

Popular diets: are they effective for people with type 2 diabetes?

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Abstract

The benefits of weight loss for people with type 2 diabetes are well established, but many individuals find dietary energy restriction and weight loss challenging. Conventional dietary advice recommends adopting a low fat, high fibre diet with moderate energy restriction for weight loss, but there are other more popular diets available including the 5:2 or Fast diet, the Paleolithic (or caveman) diet, low glycaemic index (GI) diets, low carbohydrate diets, very low calorie diets and Mediterranean diets.

This review explores the evidence for these popular diets and discusses application to clinical practice. There is no evidence for the role of the Fast diet in people with diabetes, and little evidence for the Paleolithic diet, and these diets cannot be recommended currently. Although low GI diets appear to improve glycaemic control in people with diabetes, there is no evidence that they induce weight loss, and they are no longer recommended as a primary strategy by most authorities. There is stronger evidence for the efficacy of both low carbohydrate diets and very low calorie diets showing they are more effective for weight loss over the short term, although this benefit disappears over longer periods of time. Recent evidence suggests that Mediterranean diets are effective for weight loss, improvements in glycaemic control and for reducing cardiovascular risk, although cultural aspects may limit use outside the Mediterranean region. There remains no evidence for the most effective method for weight reduction in people with type 2 diabetes. Copyright © 2014 John Wiley & Sons.

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Key words

type 2 diabetes; obesity; diet; weight loss

Introduction

Overweight and obesity are more prevalent in people with type 2 diabetes than in the general population. In both the UK and the US, approximately 86% of those with type 2 diabetes have a BMI >25kg/m², and 50% are obese (BMI >30kg/m²).^{1,2} This compares with figures in the UK in 2011 of 63.5% overweight or obese, and 25% obese in the general adult population.³ The health benefits of weight loss for people with type 2 diabetes are well established and include improvements in glycaemic control, quality of life, mobility, sleep apnoea, sexual function, reductions in cardiovascular risk,^{4,5} and even a suggestion that dietary restriction and weight loss can induce remission of diabetes.^{6,7} Despite guidelines recommending weight loss as front-line therapy for those who are overweight or obese, many people find conventional weight loss strategies challenging and are interested in trying less traditional, more popular approaches such as the Fast or Paleolithic diet. These diets have certainly been well-publicised, but is

there any evidence of safety or efficacy for people with type 2 diabetes?

Intermittent fasting and the Fast (5:2) diet

Intermittent fasting (IF) is characterised by days of eating normally and fasting days, where energy intake is typically restricted to 500–600kcal/day. It is not clear how frequently fasting should take place, and much of the research that has been conducted used alternate day fasting (ADF), rather than the Fast or 5:2 diet, which recommends eating normally for five days a week and fasting on the other two days.⁸ Despite its recent popularity, there is in fact little evidence for the 5:2 diet, and only two studies in overweight women (without diagnosed diabetes) have been performed. One study reported that both the 5:2 diet and a conventional weight loss diet were equally effective for weight loss and reducing various risk factors for disease,⁹ and the other that the 5:2 diet was more effective than conventional measures.¹⁰ There have been no studies evaluating the effect of the Fast diet specifically in people with diabetes.

Food	Low GI (≤ 55)	Medium GI (56–69)	High GI (≥ 70)
Bread	Multigrain, seeded, granary and rye	–	All wholemeal, brown and white bread including French bread and naan bread
Breakfast cereals	All-Bran, Special K, muesli and porridge	Other bran cereals	All other cereals including cornflakes, puffed rice, Shredded Wheat, Weetabix and sugared cereals
Potatoes	Sweet potato, yams	New potatoes, crisps	Old potatoes including baked, boiled, mashed, roast and chips
Pasta and rice	All types of pasta and egg noodles	Basmati rice, egg noodles	Brown and white rice, rice pasta
Vegetables	Pulses including lentils, beans, peas and sweetcorn	–	–
Fruit	Apples, pears, citrus fruit, berries and stone fruit including peaches, cherries, apricots	Tropical fruit including melon, pineapple, mango, banana and grapes	–
Dairy products	All milk and yogurt, whether full fat, semi-skimmed or skimmed	Ice cream	–
Cakes and biscuits	Plain sponge cake, fruit and malt bread	Plain, semi-sweet biscuits, crackers	Doughnuts, scones
Savoury snacks	Maize or corn chips, cashews, peanuts	Potato crisps	Extruded potato snacks including hoops and puffs and pretzels

