

comfort, the more likely it is that our limbic systems will interpret discomfort as danger, triggering our survival instinct when it isn't needed.

To avoid this, we must become more comfortable with discomfort. This can be done—consider all the discomfort that humans used to endure, and many still do, without complaint! When I was a child, my family lived in a very hot area with no air-conditioning, yet the heat didn't much bother us. It's only now that I'm used to air-conditioning that I feel I can't possibly survive without it.

Here's another example: We used to be out of contact with our colleagues and loved ones for hours every day. Only now that we have cell phones do many people become uncomfortable if they can't check their messages every 15 minutes or even more often.

If we remind ourselves that we're capable of enduring discomfort—and that most discomforts are temporary and trivial—our minds will stop associating discomfort with danger. Eventually our minds even might start associating discomfort with a sense of our own heartiness and resolve. But the only way to accomplish this is to sometimes let discomfort happen rather than rush to alleviate it.

LET IT HAPPEN

Here are some ways to let discomfort "happen"...

- If being hungry causes you discomfort, let yourself be hungry for a while each day rather than immediately reaching for a snack.
- If being lost makes you uncomfortable, occasionally drive somewhere unfamiliar without using your GPS and wander around.
- If lack of mental stimulation makes you uncomfortable, force yourself to spend time each week alone with your thoughts without turning on the TV or opening a book.
- If being out of touch makes you uncomfortable, spend some time (more than 15 minutes) with your cell phone turned off.

Don't try to distract yourself from these discomforts. Feel uncomfortable. You will grow! **BLP**



Starve Cancer to Death with the Ketogenic Diet

Explained by
Thomas N. Seyfried, PhD
Boston College

A 65-year-old woman with brain cancer had surgery to remove the tumor, but the operation couldn't remove it all. The woman started following the *ketogenic diet*—a diet very high in fat, moderate in protein and very low in carbohydrate. She also had chemotherapy and radiation. After six weeks on the diet, a brain scan showed that the tumor had disappeared. A brain scan five months later showed it was still gone. However, the patient stopped the diet—and a scan three months later showed that the tumor had returned.

Yes, a special diet called the ketogenic diet can fight cancer. It is being used to manage brain cancer and advanced (metastatic) cancer, which is when the disease has spread beyond the original tumor to other parts of the body (such as breast cancer that spreads to the liver and bones). It may be effective in fighting most, if not all, cancers, but it must be done under the supervision of an experienced oncological nutritionist.

Here, what you need to know about this little-known therapy for cancer...

HOW IT WORKS

The ketogenic diet is very high in fat—the ratio is four grams of fat to one gram of protein/carbohydrate. It has long been used to control epilepsy and is offered as an epilepsy treatment at hundreds of hospitals and clinics around the world, including The Johns Hopkins Epilepsy Center, Mayo Clinic and Mattel Children's Hospital at UCLA.

It eases epilepsy by stabilizing *neurons* (brain cells). It does so by reducing *glucose* (blood sugar), the main fuel

used by neurons, and increasing *ketones* (*beta-hydroxybutyric acid* and *acetoacetic acid*), a by-product of fat metabolism used by neurons when glucose levels are low. Reducing glucose and increasing ketones play key roles in fighting cancer as well.

The typical American diet is about 50% to 60% carbohydrate (fruits, vegetables, breads, cereals, milk and milk products, and added sugars in sweetened foods and beverages). The body turns carbohydrate into glucose, which is used for energy.

Cancer cells gorge on glucose. Eating a ketogenic diet deprives them of this primary fuel, starving the cells, which stop growing or die. Also, ketones are a fuel usable by normal cells but not by cancer cells, so this, too, helps stop cancer growth. In addition, the diet...

Puts you into a metabolic state similar to that of fasting—and fasting has repeatedly been shown to arrest cancer.

Lowers levels of insulin (the glucose-regulating hormone) and insulin-like growth factor—both of which drive tumor growth.

CASE HISTORIES

The first case report about the ketogenic diet for cancer appeared in *Journal of the American College of >>*

Bottom Line/Personal interviewed Thomas N. Seyfried, PhD, a professor of biology at Boston College and author of *Cancer as a Metabolic Disease: On the Origin, Management, and Prevention of Cancer* (Wiley). His numerous scientific articles have appeared in *Nature Medicine*, *Science*, *The Lancet Oncology*, *Proceedings of the National Academy of Sciences*, *Journal of Oncology*, *Cancer Letters*, *Journal of Neurochemistry* and many other medical and scientific journals.

» Nutrition in 1995. The ketogenic diet was used by two children with advanced, inoperable brain cancer who had undergone extensive, life-threatening radiation and chemotherapy. They both responded remarkably well to the diet.

