

The effect that ketogenic diets have on cancer is rooted in how cells make energy to sustain themselves. Most normal cells can make energy by burning sugar or glucose in a pathway called glycolysis. Normally, glycolysis makes products which feed into mitochondria, tiny "powerhouses" in each cell. The main job of mitochondria is to make and regulate the production of ATP, the energy source that runs all living things.

In order to stay alive, cells have to be able to make ATP and maintain the "free energy" of ATP at a specific level common to all cells. If there is too little ATP, a cell will become apoptotic (suicidal) and die. If there is too much ATP, cellular respiration gets interrupted in the mitochondria and this can also kill the cell.

Normal, healthy cells have metabolic flexibility to make and regulate free energy levels through glycolysis or through mitochondrial pathways which require oxygen. Healthy cells are able to utilize all fuels, including glucose, oxygen, fatty acids, and ketones to make ATP and regulate energy flow through the cell.

In contrast, most cancer cells have mitochondria which are broken in some way. They are unable to use mitochondrial energy pathways to burn oxygen dependent fuels such as fatty acids and ketones. To maintain free ATP at the necessary levels, they must rely on glycolysis even when oxygen is available. They do this by "fermenting" glucose into a product called lactate.

This lack of flexibility means cancer cells are dependent upon and must increase the rate of glycolysis and lactate production to keep themselves alive. The lactate they produce is recycled into glucose for the glycolytic pathway in the tumor. In this circular way, cancer cells sustain themselves energetically without the oxygen needed for cellular respiration in mitochondria.

Hence, the **availability of glucose is a critical need for cancer**. Glucose is the main fuel cancer cells use to thrive, and the more glucose and insulin available in the bloodstream, the more glucose is available to allow cancer to sustain itself via glycolysis and fermentation.

Excess glucose in the bloodstream comes from eating an abundance of carbohydrates. If instead, a person with cancer adopts a ketogenic diet designed to treat tumors, it reduces the amount of carbohydrate that a person consumes, which reduces blood glucose levels. This puts cancer cells under some serious metabolic stress. As glucose and insulin levels fall, cancer cells are faced with a fuel shortage.

The important thing to understand is that because of their broken metabolism, **cancer cells are vulnerable to any diet which sharply lowers blood sugar**. It follows that prescribed cancer treatments should take advantage of this vulnerability.

Dr. Otto Warburg, one of the twentieth century's leading biochemists, discovered this preference for glycolytic fermentation in cancer cells in the 1920s. His

hypothesis that cancer cells preferred glucose (blood sugar) as a fuel is called the **Warburg Hypothesis**. Recent research and some new information on cancer cell metabolism and metabolic treatments has brought Dr. Warburg's hypothesis back into focus.

Ketosis as a Cancer Treatment

The main idea behind the use of a ketogenic diet to treat cancer is to deprive the cancer cells of the glucose and other fuels they need to survive, and provide support for the mitochondrial respiration processes in healthy tissues.

When glucose or blood sugar is lowered via the diet, normal cells can switch to burning ketone bodies for fuel and survive quite nicely, while the cancer cells are starved of the glucose they need to grow. This is not to say that mainstream treatments shouldn't be included, but a ketogenic diet does give a person with cancer some control over the disease and treatment protocols.

In fact, the research looking at the effects of [ketosis](#) on cancer cells shows there are some huge advantages in using a ketogenic diet as cancer therapy.

1. First, the diet is non-toxic to the rest of the body, and actually supports the health and metabolism of normal cells, even through mainstream cancer treatments. It literally helps the patient weather the toxic effects of chemo and radiation more easily.
2. Secondly, it increases the effectiveness of mainstream treatments. In other words, it makes tumor cells more sensitive to radiation and chemotherapy so that these treatments are more likely to be successful in killing cancer cells.
3. Third, it seems to push cancer cells to into a genetic expression which is more like normal cells.

Fats and Oils

Since the majority of calories on a ketogenic diet will come from dietary fats, choices should be made with digestive tolerance in mind. Most people cannot tolerate eating a large amount of vegetable oil, mayonnaise or even olive oil over time. And this is a good thing, since vegetable oils are high in polyunsaturated Omega-6 fatty acids. The Omega-6 fatty acids (found in nut oils, margarine, soybean oil, sunflower oil, safflower oil, corn oil, and canola oil) trigger inflammation within the body and they will make you sick if they are your only fat source. In addition, cooking with them is not recommended.