Table 1. The glycaemic index (GI) of some common foods

There is more evidence for ADF, and proposed benefits include weight loss, increased lifespan, slowing the rate of cognitive decline and preventing heart disease, cancer and diabetes,¹¹ but it is important to remember that the majority of studies have been carried out in animals and there are relatively sparse data for man.¹² The few studies that have been conducted in humans have taken place over the short term, included small numbers, were not always designed as randomised controlled trials (RCTs) and used differing amounts of energy restriction in intervention and control groups, limiting firm conclusions.

Results from people without diabetes suggest that ADF is effective for weight loss over the short term,^{13,14} but that it has no advantage over the long term.¹⁵

One review has suggested that alternate day fasting may benefit people with diabetes,¹⁶ but it is challenging to draw firm conclusions in the absence of good quality evidence.

Intermittent fasting in clinical practice

Despite the lack of evidence, many people with diabetes have adopted the Fast diet in order to lose weight and improve glycaemic control. The big question is: should they be supported in this by their health care professionals? The latest guidelines from both Diabetes UK⁴ and the American Diabetes Association (ADA)⁵ state that there are a variety of strategies suitable for weight loss, and that weight loss advice should be individualised, although IF is not currently recommended due to lack of evidence. Those who decide to adopt IF as a strategy should be advised that there is no evidence of efficacy in people with diabetes, and that those taking insulin or insulin secretagogues (sulphonylureas and glinides) are at risk of hypoglycaemia during fast days and will need to reduce or omit their medication to avoid this. Home blood glucose monitoring is also advised. Other side effects of IF are largely anecdotal and include difficulties in sleeping, halitosis, irritability, anxiety and lack of energy.

Paleolithic diet

The Paleolithic diet is also known as the caveman diet, Stone Age diet or hunter–gatherer diet. This diet consists of foods that were available to humans before agriculture was introduced and includes food originally sourced from wild animals and uncultivated plants including lean meat, game and poultry, fish, eggs, leafy and root vegetables, fruit, nuts and seeds. Excluded from the diet are grains such as wheat and rice, legumes, dairy produce, salt, refined sugar and processed oils, all of which were unavailable before humans began cultivating plants and domesticating animals. A few small studies have suggested that this diet is beneficial for people with type 2 diabetes and the reported effects include reduction in weight and cardiovascular risk factors¹⁷ and improvements in satiation and glucose tolerance when compared to a Mediterranean-style diet.^{18–20} However, it is difficult to draw firm conclusions as these studies included very small numbers, took place over the short term and were not RCTs with parallel groups.²¹

