

Slim pickings

The dieting industry is a massive money-spinner. Yet across the developed world, waistlines continue to expand. Declan Butler examines the sparse scientific evidence behind the claims made for leading diet plans.

“All my friends are on the Atkins diet, and they’re losing weight like crazy. Would this be a good thing for me or not?” Four years ago, Dena Bravata, a physician at Stanford University in California, could only stare blankly at her querying patient. She was aware of the popular low-carbohydrate diet, but she didn’t have a clue what to suggest. “That’s what motivated me to do a study,” Bravata says. “I had lots of patients all asking me the same question.”

So Bravata called her twin sister Dawn at Yale University in New Haven, Connecticut. After roping in further colleagues, they began scouring the scientific literature as far back as 1966 for papers addressing the efficacy and safety of low-carbohydrate diets. In April last year, the researchers revealed the results of this systematic review¹, which should provide those embracing the Atkins craze with food for thought. They couldn’t find any evidence that diets containing low proportions of carbohydrates were more effective. Consuming fewer calories overall, and sticking with a diet for a long time, were the only significant factors for slimming success.

The survey also revealed how painfully thin the science of dieting is. Searching for relevant terms on literature databases turned up a total of 2,609 articles. But just 94 of the studies met the researchers’ criteria for inclusion in their review, such as using proper controls and lasting longer than four days. In few cases were there sufficient data to assess the safety of the diets. Information on exercise was rarely reported, making it impossible to compare diets in sedentary and active patients. Few studies looked at different ethnic groups, only five lasted longer than 90



Food fight: do commercial diet plans have sufficient scientific nous to beat the bulge?

days, and not many included participants over 60 years old. If you are planning to diet in later life, there is little evidence to go on.

Given the burgeoning obesity epidemic, that’s a sorry state of affairs. Two-thirds of US adults are overweight, a third are clinically obese, and 1 in 12 has diabetes — a common complication of weight problems. The incidence of obesity in the United States has doubled in the past decade alone, according to the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia. And where the United States has led, the rest of the world is following.

Eat yourself fitter

Hundreds of diet books claim that the answer lies with their particular prescription for tweaking the proportions of fat, carbohydrate and protein that we eat. Some focus on the idea that certain forms of carbohydrate — those with a low ‘glycaemic index’, which are metabolized more slowly — are more conducive to weight loss than others (see ‘Good carbs, bad carbs’, overleaf).

A multibillion-dollar industry hangs on these claims. Robert Atkins, the New York doctor who championed the low-carbohydrate approach, is no longer with us, having perished last April after slipping on an icy street. But Atkins Nutritionals, the

company he founded to market his diet and related products, is very much alive — in October, two leading investment firms together paid a sum rumoured to be as high as \$800 million for a controlling stake.

But do any of these diets work? And are they safe? “The public is frantic for a sane voice amid the cacophony of popular diets,” says Marion Nestle, who chairs the Department of Nutrition, Food Studies and Public Health at New York University.

Science has so far had little to say. Only recently have research agencies shown any interest in funding trials of recipes for weight loss. Many of the studies reviewed by Bravata and her colleagues were initiated to examine the effects of varying the diet on particular diseases. What we need, say experts on nutrition, are much bigger trials that are specially designed to address the issue of weight loss and that meet the standards of those used to test new drugs.

One month after Bravata’s review appeared, two randomized controlled trials of low-carbohydrate diets were published back-to-back in *The New England Journal of Medicine*. One was led by Frederick Samaha at the Veterans Affairs Medical Center in Philadelphia², the other by Gary Foster at the University of Pennsylvania in the same city³.

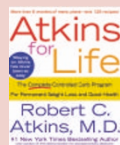
Samaha and Foster each randomly

Something to chew on

Diet plan

Atkins diet

♦ atkins.com



Sample claim

"...your body converts from the metabolic pathway of burning carbohydrate to burning fat as the primary energy source. This results in weight loss."

Eat less

Rice, whole grains, vegetables, dairy products

Eat more

Beef, poultry, soya protein

South Beach diet

♦ www.southbeachdiet.com

"[The South Beach diet] teaches you to rely on the right carbs and the right fats... [It] will not only help you lose weight but also improve your health."

Fatty meats, potatoes, white bread, soft drinks, refined grains, sweets

Poultry, lean meat, whole grains, fish, fruit and vegetables

New Glucose Revolution

♦ www.glycemicindex.com



"[Low-glycaemic-index diets] have benefits for weight control because they help control appetite and delay hunger."

Potatoes, white bread, soft drinks, refined grains, sweets

Breakfast cereals, wholemeal bread, fruit and vegetables

Weight Watchers

♦ www.weightwatchers.co.uk

"You are assigned a daily food Points allowance. Keep within your Points allowance and lose weight. It's that simple!"

Reduced intake of most food groups

Fruit and vegetables, poultry, seafood, grains, lean meats

treatment. "We have moved it from quackery to science," says Foster. "Maybe there is something there, with the emphasis on the 'maybe'."

The trials also failed to find signs that cutting carbohydrates rather than fats will increase the risk of cardiovascular disease. If anything, levels of artery-clogging triglycerides, and of 'good' versus 'bad' cholesterol, were slightly better among the volunteers on the low-carb diets.

