

Precision Nutrition for Cancer Treatment

In the near future, it may be possible to design specific diets tailored to individual genomic profiles to starve tumors.

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[Cancer genomics](#), the study of the differences in DNA and RNA sequencing and gene expression between tumor cells and healthy cells, has given rise to precision cancer treatments that target identifiable tumor mutations. Now some scientists are seeking to identify genomically informed nutrition-based treatments, an approach called precision nutrition. “It’s not just about genes and mutations—the environment matters too,” says Evan Lien, PhD, a cancer/diet researcher at the Van Andel Institute in Grand Rapids, Michigan.

Much of the emerging research has focused on specific nutrients that tumors need but healthy cells don’t. “What really kicked this field off was the finding that some cancer cells are very dependent on an amino acid named serine,” says Lien. “About 10 years ago, some groups showed that when you give animals [with certain cancers such as pancreatic and colorectal] a serine-deficient diet, it impaired tumor growth.”

Several clinical trials are looking at the potential for amino acid nutritional interventions for the treatment of pancreatic cancer. One such trial, now recruiting participants, is being run by [Faeth Therapeutics](#) (faeth is the Welsh word for “nutrient”), a private firm founded by seven established cancer researchers to explore the potential of combining dietary interventions with pharmaceuticals to enhance response to the drugs. “We can use precision nutrition to starve tumors of what they need to grow,” explains Faeth CEO Anand Parikh, JD. “Our goal is to translate a decade of preclinical research into clinical programs.”

This trial is recruiting individuals with metastatic [pancreatic cancer](#), who generally have very poor statistical survival odds. Faeth researchers sequence RNA from tumor biopsy samples and then create specific diets for individuals. About 80% of the patients have tumors that rely on serine. “It’s not an essential amino acid, so we should be able to modulate their diets to exclude it without causing harm,” Parikh explains. Participants receive a plant-based diet supplemented with special shakes that contain essential amino acids but not serine and glycine (another amino acid potentially associated with pancreatic tumor growth). The program is free for trial participants. “It’s real food, shipped to the patients’ doors,” he says.

This study is one of three currently underway at Faeth. Others focus on colorectal cancer, and endometrial and ovarian cancers. Preliminary results are expected in about a year. The company is developing software to crunch enormous amounts of data to identify potential future nutritional interventions.

“Every time a patient with pancreatic cancer comes into the office of a gastrointestinal oncologist, the first question is, ‘What can I change about what I eat?’” says Parikh. “The oncologist usually just has to wave his hands around and say, ‘Just eat healthy.’ We are aiming to change that. I want every cancer patient to have a nutrition intervention that is evidence-based.”

Says Lien, “My view is, there is never going to be a magic bullet, a single diet that will cure cancer. But there is a real opportunity to leverage nutrition to make existing cancer treatments work better. It’s pretty exciting to consider how we can leverage dietary interventions in combination with drugs that are already being used or are in development.”

The potential for precision nutrition to improve outcomes motivates K. Leigh Greathouse, PhD, MPH, RD, an associate professor of nutrition sciences at Baylor University in Waco, Texas. Her interest has a personal origin: At age 24, she was diagnosed with Stage IV uterine leiomyosarcoma, a rare uterine cancer. She was treated, and “by some miracle, at the end of the year, I was cancer-free,” she says. She went on to earn a PhD in cancer biology, did postdoc work at the National Cancer Institute and is now an independent researcher at Baylor. She is currently studying the potential for modulating diets for people with colorectal cancer to reduce the incidence of diarrhea, which affects about half of patients undergoing treatment. “Our purpose is to understand how diet influences the microbiome and how that affects colorectal cancer treatment responses and outcomes,” she says.

Greathouse sees great potential in precision nutrition but cautions that it will take a lot of research to bring it into the mainstream of clinical practice. “The way most studies have been developed do not lead to any conclusive results about how to best treat specific types of cancer with diet,” she says. “I see precision nutrition happening in two phases. Over the next five to 10 years, nutrition should become part of the standard of care in treatment plans, with clinical trials supporting the use of specific diets. For example, a ketogenic diet may become a standard of care for glioblastoma and a diet high in fiber the standard of care for people with melanoma. It shouldn’t be just an afterthought but a strong component of their immunotherapy or chemotherapy. But we’ll need five to 10 years of randomized placebo-controlled diets to incorporate specific dietary recommendations along with therapy.”

Over a 20-year horizon, she predicts, studies with hundreds of thousands of people could lead to having tumors and the gut microbiome sequenced and dietary intake evaluated. “We’ll be able to develop precision nutrition plans to encourage the growth of microbes to improve response to the type of treatment you are on and to improve survival. But it will take a lot more data.”

