

EVIDENCE-BASED EVALUATION OF CURRENT NUTRITIONAL STRATEGIES FOR WEIGHT CONTROL

Do popular diets work and what is the evidence supporting different approaches?



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The long-standing conventional and scientifically acceptable nutritional approach to weight control is a low-fat diet (< 30% fat) that elicits an energy deficit of 2 090 - 4 180 kJ/day (500 - 1 000 kcal/day) to achieve weight loss of 0.5 - 0.9 kg/week. After initial weight loss and to prevent weight regain energy intake should be individualised, while maintaining a low-fat diet ($\leq 30\%$ of total energy intake).^{1,2}

Many of the popular dietary weight-control strategies are inconsistent with this advice and offer menus ranging from butter and bacon to sugar and sweets. Even in the scientific literature the debates for and against more extreme approaches are increasing. Proponents of high-fat diets argue that the prevalence of obesity has increased despite reductions in fat intake and that high-carbohydrate diets exacerbate the metabolic manifestations of the insulin-resistance syndrome. Advocates of higher-carbohydrate diets suggest this is a half-truth – ‘per capita consumption of fat has risen by 10 lb/year since 1975, whereas per capita consumption of simple carbohydrates has increased even more by 20 lb/year. The percentage of calories from fat has decreased but the amount of fat consumed has increased.’³ Adding heat to the debate are more recent studies that provide some evidence that high-protein diets may be advantageous⁴ and others that show benefits in manipulating food choices within the various diets such as the type of fat or carbohydrate or the glycaemic load (GL).

CONCEPTUAL FRAMEWORK TO EVALUATE DIETS

Within the spectrum of diets for weight loss there are those that:

- restrict total energy intake
- manipulate macronutrients (Table I)
- eliminate or advocate specific foods based on properties such as the glycaemic index (GI) and/or type of fat and/or essential fatty acids
- include components such as group-based support, exercise and supplements.

Since one or more of these components may feature in any diet and affect not only weight loss and health outcomes but also long-term adherence, it is often confusing and challenging to tease out the effects of the different elements. For example, the Atkins diet is not only high in fat but also high in protein and low in carbohydrate and there is no requirement for energy restriction.

In this article both the pros and cons of current popular dietary approaches that are based on macronutrient manipulations are evaluated against evidence from both epidemiological and clinical intervention studies.

Several criteria considered in weighing up the diets are summarised in Table I.

For each diet category the underlying philosophies are stated and supporting evidence is given, and concerns and adverse effects are summarised. In many cases there is no evidence to support the claims made or the mechanisms by which

Table I. Comparison of different popular diets

Diet category and description	Premise	Evidence	Concerns and adverse effects
Low-carbohydrate (< 100 g), high-fat and/or high-protein diets			
Atkins 20 g carbohydrate/day for the first 14 days, then 40 - 60 g/day. Plenty protein (high in animal protein) and fat. Energy intake is not restricted. Individuals on the diet are advised to have their uric acid levels tested, to take medication to prevent gout, and to take mineral and vitamin supplements	< 100 g carbohydrate/day minimises the insulin response, promotes ketosis and decreases hunger	Weight loss is facilitated by: - ketosis and losses of body water and glycogen ⁷ - reduced overall calorie intake ⁵ - satiety on higher-protein diets ^{4,6}	Ketosis may cause constipation, diarrhoea, dizziness, headaches, fatigue, halitosis, hair loss and insomnia ⁷ Provided protein is kept within acceptable ranges on a higher-protein diet (104 g/day; 34% total energy) and emphasises plant protein foods, calcium excretion and bone loss are not a concern ⁴
South Beach First phase is a high-protein semi-starvation diet limiting carbohydrate to 10% of total energy. If goal weight is achieved (up to 5.9 kg weight loss during the first 2 weeks is promised) then one progresses to the 2nd phase, which includes restricted amounts of low-GI carbohydrates, and then to phase 3, which is much more liberal. However, if relapsing at any time, one has to revert to phase 1	Proteins offer satiety and a higher-protein diet results in less loss of lean muscle mass	Weight loss is facilitated by: - ketosis and losses of body water and glycogen ⁷ - reduced overall calorie intake ⁵ - satiety on higher-protein diets ^{4,6}	Inadequate in fibre, phytonutrients and many vitamins and minerals ⁷ Low-carbohydrate diets may not support regular physical activity needed for sustained weight loss
SureSlim Advertises an eating plan based on blood test results and a weight loss of 15 kg over a 4-week period for males (7 - 10 kg for females). An average of 3 days' intake comprises 3 632.6 kJ (869 kcal) - 35% carbohydrate; 27% fat (mostly saturated), 38% protein and 14.3 g fibre ⁸	Currently no evidence to prescribe diets based on blood analyses	Weight loss is facilitated by: - ketosis and losses of body water and glycogen ⁷ - reduced overall calorie intake ⁵ - satiety on higher protein diets ^{4,6}	Alterations in lipid profile have been found but long-term implications are unknown. Further research is needed, particularly in high-risk populations such as diabetics and patients with compromised kidney function
Moderate-carbohydrate, high-protein diet			
Zone 40% carbohydrate, 30% protein and 30% fat. The focus is on lean meats with the avoidance of most grains, starchy vegetables and some fruits	The precise 0.75 protein-to-carbohydrate ratio required with each meal will reduce the insulin-to-glucagon ratio, resulting in less body fat accumulation, and will control the production of eicosanoids	Calorie reduction and low GL cause weight loss rather than effect of diet on eicosanoids ^{9,10} Obese persons with higher blood triglyceride concentrations at baseline have been shown to lose more weight and fat mass on a high-protein compared with a high-carbohydrate diet ⁴	Meals are complicated to calculate Energy and carbohydrate intakes may be insufficient to support exercise required for weight loss