Description	Amount of carbohydrate	Foods included and restricted
Very low carbohydrate, e.g. Atkins, Bernstein's, ketogenic diets	20–50g/day	<ul style="list-style-type: none"> • Unlimited amounts of protein (meat, game, fish, eggs, cheese, nuts and seeds) and fat (oils, butter, cream, olives, avocados) • Restricted amounts of leafy green vegetables (cabbage, broccoli, cauliflower) and salad vegetables (lettuce, cucumber, tomato) • Severely restricted amounts of berries and milk, depending upon the diet • No other fruit, starchy foods (bread, flour, potato, rice, pasta) or sugary foods (sweets, chocolate, biscuits, cakes) permitted
Moderately low carbohydrate, high protein and low fat, e.g. Zone, South Beach Diet	<30% total energy intake	<ul style="list-style-type: none"> • Unlimited amounts of low fat protein (lean meat, chicken and poultry, game, fish, shellfish) • Unlimited amounts of green leafy vegetables and salad vegetables • Restricted amounts of unsaturated fat (olive, sunflower or corn oil, olives, avocados, nuts, seeds) • Restricted amounts of fruit and low-fat milk products • Severely restricted amounts of wholegrain carbohydrates (wholegrain bread, grains such as quinoa, bulgur wheat, brown rice) • No processed carbohydrate (white bread, pasta, biscuits, cakes) or high fat protein foods (burgers, sausages, pies, pasties) permitted

Table 2. Low carbohydrate high protein diets

Paleolithic diets in clinical practice

There is insufficient published evidence for the safety or efficacy of the Paleolithic diet to recommend it in clinical practice. There is also little evidence for the acceptability of this style of eating, with one researcher admitting to challenges with recruitment.²¹ The side effects of this diet are largely unknown, although the lack of dairy products has led to speculation that there may be issues with calcium and vitamin D intake and that high fish intakes may increase the risk of over-consumption of environmental toxins and heavy metals.²¹

Low glycaemic index diets

Glycaemic index (GI) was a term first coined by researchers working in Toronto to give an indication of the blood glucose response to different types of carbohydrate.²² The GI of a food can only be measured practically in the laboratory by feeding samples of a test food to subjects using a standard procedure, and the test food is then compared with a reference food, either white bread or glucose (both high GI foods). The GI of some common foods is shown in Table 1.

Low GI foods reduce the degree of postprandial hyperglycaemia and associated insulin secretion, and this action is proposed to benefit people with diabetes. Several reviews and meta-analyses have confirmed that

low GI diets improve glycaemic control in people with diabetes,^{23–26} and reduce cardiovascular risk.²⁷ Interestingly, although low GI diets appear to promote weight loss in people without diabetes,²⁸ there is no evidence for this in people with diabetes.²⁷ There has been some scepticism expressed about the efficacy of low GI diets for people with diabetes; although they have been shown to lower HbA_{1c} by 4–5mmol/mol (0.4%) when compared to high GI diets, this effect is reduced to 1mmol/mol (0.14%) when compared with other diets such as the Mediterranean diet or low carbohydrate diets.²⁷ It is now generally accepted that the amount of carbohydrate, rather than the type, is the best predictor of postprandial glycaemic response,²⁹ and there is evidence that dietary approaches addressing the amount of carbohydrate and appropriate insulin adjustment can significantly reduce HbA_{1c} in people with type 2 diabetes.^{30,31} Low GI diets are now no longer recommended as a primary strategy for type 2 diabetes by either Diabetes UK⁴ or the ADA,⁵ due to the absence of evidence for any effect on body weight and the difficulties of discerning an independent effect on glycaemic control.

Low GI diets in clinical practice

Apart from the ambivalence about low GI diets and their role in the diet of people with type 2 diabetes, there

are also some concerns about translating low GI diets into practice. It has been suggested that low GI diets are difficult to understand and implement, and that this may be counter-productive for those attempting weight loss and trying to improve glycaemic control.²⁹ It is challenging for those well-versed in healthy eating to discover, for example, that wholemeal bread, baked potatoes and bananas are high GI foods, whereas milk chocolate and peanuts are low GI. Other than this, there are no obvious side effects for people with diabetes and low GI diets are safe and have proven (if limited) efficacy in improving glycaemic control. Low GI diets should not be seen as a diet that can be used in isolation to manage diabetes, but they offer useful additional information to support the choices people with diabetes make about the type and amount of food they eat.