A case report that I coauthored, published in *Nutrition & Metabolism* in 2010, told the story (see beginning of this article) of the 65-year-old woman with *glioblastoma multiforme*—the most common and most aggressive type of brain tumor, with a median survival of only about 12 months after diagnosis. Standard treatment—surgery to remove as much of the tumor as possible, plus radiation and/or chemotherapy—extends average survival time only a few months beyond that of people who aren't treated.

My viewpoint: In animal research, the ketogenic diet is the only therapeutic approach that deprives tumors of their primary fuel...stops tumor cells from invading other areas...stops the process of *angiogenesis* (blood supply to tumors)...and reduces inflammation, which drives cancer. The diet also could reduce the need for anticonvulsant and anti-inflammatory medications in brain cancer patients.

Considering how ineffective the current standard of care is for brain cancer (and for metastatic cancer), the ketogenic diet could be an attractive option for many cancer patients.

WORKING WITH AN EXPERT

The ketogenic diet for cancer is not a diet you should undertake on your own after reading a book or other self-help materials. It requires the assistance of an oncological nutritionist or other health professional who is familiar with the use of the regimen in cancer patients. Ask your oncologist for a referral.

Important aspects of the ketogenic diet include...

■ **Measuring glucose and ketone levels.** For the management of cancer, blood glucose levels should fall between 55 mg/dL and 65 mg/dL, and ketone levels between 3 mmol and 5 mmol. In order to monitor

those levels—and adjust your diet accordingly—you need to use methods similar to those used by patients with diabetes. These methods include glucose testing several times a day with a finger stick and glucose strip...daily urine testing for ketones...and (more accurate) home blood testing for ketones, perhaps done weekly.

■ **Starting with a water-only fast.** If you are in relatively good health (aside from the cancer, of course), it is best to start the ketogenic diet with a water-only fast for 48 to 72 hours, which will quickly put you in *ketosis*—the production of a therapeutic level of ketones. This fast should be guided by a health professional.

If you are fragile or in poor health, you can skip the water fast and initiate ketosis with the ketogenic diet, reducing carbohydrates to less than 12 grams a day. This should produce ketosis within two or three weeks.

■ **Macronutrient ratios and recipes.** Working with a nutritionist, you will find the fat/protein/carbohydrate ratio that works best for you to lower glucose and increase ketones...and the recipes and meal plan that consistently deliver those ratios. A food diary, a food scale and the use of a "KetoCalculator" (available on Web sites such as www.KetoCalculator.com/ketocalc/diet.asp)

are necessary tools to implement the ketogenic diet.

Helpful: The oncological nutritionist Miriam Kalamian, EdM, MS, CNS, managed her own son's brain tumor with the ketogenic diet, and she counsels cancer patients around the world in the implementation of the diet. You can find more information on her Web site, DietaryTherapies.com.

CLINICAL TRIALS

Currently, there are several clinical trials being conducted using the ketogenic diet for cancer.

■ **Brain cancer.** There are trials at Michigan State University and in Germany and Israel testing the diet's efficacy as a complementary treatment with radiation for recurrent glioblastoma...and by itself to improve the quality of life and survival time in patients with brain cancer. Michigan State University currently is recruiting patients for its trial. *Contact:* Ken Schwartz, MD, 517-975-9500, e-mail: ken.schwartz@ht.msu.edu.

■ **Pancreatic cancer.** A trial at Holden Comprehensive Cancer Center at University of Iowa is recruiting patients with pancreatic cancer for a trial using the ketogenic diet along with radiation and chemotherapy. *Contact:* Jane Hershberger, RN, BSN, 319-384-7912, e-mail: jane-hershberger@uiowa.edu.

■ **Lung cancer.** The University of Iowa also is recruiting lung cancer patients for a similar trial. The contact information is the same as for the trial on pancreatic cancer.

■ **Metastatic cancer.** The VA Pittsburgh Healthcare System is recruiting patients with metastatic cancer for a study of the effect of the ketogenic diet on quality of life, tumor growth and survival. *Contact:* Jocelyn Tan, MD, 412-360-6178, e-mail: jocelyn.tan@va.gov.

You can find out more about these trials at ClinicalTrials.gov. Enter "Ketogenic Diet" into the search engine at the site for a complete listing of cancer trials and trials testing the ketogenic diet for other conditions, including epilepsy, amyotrophic lateral sclerosis (ALS), Lafora disease (a severe neurological disease), Parkinson's disease and obesity. **BLP**

More from Dr. Seyfried

Can the Diet Prevent Cancer?

Cancer survivors and people with a family history of cancer may wonder if they should go on the ketogenic diet as a preventive measure. It is not necessary for people to follow the diet if they do not have cancer. A six-to-seven-day water-only fast done once or twice a year—under a doctor's supervision—can be effective in reducing the risk for recurrent cancer in survivors and in those individuals with a family history of cancer. Fasting reduces glucose and elevates ketones.