Table I. Comparison of different popular diets (continued)

Conventional low-fat diets			
Weight Watchers, Weigh Less 55 - 60% carbohydrate, 25% fat, 15 - 20% protein, 5 016 - 9 196 kJ/day (1 200 - 2 200 kcal/day). Meal plans allow for a reasonable amount of flexibility, personal tastes and preferences	These diets are based on current accepted weight-control guidelines ^{1,2}	A 10% reduction in dietary fat produces weight loss, even when consumed <i>ad libitum</i> ² These type of diets can result in average weight losses of 13.6 kg at 5.5 years ²	None, if diet well planned
Very low-fat, high-carbohydrate diets			
'X-diet' Only includes foods containing less than 3 g fat per 100 g but allows sugar and other carbohydrates in unlimited quantities and advises supplementing with essential fatty acids	Obesity is directly associated with dietary fat and inversely with carbohydrate	Fewer calories are consumed, particularly if the diet is high in fibre, causing weight loss ^{7,11}	Excessive amounts of processed foods high in simple carbohydrates, including sugar, high-fructose corn syrup, white flour, white rice and alcohol (i.e. high-GI foods), increases insulin (and plasma TG) and lipoprotein lipase, ultimately causing weight gain ³
Ornish 10% fat diet focusing on plant-based foods and a low GL			Fat-free diets are highly restrictive and low in minerals, some vitamins and essential fatty acids

GI - glycaemic index; GL - glycaemic load; TG - triglycerides.

weight is lost. For example, there is currently no evidence for the use of blood analyses to prescribe weight loss diets (SureSlim diet), nor is there evidence that manipulating eicosanoids through diet causes weight loss (Zone diet), as weight loss is more likely to be a result of total calorie reduction. Practical issues, such as the effort and flexibility in planning meals and whether or not the diet takes into account personal lifestyle, tastes and preferences are always a concern as these may influence long-term compliance as well as overall nutrient status. Generally, the more limited the food options, the greater the risk of nutrient deficiencies.

WHICH IS THE MOST EFFECTIVE DIET?

Several randomised trials have shown that after 6 months weight loss may be greater on a low-carbohydrate than on

a low-fat diet. However, after 1 year the differences are no longer statistically significant.¹² Results from a recent 1-year trial in which 160 subjects with metabolic characteristics reflecting those of the USA overweight population (note: South Africa has a similar prevalence of overweight and obesity) were randomly assigned to the Atkins, Zone, Weight Watchers or Ornish diet are given in Tables II and III.⁵

The prescribed total calorie intake was not significantly different between diets. Subjects received standardised recommendations pertaining to supplements, exercise and external support and were well matched in terms of age, race, sex, and BMI (average 25). They attended 4 1-hour small-group meetings over 2 months, after which they self-selected the degree to which they would adhere to the diets.