High protein/low carbohydrate diets

High protein, low carbohydrate diets have been widely promoted in recent years as an effective approach to losing weight and improving glycaemic control in people with type 2 diabetes. However, not all high protein, low carbohydrate diets are the same. The Atkins-style diet tends to be high in both protein and fat and low in carbohydrate,³² whereas diets such as the Zone diet³³ and the South Beach diet³⁴ combine high

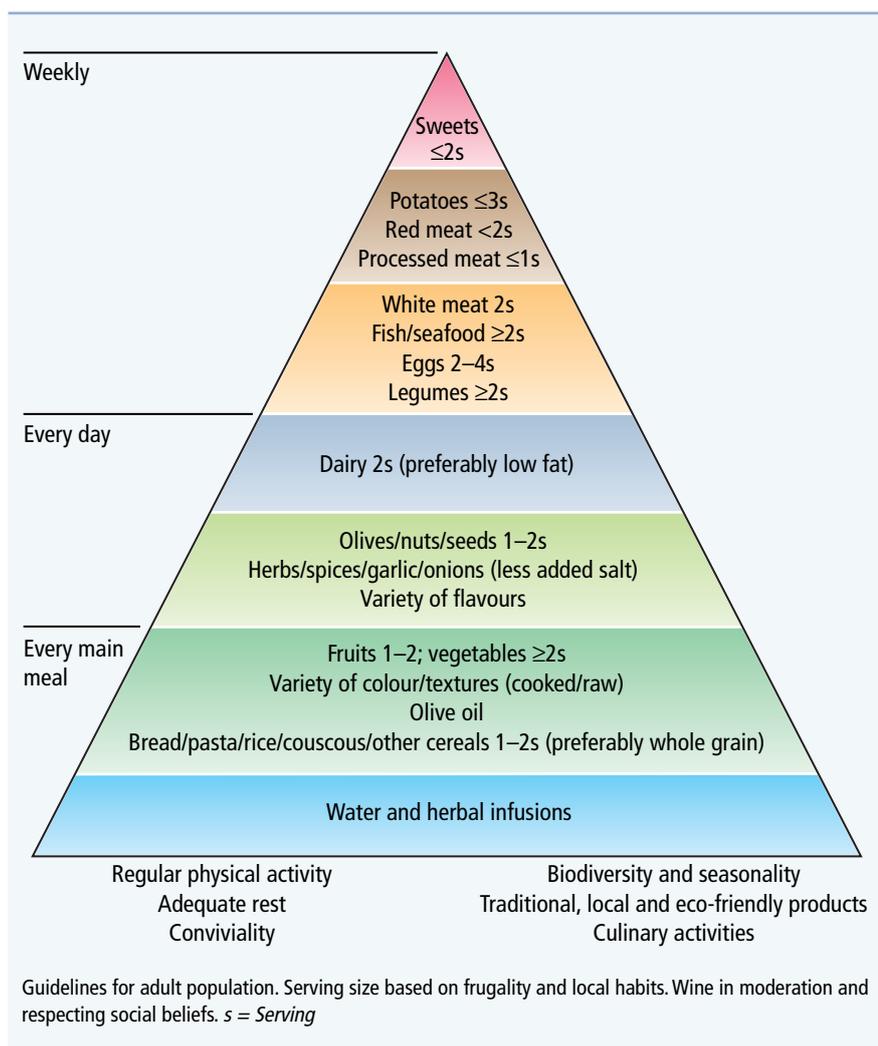


Figure 1. The Mediterranean diet food pyramid

protein with low fat and a moderate intake of carbohydrate, usually derived from fruit, vegetables and wholegrains; see Table 2. Although many studies have attempted to identify the optimal macronutrient (protein, fat and carbohydrate) intake for managing type 2 diabetes, a recent systematic review reports that there is no evidence for an ideal intake for improving glycaemic control, weight loss or cardiovascular risk.³⁵ Both Diabetes UK⁴ and the ADA⁵ stress the importance of individualising dietary advice for people with type 2 diabetes, although there is recognition that low carbohydrate diets may have a place in managing glycaemia and weight.