Most nuts (with the exceptions of macadamias and walnuts) are high in Omega 6 fatty acids as well, so go easy on them). However, there are polyunsaturated fats which are essential and these are the Omega 6 and Omega 3 fats. Your intake of Omega 6 and Omega 3 types should be balanced, and you only need about a teaspoon a day. Eating wild salmon, tuna and shellfish will provide balancing

Omega 3 fatty acids are an important part of a low carb food list. A few nuts or some mayonnaise will provide the Omega 6. If you don't like seafood, then consider taking small amounts of a fish or krill oil supplement for Omega 3s.

Saturated and monounsaturated fats such as butter, macadamia nuts, coconut oil, avocado and egg yolks are tolerated more easily by most people, and since they are more chemically stable, they are less inflammatory. Fats and oils can be combined in sauces, dressings, and other additions to basic meals. Over time, it will become a habit to add a source of fat to each meal.

Avoid hydrogenated fats such as margarine to minimize trans fats intake. If you use vegetable oils (olive, canola, sunflower, safflower, soybean, flaxseed and sesame oils) choose "cold pressed." Keep cold pressed oils like almond and flaxseed refrigerated to avoid rancidity. Avoid heating vegetable oils. Use clean non-hydrogenated lard, beef tallow, coconut oil, ghee and olive oil for frying, since they have high smoke points.

- Avocado (very high in fat, so I'm including it here)
- Avocado oil
- Almond oil
- Beef tallow, preferably from grass fed cattle
- Butter: try to find organic sources
- Chicken fat, organic
- Duck fat, organic
- Ghee (butter with milk solids removed)
- Lard such as organic leaf lard (make sure it is NOT hydrogenated)
- Macadamia Nuts
- Macadamia oil
- Mayonnaise (most have carbs, so count them. Duke's brand is sugar free.)
- Olives
- Olive oil, organic
- Organic coconut oil, coconut butter and coconut cream concentrate
- Organic Red Palm oil
- Peanut Butter: make sure to use unsweetened products, and limit due to Omega 6 content.
- Seed and most nut oils: Sesame oil, Flaxseed oil, etc. These are higher in inflammatory Omega 6 fats, so limit amounts, and don't heat them.
- 85-90% dark chocolate can be used in small amounts, or use Chocoperfection low carb chocolate.

Sources of Protein

Fattier cuts of meat are better because they contain less protein and well, more fat. Choose organic or grass fed animal foods and organic eggs if possible to minimize bacteria, antibiotic and steroid hormone intake. These clean proteins are the best choices for a low carb food list.

- Meat: beef, lamb, veal, goat and wild game. Grass fed meat is preferred, as it has a better fatty acid profile.
- Pork: pork loin, Boston butt, pork chops, ham. Look out for added sugar in hams.
- Poultry: chicken, turkey, quail, Cornish hen, duck, goose, pheasant. Free range is better if it's available.
- Fish or seafood of any kind, preferably wild caught: anchovies, calamari, catfish, cod, flounder, halibut, herring, mackerel, mahi-mahi, salmon, sardines, scrod, sole, snapper, trout, and tuna.
- Tuna and salmon are acceptable.
- Shellfish: clams, crab, lobster, scallops, shrimp, squid, mussels, and oysters. (Exception: imitation crab meat. It contains sugar, gluten and other additives.)
- Whole eggs: These can be prepared in various ways: deviled, fried, hard-boiled, omelets, poached, scrambled, and soft-boiled.
- Bacon and sausage: check labels and avoid those cured with sugar or which contain fillers such as soy or wheat. Specialty health food stores carry most brands of sugar-free bacon.
- Peanut butter and soy products such as tempeh, tofu and edamame are good sources of protein, but they are higher in carbohydrate, so track them carefully.
- Whey protein powders, plus rice, pea, hemp or other vegetable protein powders. Be aware that whey protein is insulinogenic (meaning it causes an insulin spike) in the body, so if you having trouble losing weight or getting into ketosis, limit amounts or avoid whey.

