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Ketogenic diet's reputed anticancer credentials put to test

Did a low-carb, high-fat diet aid Andrew Scarborough's recovery from a brain tumour? We'll never know, but studies are now looking at the DIY therapy



Andrew Scarborough was diagnosed with cancer aged 27
Dave Stock for New Scientist

THE late morning train was packed. Andrew Scarborough had been feeling odd recently – headaches would come and go, leaving him slurring his words. He blamed the stress of his master's degree. The flu, perhaps.

Pain unfurled in his head as the train pulled south from London. Spasm gripped his face and his throat seized up. He started to yelp uncontrollably. "I felt like I was going to die," he says. Then he slithered off his seat onto the floor of the carriage, unconscious.

It wasn't flu. Scarborough collapsed because vessels in an undiagnosed tumour had burst, spreading blood and cancerous cells through his brain. Once he had recovered from the aneurysm, he started down the usual path: surgery, followed by chemotherapy and radiotherapy.

This is the "gold standard" treatment for aggressive brain cancer. There's only one problem, says Matt Williams, a clinical oncologist at Charing Cross Hospital in London: "It doesn't work." Williams means that brain cancer patients still die: they just gain, on average, an extra 15 months. "We've made very little progress. The last significant advance was the addition of chemotherapy to radiotherapy – in 2005," says Williams. Candidate drugs have failed in clinical trials, and there's little hope that any will be found in the near future.

Like others in his position, Scarborough quickly realised that his prognosis was bleak and turned to the internet for alternatives. He read peer-reviewed scientific papers that seemed relevant to his condition, albeit about studies done on mice or on cells in Petri dishes, not humans, and he came up with a plan. Having studied nutrition at university, his starting point was a food plan known as the ketogenic diet, which involves cutting back on carbohydrates and increasing fat intake (see "[Cake out, insects in](#)").

"The last big advance in treating brain tumours was the addition of chemo to radiotherapy – in 2005"

The medical establishment tends to disapprove of self-imposed diets to control cancer, and for good reason. Apricot kernels and coffee enemas, pills made of kelp and clover: the web is awash with alternative cancer therapies, most of them with no scientific basis whatsoever. Many could be dangerous for people already debilitated by cancer.

What makes Scarborough's approach noteworthy is that some oncologists think the basic idea is worth exploring. Adrienne Scheck is running a study at the Barrow Neurological Institute in Phoenix, Arizona, in which people who have been newly diagnosed with brain cancer are put on a ketogenic diet that contains four parts fat to one

part of protein or carbohydrate, and stay on it through their radiation and chemotherapy.

Our cells usually get their energy from glucose, which comes from the carbohydrates we eat. But when these aren't available, the liver breaks down fat into fatty acids and chemicals called ketones, which our cells can burn for energy instead. Cancerous cells are particularly glucose-hungry and, unlike other cells, don't have the ability to switch fuel sources. Scarborough knew that a ketogenic diet is [sometimes helpful for the management of epilepsy](#), because one of the breakdown products of fat binds to brain cells, calming the electrical activity that triggers seizures. He hoped his version would deprive the tumour of the glucose it needed, starving it into submission.

You bet your life

Three years later, the remnants of Scarborough's tumour that survived the standard therapy have all but disappeared. That striking outcome has surprised his doctors but it is impossible for anyone to know what his experience tells us. He might have responded unusually well to the conventional treatment, with the ketogenic diet having been irrelevant or actually harmful to his overall health. Scarborough would occasionally have seizures, an after-effect of the aneurysm, if he miscalculated his nutrient balance: it took trial and error to find what seemed a stable approach.

If the diet did have any effect, that would have to be pinned down, along with the risks, before doctors could suggest it (or more likely a less extreme version) to other people with similar conditions. And because no one knows if it made any difference, Scarborough has no greater assurance that the cancer won't return than anyone else in remission.

But if the ketogenic approach is promising, why has it been left to people like Scarborough to cobble together a diet without any real idea of whether it will work? Part of the problem is that there is no commercial incentive to pursue it: drug companies can't afford to conduct trials that cost hundreds of millions of pounds to prove the efficacy of a treatment that anyone can get for themselves at the local supermarket. And there is no accepted way for showing efficacy of a treatment other than trials.

The nature of the intervention also stands in the way of doing a traditional clinical trial. For example, the status quo is a randomised double blind trial, in which people are put into groups at random and neither they nor researchers know who is having the treatment and who is having a placebo. The ketogenic trials could never be double blinded because the change to the participants' diet would be impossible to hide. Nor can it be randomised because people need to agree to make drastic lifestyle changes.

Some, like Scheck, are investigating its potential anyway. Williams, inspired by the same body of literature of case reports as Scarborough, is designing a trial to offer the ketogenic diet to between 40 and 80 people with brain cancer over the next two years and track their progress.

Neither study will be able to confirm whether adhering to the ketogenic diet for the long term will extend life by more than 15 months, but they may offer useful insights. For example, Williams's study will be tracking how chemicals and metabolites in participants' blood respond to the diet, perhaps eventually offering a way to get any benefits more directly. And both are deploying "keto" alongside the current gold-standard combination of surgery, chemotherapy and radiotherapy. "I think the most bang for the buck is using it to make those therapies better," says Scheck.

"Scarborough would occasionally have seizures if he miscalculated his nutrient balance"

If the initial results are promising, Scheck and Williams are planning larger follow-ups. Scheck says her study is about looking at what people are already doing to themselves, in an attempt to validate methods that seem to work. "There is a wide variety of things people are doing: some work and some do not. A trial must have enough people doing the same thing to allow a conclusion to be made, otherwise it is just another collection of anecdotal studies," she says.

Halima Khan of the [Health Lab at Nesta](#), a charity that supports innovation, says the way medical interventions are validated will need to change. It's becoming more widely recognised that traditional clinical trial methods will need to be adapted to enable patient-generated data to be gathered and analysed for clinical research.

Whether or not this happens, those who feel they have little to lose by trying alternative approaches are increasingly likely to find or devise their own treatments, even if the benefits are unknowable and the potential dangers enormous. "I was willing to take a lot of risks at that time, even risking my life," says Scarborough, who plans to continue with his diet.

Unless we can find a way to test approaches that don't fit into the traditional mould, people like Scarborough will be left needing to gamble with their lives to see if a treatment works.

Cake out, insects in

Andrew Scarborough was diagnosed with cancer aged 27

Andrew Scarborough's self-designed version of the high-fat, low-carb ketogenic diet is pretty extreme. As he tries to starve his cancerous cells of food, he eats less than a gram of carbohydrate a day. Instead, he eats a lot of oily fish, animal fats and insect flour. "To make sure I didn't have any micronutrient deficiencies, I started to include nutrient-dense organ meats and the insects," he says. Buying kilos of lamb's hearts and brain from the butcher, or going online to order crickets sold as snake food became the norm for him.

Now two studies aim to test the ability of such a diet to help treat cancer (see main story). To do this, the researchers have to work out how to give a version of this diet to people who are undergoing cancer treatment and already struggling with a dramatic lifestyle change.

However you do it, keto isn't easy. The idea is to make cells survive off ketones generated from fat, rather than glucose from carbohydrate. A single slice of bread can knock the body back to glucose. "It's about reconfiguring all the food in your house. Changing personal behaviour is much harder than taking a drug," says Matt Williams at Charing Cross Hospital in London, who is carrying out one of the trials.

He envisions specially designed ready meals. "I have to say to people: if being on the ketogenic diet isn't effective, you're still going to die of your brain tumour, and all I've done is I've deprived you of cake – for the last year of your life," he says.

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