There have been a number of studies of low carbohydrate diets in people with type 2 diabetes, and although reviews have shown that there are benefits in terms of

glycaemic control and weight loss over the short term,^{27,36,37} this advantage disappears in trials lasting longer than 12 weeks.^{38,39}

Low carbohydrate diets in clinical practice

Low carbohydrate diets can be safely adopted over the short term to improve glycaemic control and induce weight loss, although over the longer term they are no more advantageous than conventional healthy eating advice. Reductions in carbohydrate intake increase the risk of hypoglycaemia in people taking insulin, sulphonylurea or glinide therapy and require dose adjustment. Anecdotally, those on insulin are advised to reduce the total dose by 50%, and sulphonylurea and glinide therapy should be stopped entirely,⁴⁰ and frequent home blood glucose monitoring is

recommended. Other side effects of low carbohydrate diets include lack of energy, feeling light-headed, headaches, halitosis and constipation. The long-term safety and efficacy of low carbohydrate diets have not been fully established. There have been concerns expressed about the possibility of dyslipidaemia as a consequence of high fat intake,⁴¹ although most studies to date have shown improvements in lipid levels, and especially HDL cholesterol.²⁷ Other potential problems include accelerated decline in renal function and increased calcium loss in urine leading to osteoporosis and renal stones.⁴² In fact, no study published to date has shown a deleterious effect on glycaemic control or cardiovascular risk factors, but little is known about the long-term effects of low carbohydrate diets in people with diabetes.

Very low calorie diets

Very low calorie diets (VLCDs) have long been used to induce significant weight loss in people with type 2 diabetes. VLCDs are defined by NICE as those providing $< 1000\text{kcal/day}$,⁴³ although a more stringent definition of $450\text{--}800\text{kcal/day}$ is used by the National Obesity Forum.⁴⁴ VLCDs can be provided from either food-stuffs (usually accompanied by a vitamin and mineral supplement) or, more commonly, they consist of liquid food (often a proprietary formula) that provides the sole source of nutrition and includes the full complement of vitamins, minerals, electrolytes and fatty acids. These liquid food replacements are known as very low calorie liquid diets (VLCLDs).

The majority of studies conducted in people with type 2 diabetes have used a VLCLD, and a Cochrane review reports that use of VLCLD significantly improves HbA_{1c} and results in a weighted mean difference of 3kg weight loss in people with type 2 diabetes, although the weight loss is not significantly different from that achieved by conventional low calorie diets.⁴⁵ VLCLDs have come to the fore recently, with the results of a small intervention trial reporting reversal of diabetes in 11 subjects consuming 600kcal/day over eight

Type of diet	HbA _{1c} (%)	Body weight (kg)	HDL cholesterol (mmol/L)	LDL cholesterol (mmol/L)	Triglycerides (mmol/L)
Intermittent fasting	No data	No data	No data	No data	No data
Paleolithic [†]	-0.4*	-3.0*	0.08*	-0.1	-0.4*
Low GI ^{††}	-0.14*	1.39	0.05*	-0.07	-0.01
Low carbohydrate ^{††}	-0.12*	-0.69	0.08*	-0.03	-0.04
Very low calorie ^{††}	-1.23*	-2.95	0.06	Not reported	0.17
Mediterranean ^{††}	-0.47*	-1.84*	0.04*	-0.08	-0.21*

[†]Data from one small, short-term cross-over study with 13 subjects.¹⁷

^{††}Data from meta-analyses and Cochrane review.^{27,45} All data presented as weighted mean difference.

*p<0.05.

Table 3. Effects of popular diets on glycaemic control, body weight and cardiovascular risk in people with type 2 diabetes

weeks,⁷ and this is supported by anecdotal evidence from the general population.⁴⁶ However, it is probably too early to draw conclusions from this, and results from a larger trial are awaited.