Fresh Vegetables

Most non-starchy vegetables are low in carbs. Choose organic vegetables or grow your own to avoid pesticide residues. **Avoid the starchy vegetables such as corn, peas, potatoes, sweet potatoes, and most winter squash as they are much higher in carbs.** Limit sweeter vegetables such as tomatoes, carrots, peppers, and summer squashes. This list is by no means comprehensive, so if there is a green vegetable you like that is not on this low carb food list, feel free to include it.

- Alfalfa Sprouts
- Any leafy green vegetable
- Asparagus
- Avocado
- Bamboo Shoots
- Bean Sprouts
- Beet Greens
- Bell peppers*
- Bok choy
- Broccoli
- Brussels sprouts
- Cabbage
- Carrots*
- Cauliflower
- Celery
- Celery root
- Chard
- Sauerkraut (watch for added sugar)
- Scallions
- Shallots
- Snow Peas
- Spinach
- Sprouts
- Summer squash*
- Swiss chard
- Tomatoes*
- Turnips
- Water chestnuts
- Chives
- Collard greens
- Cucumbers
- Dandelion greens
- Dill pickles
- Garlic
- Kale
- Leeks
- Lettuces and salad greens (arugula, Boston lettuce, chicory, endive, escarole, fennel, mache, radicchio, romaine, sorrel.)
- Mushrooms
- Olives
- Onions*
- Radishes

* Limit amounts of these vegetables, as they are higher in carbs.

Dairy Products

Raw milk products are preferable; choose organic if raw products are not available. Be aware that dairy proteins (whey and casein) are insulinogenic (meaning they cause an insulin spike) in the body, so if you having trouble losing weight or getting into ketosis, limit amounts or avoid. I also try to avoid products that have added whey protein because whey adds to the insulin spike.

- Heavy whipping cream
- Full fat sour cream (check labels for additives and fillers. Look for brands such as Daisy which are pure cream with no added milk; carbs and protein will be low.)
- Full fat cottage cheese
- All hard and soft cheeses: (count each 1 ounce portion as 1 carb generally)
- Cream cheese (count each 1 ounce portion as 1 carb generally)
- Unsweetened whole milk yogurt (limit amounts as it is a little higher in carb) (Fage full fat Greek yogurt is divine)
- Mascarpone cheese

Nuts and Seeds

Nuts and seeds are best soaked and roasted to remove anti-nutrients (activated). They are also very high in calories and higher in carbs per serving. It's very easy to eat a handful of nuts and not realize how much carb is included. If you are having trouble getting into ketosis or losing weight, reduce or avoid nuts.

- Nuts: macadamias, pecans, almonds and walnuts are the lowest in net carbs and can be eaten in small amounts. Cashews, pistachios and chestnuts are higher in carb, so track carefully to avoid going over carb limits.
- Nut flours, such as almond flour. I include this because a low carb food list shouldn't completely exclude baking. Almond flour is a great flour substitute. See my [recipe page](#) for ideas on how to use it with the foods on this low carb food list.
- Peanuts are actually legumes and are higher in protein and are also high in Omega 6 fats, so limit amounts and include protein grams in daily totals.
- Seeds (pumpkin, sunflower, sesame, etc..) are also very high in Omega 6 fats, limit amounts.
- Most nuts are high in Omega 6 fats, which increase inflammation in the body, so don't rely on nuts as your main protein source. I have found that eating too many nuts over several days makes me feel stiff and sore and ruins my mood. I attribute this to the Omega 6 fats. Your mileage may vary.

Fruit/Miscellaneous

- Berries (blueberries, strawberries, raspberries) can be enjoyed occasionally in small amounts, as they are the lowest in carbohydrate. Avoid other types of fruit as most are too high in carb and can interfere with ketosis.
- Japanese Shirataki noodles
- Pork Rinds (these are great with dip, or as a substitute for bread crumbs, but note they are also high in protein, so limit amounts)

Spices

Spices do have carbs, so be sure to count them if they are added to meals made using this low carb food list. Commercial spice mixes like steak seasoning usually have added sugar. Sea salt is preferred over commercial salt, which is usually cut with some form of powdered dextrose.

Beverages

- Clear broth, bone broth
- Decaf coffee (caffeine can drive up blood sugar)
- Decaf tea (unsweetened)
- Herbal tea (unsweetened)
- Water (filtered)
- Lemon and lime juice in small amounts
- Almond milk (unsweetened)
- Coconut milk (unsweetened, can or carton)