Investigating the Impact of Diet on Tumor Growth

In animal studies, calorie-restricted diets slowed pancreatic tumor growth more than did high-fat ketogenic diets.

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Matthew G. Vander Heiden, MD, PhD, former Damon Runyon Innovator and current mentor, says he gets a lot of questions from his cancer patients about how their diet might impact disease progression. Often, these patients have heard the hypothesis that an aggressively calorie-restricted diet or the low-carbohydrate, high-fat ketogenic diet may slow tumor growth. The logic for these diets is that cancer cells require high levels of glucose to fuel their rapid proliferation, so depriving them of sugar might throw a wrench in the works. However, as Damon Runyon Fellow Evan C. Lien, PhD, a postdoc in Dr. Vander Heiden's lab at MIT, put it: "A lot of the advice out there isn't necessarily based on very good science."

To bring the debate into the realm of good science, Dr. Vander Heiden's team, including Dr. Lien and Damon Runyon Fellow Allison N. Lau, PhD, administered normal, calorie-restricted, or ketogenic diets to mice with pancreatic tumors. To their surprise, they found that calorie restriction slowed tumor growth far more effectively than the ketogenic diet. Upon further examination, they discovered that while both diets lowered glucose levels, only the calorie-restricted diet lowered lipid levels, suggesting that lipid availability is what determines if a low-glucose environment will constrain tumor growth.

Why cancer cells need lipids to grow is no mystery—they are the main component of cell membranes. In the event of lipid depletion, cells normally use an enzyme called stearoyl-CoA desaturase (SCD) to make unsaturated fatty acids out of saturated fatty acids. Calorie restriction and ketogenic diets both impair SCD activity, but a ketogenic diet supplies enough lipids that cancer cells do not have to rely on this enzyme, whereas calorie-restricted diets do not.

This research, Dr. Lien emphasizes, was not undertaken in order to recommend a particular diet, but rather to shed light on the mechanism by which certain diets slow tumor growth, so that "we might mimic those situations for cancer therapy." Inhibiting the SCD enzyme, for example, may work as a therapeutic strategy. In the meantime, cancer patients might be wise to continue taking dietary advice with a grain of salt.

Read more in Nature.

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