Very low calorie diets in clinical practice

There are a number of issues with VLCLDs in practice, and use of VLCLDs should only take place under medical supervision.⁴³ In common with other very restrictive diets, including IF and low carbohydrate, adjustment of medication is necessary to avoid hypoglycaemia, and frequent blood glucose monitoring is recommended. Reported side effects include lethargy, headaches, palpitations and constipation, and avoiding all food can have a detrimental effect on quality of life. Hunger does not appear to be an issue; anecdotally most people taking a VLCLD report that they do not feel hungry after the first few days. Individuals who choose to adopt a VLCD based on foods are advised to take a vitamin and mineral supplement, although this should not, in theory, be needed by those who are using a VLCLD. Those who are successful with weight loss may find weight maintenance challenging and it is likely that individuals will need dietary counselling once food is re-introduced, as the phenomenon of rapid

weight regain following normal eating is common.⁴⁷

Mediterranean diet

There has been recent interest in the Mediterranean diet as a means of reducing cardiovascular risk, promoting weight loss and improving glycaemic control in people with type 2 diabetes, and several studies have shown a significant positive effect of this diet on these outcomes.^{27,48} The Mediterranean diet is based on plant foods and includes abundant amount of vegetables, fruit, beans and pulses, nuts, seeds and cereal foods such as bread and pasta, with olive oil providing the principal dietary fat. The majority of food in the diet is fresh, seasonal and unprocessed. Dairy foods (usually milk and yogurt), eggs and fish are consumed in moderate amounts, and red meat and processed foods are largely avoided. Wine is drunk in moderate amounts, usually with meals. The Mediterranean diet, unlike low carbohydrate or high protein diets, is food-based rather than a nutrient-based eating pattern and it has been proposed that this may improve its accessibility and understanding. However, the majority of studies evaluating this diet have taken place in Mediterranean countries where this style of eating is the cultural norm, and how these results can be extrapolated to other countries has not yet been fully tested.

Key points

- Many people with type 2 diabetes find weight loss through conventional dietary means challenging and turn to popular diets such as the Fast diet or the Paleolithic diet
- The efficacy and safety of these popular diets are unclear. Diets such as the Fast diet and the Paleolithic diet lack evidence and cannot be currently recommended
- Other diets such as the low GI diet, low carbohydrate diets, very low calorie diets and the Mediterranean diet can be used by people with diabetes, but require medical supervision and may need medication adjustment

Mediterranean diet in clinical practice

Mediterranean-style diets are not commonly used in countries outside the Mediterranean, although food pyramids explaining the concept are widely available; see Figure 1. There are no documented side effects for Mediterranean diets, and medication adjustment is not usually required unless there is significant weight loss.

Conclusions

There is no evidence, as yet, for the most effective dietary strategy for weight reduction, improving glycaemic control and reducing cardiovascular risk in people with type 2 diabetes, and the guidelines from both Diabetes UK and the ADA recommend an individualised approach, where health professionals work with the person with diabetes to identify an eating pattern that is based on that individual's lifestyle, culture and preferences. Suitable evidence-based strategies include conventional healthy eating, low fat diets, low GI diets, low carbohydrate diets, and Mediterranean diet. A comparison of the effects of these diets is shown in Table 3. Blood glucose monitoring and medication adjustment are necessary for those wishing to adopt low carbohydrate diets. Other popular diets, including the Fast diet and the Paleolithic diet, are not supported by sufficient published evidence, have side effects including hypoglycaemia and are not currently recommended for people

with diabetes. More extreme dietary restriction using VLCLDs requires medical supervision and, although there is limited evidence of effect, more studies are needed before this strategy can be recommended for general use.

In conclusion, although many popular diets may be promoted for weight loss in people without diabetes, lack of evidence prevents use of many of these approaches in people with type 2 diabetes.

Declaration of interests

There are no conflicts of interest declared.

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