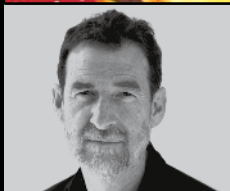




## THEME

Weight



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# The science behind weight loss diets

## A brief review

### BACKGROUND

Controversy surrounds both the Atkins diet and moderate carbohydrate, high protein diets.

### OBJECTIVE

This article undertakes a brief review of the evidence for efficacy and possible harmful effects of various popular diets.

### DISCUSSION

Low fat diets have been shown to reduce weight at 12 months and have additional benefits of high fibre intake and may reduce the risk of diabetes. However, many people cannot maintain these diets long term so new solutions have been sought. Surprisingly, trials have only appeared over the past 3–4 years evaluating the effects of the Atkins diet, and these have shown weight loss benefits at 6 months, but the benefit is lost by 12 months. Adherence to this regimen is difficult. Problems include constipation from the relatively low fibre intake and a less than expected rise in LDL cholesterol. A moderate carbohydrate, high protein diet has been shown to maintain weight loss at 12 months and beyond, with improvements in cardiovascular risk factors and little risk of long term side effects. Patient choice will depend on dietary preferences and previous experiences with diets. Those with metabolic syndrome might benefit more from carbohydrate restriction.

### What is the evidence behind the various popular diets advocated for weight loss such as low fat, low carbohydrate, high protein, and combinations thereof?

#### Low fat diets

Low fat diets have been advocated for weight loss for many years and are based on several well established principles. Low fat diets have a lower energy density than high fat diets, and as humans respond mostly to volume of food eaten rather than calories, this should lead to a lower energy intake. Lower fat diets also have higher fibre content and this may also enhance satiety. There is some evidence that carbohydrate diets require more energy to metabolise than fat, but this is likely to be of little consequence. Some minor degree of faecal loss of energy occurs with high carbohydrate diets, especially those with a high fibre/high resistant starch level. A review by Avenell et al<sup>1</sup> found that low fat diets reduced weight by an average of 3.6 kg for up to 3 years, while

four studies found that low fat diets are associated with lower rates of diabetes and reduced antihypertensive medication for up to 3 years.<sup>1</sup>

It has been estimated that a reduction in fat by 10% of energy (without any conscious effort to reduce calories – this would occur through greater satiety and better control of food intake) would reduce weight by 16 g/day over a year with a loss of this effect beyond a year. The mechanism for the loss of this effect is not clear. People on the National Weight Loss Registry in the USA (629 women and 155 men) who have maintained a minimum weight loss of 13.6 kg over 5 years, usually consume a low fat diet (24+/-9% from fat) but also exercise extensively using about 30% of their daily energy intake on exercise.<sup>2</sup> Most of us would use about 5–10%. So although there is good evidence that low fat diets work for some people, many cannot maintain them long term so new solutions have been sought.

## Very low carbohydrate diets

A complete contrast to the low fat, high carbohydrate diet is the low carbohydrate diet that has been in use for over 100 years but was popularised by Atkins many years ago. Surprisingly, trials have only appeared over the past 3–4 years evaluating the effects of the Atkins diet.<sup>3</sup> These trials are very uniform in their findings with a better weight loss of about 3.3 kg at 6 months but with no difference from low fat diets at 12 months. These diets worked by reducing caloric intake by removing a wide range of carbohydrate rich foods, but as compliance to this fairly severe regimen drifted, so did the weight. Although triglyceride levels dropped, and HDL cholesterol levels were maintained on the Atkins diet, LDL cholesterol rose by about 2–3%. This is a lot lower than expected and shows that a large amount of saturated fat in the virtual absence of carbohydrate and the presence of weight loss acts differently to what is expected. There is no data beyond 12 months on the Atkins diet. There are modified forms of the Atkins diet that endeavour to replace some of the saturated fat with unsaturated fat (eg. the South Beach Diet) but there is no trial data. One would expect similar weight loss but better LDL results compared with the Atkins diet.

