

theoretically trigger or exacerbate existing diseases, such as inflammatory bowel disease. Finally, depending on their source, microplastics are potentially a vector of chemical toxins. Non-inert chemical additives are routinely added to plastics during manufacture; these are not chemically bound to the plastics but rather are kept within the plastic matrix, and therefore could leach, releasing toxins along a concentration gradient from the microplastic as it degrades.

However, based on the current evidence, such fears are speculative. Schwabl agrees with the conclusions of the WHO report: more research is needed before there's any evidence that microplastics pose a harm to human health. The jury is still out on microplastics—and so, *moules et frites* remain on the menu. For now.

Cassandra Coburn



## Food Fads

### The keto diet and the gut: cause for concern?

For a Cochrane review of the ketogenic diet for epilepsy see *Cochrane Database Syst Rev* 2012; 14: CD001903

For clinical guidelines of the use of the ketogenic diet in epilepsy see *Epilepsia Open* 2018; 3: 175–92

For a consensus statement on use of the keto diet in metabolic diseases see *J Endocrinol Invest* 2019; published online May 20. DOI:10.1007/s40618-019-01061-2

For an animal study of the ketogenic diet and the role of the microbiota see *Cell* 2018; 174: 497

For a review of the effect of the ketogenic diet on the gut microbiota see *Nutrients* 2019; 11: 373

The ketogenic (or keto) diet is a rapidly growing dietary trend for weight loss and was initially designed in the USA in the 1920s for treatment of refractory epilepsy. It was a diet that resulted in similar physiological effects to that of fasting, which appeared to reduce the incidence of epileptic seizures, but it could be maintained for a longer time. Since the 1990s, the keto diet has been under scrutiny for its use in the treatment of people with obesity or who are overweight, metabolic syndrome, cancers, and specific psychiatric and neurological disorders. The high-fat diet restricts carbohydrate intake

to 20–50 g non-fibre carbohydrate daily (around 5–10% total energy intake): a drastic change from a typical intake of approximately 150–250 g carbohydrate per day in developed countries (up to around 50% total energy intake). In practice, this means consuming eggs, bacon, and avocado for breakfast instead of porridge with milk and fruit, for example. The drastic reduction in carbohydrate intake results in the production of ketones in the liver, which switches the body's fuel source from glucose to fatty acids. This shift affects many fundamental biological systems and molecular intermediate and end-products, which is thought to underlie the keto diet's therapeutic benefit. Interestingly, the neuroprotective effect of a keto diet in animals might be modulated by the gut microbiota, raising the question of the relevance of the keto diet in gastrointestinal disease.

Individuals with gastrointestinal conditions will sometimes try extreme diets, often with the aim of optimising health or weight management. Unfortunately, the direct effect of a keto diet in conditions affecting the gastrointestinal tract, including how it might affect gut symptoms (eg, in irritable bowel syndrome) or disease progression (eg, in inflammatory bowel disease), is unknown. Furthermore, although there is some evidence for the keto diet improving weight loss, experts are cautious because of the potential risks of such an extreme diet and its use in the long term, and because many people who attempt the diet struggle with good compliance.

There are at least three reasons for exercising caution with the keto diet in patients with a gastrointestinal condition. First, gut-related side-effects such as constipation, vomiting, and abdominal pain occur in 30–50% who try it. This is far from ideal for people who are already experiencing substantial symptom burden. However, under expert supervision, some additional dietary strategies might help alleviate these effects—eg, maximising fluid and fibre intake to reduce constipation. These side-effects might also resolve over time with gut adaptation, but this could take days or weeks. Second,



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there are concerns relating to the nutritional safety of the keto diet. The diet excludes or limits major food groups (eg, grains, dairy, and certain fruit and vegetables), meaning it is much more difficult to obtain all required nutrients, particularly fibre and B vitamins. As such, a strict keto diet should be conducted under dietetic supervision and consideration given to supplementation with a multivitamin including trace minerals. The diet should be used with extreme caution in people already at risk of nutrition deficiency (eg, individuals with inflammatory bowel disease or coeliac disease). In addition to concerns about nutritional safety, such a restrictive diet might impose harmful effects on food-related quality of life (eg, reduced food choice and enjoyment in social situations). Third, the keto diet has been associated with a range of shifts in the gut microbiota. Although the evidence predominantly comes from animals and humans with epilepsy or related disorders, several studies show the keto diet has negative effects on microbial diversity, and reduces concentrations of saccharolytic taxa, including beneficial bacteria such as *Bifidobacteria* spp. The reduction in

quantity and diversity of carbohydrates consumed is probably responsible. Supplementation with a prebiotic or probiotic has been proposed to counteract the effects of the diet on the microbiome, although this has never been methodically evaluated.

The keto diet has been well researched in specific conditions, particularly epilepsy. But, the lack of evidence in people with gastrointestinal conditions, including how it might alter symptom response or disease progression, coupled with the potential effects on gut function, nutritional intake, and the gastrointestinal microbiota, suggests it should only be applied with extreme caution in this population. Crucially, the long-term effects of the keto diet (>2 years) have yet to be evaluated, including its effect on bowel cancer risk (there is a known link with low fibre and high red meat intake) and cardiovascular disease risk (due to its fat content and related hyperlipidaemia). So, for now, a well-balanced diet, tailored to the individual to target specific disease requirements, is the best option for people with gastrointestinal conditions.

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## Country Focus

### Coeliac disease in Finland: what can we learn?

Finland is very accommodating to people with coeliac disease. In Finnish, the condition is known as *keliakia*. "Generally in Finland it is possible to find some gluten-free food almost in every restaurant, hotel, coffee shop, and supermarket", notes Eliisa Girsén, nutrition specialist at the Finnish Coeliac Society. Searching for "gluten-free restaurants in Helsinki" on TripAdvisor yields 193 results. Venture out of the capital, and gluten-free burgers are available at McDonald's restaurants and at its rival, Hesburger. Gluten-free pizzas can be ordered from any one of the Rosso or Kotipizza restaurants scattered across the nation.

Finland's service stations offer gluten-free pastries. Their grocery stores and supermarkets stock an abundance of foods suitable for people with coeliac disease: breads, crackers, biscuits, breakfast cereals, and cakes. These products might be slightly pricier than the standard range, but the state offers some assistance. The Finnish Social Insurance Institution offers a monthly stipend to parents of children diagnosed with coeliac disease, to help towards the cost of maintaining a gluten-free diet.

From the early 1970s, the epidemiology of coeliac disease in Finland started to change. Less severe forms became more prevalent, resulting in an upward shift in the age at which patients were diagnosed. "A new world emerged

by detecting milder and even clinically silent forms of the disease, as is the case among healthy first-degree family members of coeliac disease patients, and detecting patients with extraintestinal manifestations", explains Markku Mäki, Professor Emeritus in the Faculty of Medicine and Health Technology, Tampere University, Tampere, Finland.



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