It is evident from Table II that all 4 diets resulted in modest, but statistically significant weight loss ($p < 0.01$) at 1 year. Importantly, however, there were no differences in weight losses between diet groups. In each diet group, approximately 25% of participants sustained > 5% weight loss and 10% sustained > 10% weight loss at 1 year. For every diet group, reported dietary adherence and weight loss were strongly associated, and participants in the top tertile of adherence lost 7% body weight on average. The tendency for dropping out, although not statistically significant, was higher in the Atkins and Ornish diet groups (Table II). The most common reasons for discontinuation were that the diets were too hard to follow or were not yielding sufficient weight loss.

Although at 1 year weight losses were similar in all 4 diet groups, and all diets achieved improvements in car-

Table II. One-year results of 4 popular weight-loss diets⁵

Measured outcome	Atkins	Zone	Weight Watchers	Ornish	p-value
Drop-out rate	48%	35%	35%	50%	$p = 0.08$
Weight loss (kg) (A)	2.1	3.2	3.0	3.3	$p = 0.40$
Weight loss (kg) (B)	3.9	4.9	4.6	6.6	$p = 0.40$
Mean kJ (kcal) reduction from baseline	577 (138)	1 049 (251)	1 020 (244)	803 (192)	$p = 0.70$ between diets $p < 0.05$ for within-diet effects

A - intention-to-treat; B - excludes missing data.

Table III. Changes in metabolic risk factors at 1 year in response to 4 popular diets⁵

Measured outcome	Atkins	Zone	Weight Watchers	Ornish
LDL	↓ (NS)	↓	↓	↓↓
HDL	↑↑	↑	↑	↑ (NS)
LDL/HDL	↓↓	↓↓	↓	↓↓
Triglycerides	↓ (NS)	(NS)	(NS)	(NS)
Insulin	↓ (NS)	↓	↓↓	↓
C-reactive protein	↓	↓ (NS)	↓↓	↓

NS – not significant ; ↑ and ↓ $p < 0.05$; ↑↑ and ↓↓ $p < 0.01$.

diac risk factors (Table III), these changes were not consistent and often not significant. For example, the decreases in triglycerides, insulin and LDL cholesterol levels seen in those on the Atkins diet were not significant. Other studies have shown that a 10% fat diet (i.e. the Ornish diet) with little saturated fat and dietary cholesterol resulted in a 40% decrease in LDL cholesterol over 1 year compared with a 5 - 7% decrease with a 30% fat diet (i.e. the Zone diet), with no significant change with the Atkins diet.² Interestingly, in the study by Danzinger *et al.*,⁵ no diet significantly worsened any cardiac risk factor at 1 year (Table III). However, in previous studies measuring myocardial perfusion, for example those individuals on the Atkins diet had significantly attenuated perfusion compared with those on a moderate- and low-fat diet.¹³ These results warrant closer investigation.

CONCLUSIONS AND RECOMMENDATIONS

The key factor for successful weight control is an energy deficit, but actual

food choices (macro- and micronutrients) are also important as they have the potential to affect clinical outcomes significantly. There is no one specific formula in terms of diet composition that is optimal for all overweight or obese persons. Responses vary widely and are dependent on a combination of genetic, environmental, psychosocial and clinical factors.¹⁴ Future studies are required to elucidate the mechanisms underlying the individual responses to specific diets that can be used to inform decisions regarding appropriate weight loss interventions. Together with the patient, the clinician should decide on the best weight loss strategy, also taking into account dietary history and previous history of weight cycling. Strategies should be chosen that result in better compliance, bearing in mind that diets on the extreme ends of the continuum are more difficult to adhere to.

References available on request.

IN A NUTSHELL

For many popular diets there is no evidence to support the claims made or the mechanisms by which weight is lost.

All diets that create an energy deficit will result in weight loss.

For weight loss there is no one specific formula in terms of diet composition that is optimal for all overweight or obese persons. Genetics and clinical, psychosocial and environmental factors may have an impact on outcomes.

Diet composition does, however, influence metabolic outcomes and at 1 year most overall improvements in cardiac risk factors are seen on the lower-fat diets.

Dietary adherence is a key determinant of long-term weight loss and therefore the prescribed diet should take into account practical issues such as the effort and flexibility in planning meals, personal lifestyle, tastes and preferences.

Generally the more limited the food options, the greater the risk for nutrient deficiencies.