## High protein diets

This is the compromise position diet and there are many variants such as the Zone diet, the Protein Power diet, and the CSIRO diet. It makes use of the increased satiating effect of protein with the modest reduction in carbohydrate benefiting triglyceride levels and sometimes HDL cholesterol. Fat is kept low at 30% and its composition is healthy. Only the CSIRO diet has been extensively studied<sup>4–6</sup> in large groups of people and other investigators have confirmed the results with smaller numbers of patients. In general, protein as a percentage of energy is doubled from 15–30% and this has the effect of increasing weight loss at 12 months by about 3 kg compared with a high carbohydrate diet with benefits on triglyceride levels.<sup>7</sup> People with elevated triglyceride levels gain particular benefits (at least at 3 months) with greater weight, fat and central fat loss. Doubling the amount of protein as a percentage of energy does not mean doubling the amount of protein – it mostly occurs by reducing the amount of fat and carbohydrate and energy with only a 10–15% increase in the actual amount of protein. The Zone diet has a very similar composition to the CSIRO diet but it insists, with no evidence to support it, that every meal should have the correct Zone composition of 30:30:40 (protein, fat, carbohydrate).

In a recent meta regression, Krieger<sup>8</sup> examined 87 short term studies and found that protein intakes of >1.05 g/kg of actual rather than desirable body weight were associated with 0.6 kg better retention of lean mass, and in studies greater than 12 weeks in duration, this increased to 1.2 kg. This is similar to the protein intake in the CSIRO diet. In studies that used a carbohydrate intake of less than 35–41% there was a 2 kg greater loss of fat mass, and this was accompanied by a 0.7 kg greater loss of lean mass. In studies of 12 weeks or more this increased to 5.6 kg and 1.7 kg respectively. Therefore a low carbohydrate, high protein diet is associated with better fat loss and relatively less lean mass loss.

## Meal replacements

An alternative approach to weight loss is to use meal replacements such as 'Optifast' or 'Kickstart' either replacing one, two or three meals. Total replacement can lead to dramatic weight loss of 20 kg or more, but in the long term, the amount of weight lost is the same whether more gradual approaches are taken or not. The best long term data has shown that a 10% weight loss can be maintained for up to 5 years with the use of one meal replacement per day, increasing to two if weight regain occurs.<sup>9</sup>

## The risks

There is no risk from eating a high fibre, high carbohydrate diet, but high protein diets have several risks attributed to them. One paper suggests that women with impaired renal function have a greater decline in renal function with a greater protein intake.<sup>10</sup> Those with normal renal function had no such decline. Therefore until evidence to the contrary is shown, care should be taken in those with renal impairment. However as noted, high protein weight loss diets may not actually contain an increase in the amount of protein in grams. Although high protein diets (particularly those high in meat) have been shown to increase calcium loss, high protein diets have been shown to reduce the risk of fractures.<sup>11</sup> High meat diets have also been shown to be associated with increased colorectal cancer. However, the European Prospective Investigation into Cancer and Nutrition (EPIC) study, the largest study undertaken, found this was true only for processed meats.<sup>12</sup> Nevertheless, studies from the USA have implicated red meat alone as increasing the risk of rectosigmoid cancers with the risk in order of a 30–40% increase in the highest quintile.<sup>13</sup> The risk of colorectal cancer can be reduced substantially by eating chicken and fish, undertaking regular exercise, and by weight loss itself. Eating more than 28 g fibre per day removes

the effect of meat altogether. So in terms of this diet, replacing processed meat with fish or chicken or ensuring fibre intake is high is the best strategy.

The Atkins diet has been portrayed as prone to many adverse outcomes but the evidence is very limited. Certainly constipation is a problem and fibre supplements may be required. Ketogenic diets in children can cause renal stones (about 6% incidence over 5 years) but appears not to be seen in adults. Although in theory, long term use of the Atkins diet might lead to vitamin and mineral deficiency and possibly increased risk of gastrointestinal tract cancer, this seems unlikely as a very restricted diet is usually not maintained long term.

### What advice should the GP give?

The best evidence relates to high carbohydrate diets and high protein moderate carbohydrate diets as well as meal replacements. The choice is really up to the patient depending on their tastes and previous experiences with dieting. Patients with metabolic syndrome, particularly with elevated triglycerides and glucose, may benefit more from carbohydrate restriction.

### Does that advice need to be modified?

For patients with diabetes or cardiac disease, no modification is required. Reduction of energy intake, loss of weight and reduction of carbohydrate will lower glucose levels and may require adjustment of drug doses in well controlled overweight people with diabetes (who are a rarity). Weight loss is important for those with cardiac disease and avoidance of the Atkins diet may be required in patients with elevated LDL cholesterol. However, the interaction between statin drugs and the Atkins diet has not been explored and LDL cholesterol may not rise in people on these drugs.

Conflict of interest: none declared.

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