also been shown to improve on a low-carb diet high in healthy fats. In one study,<sup>13</sup> obese men diagnosed with metabolic syndrome and NAFLD showed significant improvement in their weight, blood pressure, liver

enzymes and liver fat after four months on a ketogenic diet; 21 percent completely resolved their NAFLD.

Glycogen storage disease (GSD) and glucose transporter 1 (GLUT1) deficiency syndrome are two other conditions for which a ketogenic diet is a literal life saver. GSD is characterized by a lack of an enzyme that helps store glucose as glycogen or break glycogen down into glucose. The exact form of the disease depends on which enzyme in question that's lacking. As noted by Authority Nutrition:

*"GSD patients are often advised to consume high-carb foods at frequent intervals so glucose is always available to the body. However, early research suggests that a ketogenic diet may benefit people with some forms of GSD, [for example] GSD III, also known as Forbes-Cori disease ... [and] GSD V, also known as McArdle disease ... "*

In GLUT1 deficiency syndrome (a rare genetic disease), you lack a protein that helps shuttle blood sugar into your brain. Seizures and impaired motor skills are two common symptoms that typically manifest shortly after birth. The benefit of a ketogenic diet is quite apparent in this case, as ketones do not need this protein in order to enter your brain. Hence ketones are an ideal fuel for GLUT1 deficient people, allowing their brains to function more normally.

## **Hormonal and Nervous System Disorders May Improve on Ketogenic Diet**

Your hormone regulation and nervous system may also benefit from being an effective fat burner. Polycystic ovary syndrome (PCOS) and multiple sclerosis (MS) are two conditions that appear to respond well to this switch in primary fuel. PCOS, which puts women at an increased risk of developing insulin resistance, diabetes, infertility, coronary artery syndrome, lipid disorders (such as elevated cholesterol and high blood pressure) and possibly breast cancer, is characterized by:

- Hyperinsulinemia (insulin resistance with elevated serum insulin levels)
- Increased androgen (male hormone) production, causing facial hair and/or acne
- The complete or almost complete lack of ovulation
- Obesity

In one study, women diagnosed with PCOS who followed a ketogenic diet for six months lost an average of 12 percent of their body weight and reduced their fasting insulin by an average of 54 percent. Levels of sex hormones also showed improvement, and 2 of the 11 women were able to get pregnant despite a history of infertility.

MS, an autoimmune disease, results in damage to the myelin sheath (the protective nerve

covering), causing symptoms such as numbness, loss of balance and declining motor function, as well as vision and memory problems. As noted in the featured article: “One study of MS in a mouse model found that a ketogenic diet suppressed inflammatory markers. The reduced inflammation led to improvements in memory, learning and physical function.”

## **Nutritional Ketosis May Be the Key to Cancer Prevention**

Cancer is a devastating disease, and today it’s hard to find anyone whose life hasn’t been affected in some way by this disease. In fact, it’s become one of the leading causes of death around the world. What’s worse, the medical profession is largely ignorant of the fact that most cancers are rooted in metabolic and mitochondrial dysfunction, and hence the conventional prevention recommendations do little to nothing to quell the tide of cancer diagnoses.

It is my belief, as well as that of many of the experts I have interviewed, that over 90 percent of cancer cases are either preventable or treatable. The key is recognizing that cancer is really a mitochondrial metabolic disease, rooted in poor diet choices combined with a toxic lifestyle.

Viewing cancer as a metabolic disease — opposed to a disease of damaged DNA, which is a downstream effect of mitochondrial dysfunction — gives us the power to control this dysfunction by carefully choosing foods and nutrients and employing strategies that help optimize the biochemical pathways that suppress cancer growth while simultaneously stimulating mechanisms to push it into remission.

Nutritional ketosis has received a lot of attention by cancer researchers in recent years, and many studies show it has great potential not just as a form of cancer prevention but also treatment — in combination with other treatments such as chemotherapy and radiation. Research is looking at whether non-toxic metabolic therapies and drug cocktails may be just as effective, with less toxicity.

