# The Paleo diet and diabetes

## Studies are inconclusive about the benefits of the Paleo diet in patients with type 2 diabetes

Type 2 diabetes is characterised by fasting hyperglycaemia as a result of insulin resistance and defects in insulin secretion. Obesity is the major risk factor for the development of the condition and a number of studies — including the Diabetes Prevention Program, the Da Qing IGT and Diabetes Study, and the Finnish Diabetes Prevention Study — have shown that lifestyle modification (diet and exercise) can significantly prevent the progression of glucose intolerance (prediabetes) to diabetes by up to 58%.[1-3] In addition, a recent study showed that a very-low-calorie diet for 8 weeks resulted in remission of type 2 diabetes for at least 6 months in 40% of the participants.[4] As such, clinical guidelines prescribe lifestyle modification as first-line treatment for type 2 diabetes and indeed throughout the management of the disease process.[5] Therefore, it is clear that dietary intervention is a critical component of the glucose-lowering strategy in diabetes.

The Paleolithic or hunter–gatherer diet is currently popular for weight loss, diabetes management and general wellbeing. It recommends avoidance of processed food, refined sugars, legumes, dairy, grains and cereals, and instead it advocates for grass-fed meat, wild fish, fruit, vegetables, nuts and "healthy" saturated fat. In the early 1980s, O'Dea showed that 7 weeks of living as hunter–gatherers and consuming a high-protein, low-fat diet with an energy intake of 5020 kJ per person per day significantly improved or normalised the metabolic abnormalities of Indigenous Australians with type 2 diabetes.[6] Thus, in its purest sense, the focus on fresh foods and avoidance of processed foods seems reasonable and consistent with dietary guidelines worldwide. However, what constitutes a Paleolithic diet is often skewed by individual interpretation or bias. This lack of a standard definition further complicates research evidence for or against this dietary approach and is often supported by individual self-reported benefits on health and wellbeing in popular social media channels. Is there scientific evidence that the Paleolithic diet is better for diabetes management than any other diet that advocates reducing energy intake?

Given its popularity, it was somewhat surprising that a PubMed search using the terms "Paleolithic diet and diabetes" resulted in only 23 articles, with many being reviews or commentaries. This is a similar outcome to a recently published systematic review of Paleolithic nutrition and metabolic syndrome.[7] Clinical studies in patients with type 2 diabetes have only been performed by two research groups. Lindeberg and colleagues, from Sweden, published a randomised crossover study of the effects of a 3-month Paleolithic diet compared with a diabetes diet (according to current guidelines) in 13 obese (body mass index [BMI] of $30 \pm 7$ kg/m$^2$) well controlled (glycated haemoglobin [$HbA_{1c}$], $48.6 \pm 1.5$ mmol/mol) patients with type 2 diabetes.[8] The data showed that while both diets resulted in a reduction in BMI and $HbA_{1c}$, the Paleolithic diet achieved a significantly lower absolute

value for these parameters. However, it is important to note that the patients on the Paleolithic diet had a lower BMI and $HbA_{1c}$ at baseline and at the 3-month crossover, so it is not clear whether the relative reductions were similar with these diets. In addition, although there was no significant difference in oral glucose tolerance, the high-density lipoprotein levels were higher and triglyceride levels and diastolic pressure were lower with the Paleolithic diet. It is interesting that, based on a 4-day diet diary halfway through the intervention, the patients on the Paleolithic diet consumed less total energy. A follow-up study suggested that the Paleolithic diet may well be more satiating in patients with type 2 diabetes.[9] In support of these results, Frassetto and colleagues showed, in a 14-day study of patients with type 2 diabetes, that both the Paleolithic diet (including canola oil and honey; $n = 14$) and standard diet (according to the American Diabetes Association recommendations; $n = 10$)[10] resulted in a small reduction in $HbA_{1c}$ levels, with no differences in insulin resistance (as assessed with a euglycaemic–hyperinsulinaemic clamp), blood pressure or blood lipids between the diets.[11] There was, however, a beneficial effect of the Paleolithic diet only when compared with baseline for fasting plasma glucose, fructosamine, lipid levels and insulin sensitivity. It is important to note that canola oil is generally not considered a component of a Paleolithic diet. Moreover, this study was designed to maintain body weight at the baseline level in both groups of patients, with the result being a small but significant weight loss of $2.1 \pm 1.9$ kg and $2.4 \pm 0.7$ kg in the standard and Paleolithic diets respectively. In summary, these small and short term studies tend to indicate some benefit but do not convincingly show that a Paleolithic diet is effective for weight loss and glycaemic control in type 2 diabetes.

In addition to the above studies of patients with type 2 diabetes, the Paleolithic diet has also been studied in healthy normal-weight individuals.[12] Compared with a reference meal (based on the World Health Organization guidelines),[13] there was very little effect on plasma glucose and insulin levels during an oral glucose tolerance test, but statistically significant increases were found in

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plasma glucagon-like peptide-1, glucose-dependent insulinotropic peptide and peptide YY. These hormone changes were associated with a higher satiety score. One of the Paleolithic meals used in this study caused an increase in the glucose excursion associated with a reduction in the insulin excursion during the glucose tolerance test.[12] Similarly, in nine overweight healthy individuals, a Paleolithic diet for 10 days resulted in no change in fasting plasma glucose or insulin levels, but it showed reduced plasma lipid levels and blood pressure compared with the baseline usual diet.[14] It is interesting that, while insulin levels during an oral glucose tolerance test were lower with the Paleolithic diet compared with baseline, the authors did not report the glycaemic excursions during this test. Moreover, a 2-week study in obese patients ($n = 18$) with the metabolic syndrome did not show an effect on glucose tolerance, but it resulted in reduced blood pressure and plasma lipid levels associated with a small but significant decrease in weight.[15] In patients with ischaemic heart disease plus either glucose intolerance or type 2 diabetes ($n = 14$), a Paleolithic diet for 12 weeks resulted in reduced glucose and insulin excursions during the glucose tolerance test and was associated with a 26% reduction in energy intake, compared with a Mediterranean-style diet ($n = 15$).[16] Again, in the absence of changes in weight or energy intake, the Paleolithic diet is as effective in improving the above metabolic parameters as a standard diet.

Thus, given that even very short deficits in energy balance can improve metabolic parameters,[17] it is difficult to make strong conclusions about the long term benefits of the Paleolithic diet in type 2 diabetes (or any other condition), because of the short duration of the interventions (less than 12 weeks), the lack of a proper control group in some instances, and the small sample size (less than 20 individuals) of the above studies. While it makes sense that the Paleolithic diet promotes avoidance of refined and extra sugars and processed energy dense food, clearly more randomised controlled studies with more patients and for a longer period of time are required to determine whether it has any beneficial effect over other dietary advice.

**Podcast** with Associate Professor Sofianos Andrikopoulos is available at mja.com.au/multimedia/podcasts

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