In fact, according to Dr. Thomas Seyfried, who is one of the leading academic researchers of nutritional interventions for cancer, the mechanism by which the ketogenic diet manages cancer is far clearer and more readily understood than the way the ketogenic diet manages epileptic seizures. This is ironic considering that it's barely recognized, let alone applied, within oncology circles, while it's been an accepted treatment for epilepsy since the 1920s.

The central premise is that since cancer cells need glucose and insulin to thrive, lowering the glucose level in your blood through carb and protein restriction literally starves the

cancer cells. Additionally, low protein intake tends to dampen the mTOR pathway that is often responsible for accelerating cell proliferation.

## **Correcting Metabolic Dysfunction and Optimizing Mitochondrial Health Paves the Way for a Long, Healthy Life**

I have come to recognize that mitochondrial dysfunction is at the core of what is causing your system to go haywire. You have thousands of mitochondria in nearly all of your cells and they generate around 90 percent of the energy you need for health and survival.

When large numbers of them cease to function properly, your body can no longer function as intended, setting you up for developing any number of diseases. For some, it may manifest as diabetes or heart disease; in others, it shows up as cancer or some form of neurodegenerative disease.

The remedy lies in optimizing your mitochondrial function and correcting the metabolic dysfunctions of insulin and leptin resistance. Here, we have focused on the benefits of a ketogenic diet, which means eating foods high in healthy fats, with moderate protein and low net carbs (think non-fiber carbs).

The choices you make in dietary fats are really critical, as fatty acids contribute to the formation of cellular membranes, and it's virtually impossible to have optimal biological function with impaired cell membranes. So dietary fat serves two purposes; first, as a fuel, but also as the building blocks for the structural components of your body.

Most Americans unknowingly consume large quantities of harmful fats, like processed vegetable oils, which contribute to your deterioration over time. So when I talk about dietary fats, I'm referring to natural, unprocessed fat, found in whole foods like seeds, nuts, butter, olives, avocado, coconut oil, raw cacao or cacao butter. But also remember that MCT oil has some great health benefits as well.

## **Other Strategies That Promote Healthy Fat Burning**

Two other strategies that will help you make the transition from burning sugar to burning fat as your primary fuel are:

- **Extended or intermittent fasting, such as Peak Fasting.** Intermittent fasting is an alternative to extended fasts. While I used to recommend skipping breakfast and making lunch your first meal, I eventually learned that for most, skipping dinner is a far more effective strategy.

This is because you are the least metabolically active while you are sleeping, so the last thing you want to do is add fuel you don't need in the evening. Doing so will simply generate excess dangerous free radicals.

However, this may be enormously challenging for most people to implement. It's easy for most people in nutritional ketosis to skip breakfast because they're not hungry anyway but skipping dinner may seem more like a hardship. Most people view breakfast as an obligation and dinner as more of a social event. If you can't skip dinner, allow at least three to six hours between this last meal and bedtime.

The challenge then becomes to determine the most appropriate time to eat your breakfast. I wear a 24-hour glucose monitor and I have learned that I can pin-point the ideal time to break my fast by tracking my glucose. You can, too, even without this specialized monitor. Simply measure your glucose at regular intervals in the morning, and when you notice your glucose level rising, even though you haven't eaten, it's a sign you're undergoing gluconeogenesis.

Basically, your body is starting to break down protein (muscle), turning it into glucose. This is not a healthy process, so when this occurs, you'll want to eat something to avoid muscle degeneration. In my experience, that will typically occur after 16 hours of fasting or so, although it's highly individual. If you're a competitive athlete, this strategy may not be appropriate, but it could work for most average people.

• **Exercising** is a great way to increase mitochondrial repair and regeneration as it is a potent stimulus of PGC1 alpha which is likely the most potent stimulus in your body for mitochondrial biogenesis.