But the studies were small: Samaha's included 132 patients, Foster's just 63 — and only 79 and 37, respectively, saw the studies through to the end. Until longer-term data from larger trials are in, Foster is loath to recommend any low-carbohydrate diet. He is now starting a larger study in 360 patients, funded by the US National Institutes of Health, which will last for two years. "Our initial study was just a pilot project; this is a full-blown clinical trial," says Foster. It will not only address the big question of whether low-carb or low-fat diets are better at maintaining weight loss in the long term, but will also include a wider assessment of the volunteers' health. Foster will collect data on the patients' ability to exercise, and on the health of their arteries, bones and kidneys.

This is important, because many nutritionists remain concerned about the safety of long-term adherence to diets that are biased heavily towards fats and proteins. One recent review of the safety of low-carbohydrate diets⁴ reeled off an alarming list of potential problems: "Complications such as heart arrhythmias, cardiac contractile function impairment, sudden death, osteoporosis, kidney damage, increased cancer risk, impairment of physical activity and lipid abnormalities can all be linked to long-term restriction of carbohydrates in the diet."

Unbalanced diet?

Robert Eckel of the University of Colorado's Center for Human Nutrition in Denver is concerned that people following the Atkins diet, or similar plans, won't eat the wide range of fruits, vegetables and whole grains that is almost universally held to be beneficial. "The Atkins diet is anything but health-promoting," he argues.

Other experts argue that the debate over the relative merits of various diets is a sideshow to the main message for those wanting to lose weight and keep it off: consume fewer calories and exercise more. "Thinking that a specific diet should eliminate people's weight problems is totally unrealistic," asserts Arne Astrup, a nutritionist at the Royal Veterinary and Agricultural University in

assigned obese volunteers to either an Atkins-style low-carbohydrate or a traditional low-fat diet. In Samaha's six-month study, subjects on the low-carb diets lost the most weight — an average of about 6 kilograms, roughly three times the weight loss reported for the low-fat group. Foster's smaller, year-long trial initially showed similar results, but the difference between the two groups had disappeared by the end of the year.

These two studies provide the best evidence so far that low-carbohydrate diets may be of some use for patients who need to shed weight — at least in the early stages of their

Frederiksberg, Denmark, and president-elect of the International Association for the Study of Obesity. "There is no getting round the laws of thermodynamics." In other words, if your energy intake exceeds your energy output, you will get fat whatever the proportions of fat, carbohydrate and protein in your diet.

The svelte Astrup practises what he preaches, cycling a total of 25 kilometres to and from work each day. "That burns up about 800 calories," he says. "As a result, I can enjoy eating without ever thinking about it."

Hard to swallow

Studies on people in hospital wards where their food intake is strictly controlled reinforce Astrup's message. These show that weight loss is similar for diets containing the same number of calories, irrespective of the proportion of carbohydrate, fat and protein^{5,6}.

But some experts, including researchers who are otherwise critical of the Atkins diet, say that the low-carb approach at least has the merit of encouraging people to cut out large portions of calorie-rich foods such as doughnuts, cakes and pastries. That may result in dieters consuming fewer calories overall, which would explain the results of Samaha's and Foster's trials.

But it is difficult to determine how many calories patients in dieting trials are consuming. Many volunteers don't stick to their prescribed diets, and they typically under-report the amount that they have eaten.

"The main reason the science is so poor is the same reason why we study the issue in the first place — most people don't like restricting their food intake," says Sandi Pirozzo, an epidemiologist at the University of Queensland in Brisbane, Australia. Pirozzo is the lead author of a recent review suggesting that the low-fat diets that have been recommended by doctors for decades seem to be no more successful than alternative diet plans⁷.

Another way to examine the value of various approaches to weight loss is to start with success stories — people who have lost large amounts of weight and kept it off — and look for common factors. This approach can be useful for generating hypotheses to test in subsequent controlled clinical trials, and has been used by Rena Wing, a psychiatrist at the Lifespan Academic Medical Center at Brown University in Providence, Rhode Island, and James Hill of the University of Colorado's Center for Human Nutrition.

A taste of success

Wing and Hill's National Weight Control Registry tracks the habits of nearly 3,000 successful dieters. People who can manage their weight, Wing and Hill suggest, share four common factors: they are on low-fat diets, closely monitor their weight and food consumption, exercise for more than one hour a day, and don't skip breakfast⁸. These

Good carbs, bad carbs

One of the hottest debates in dieting science is whether carbohydrates that are slowly broken down into glucose are better for people wanting to lose weight than those that are metabolized more rapidly.

Carbohydrates can be rated according to their glycaemic index (GI), a measure proposed in 1981 by David Jenkins of the University of Toronto in Canada¹⁰. This is based on the rate of digestion of a given carbohydrate and its conversion into blood glucose.

High-GI foods, such as white bread and potatoes, provoke a rapid post-meal spike in blood glucose and insulin, which subsequently converts blood sugar into long-term energy stores. Foods with a low GI, such as lentils, breakfast cereals and brown rice, cause a much lower and smoother response. Diabetics are often advised to eat low-GI foods, and there is evidence that these carry lower risks for conditions such as heart disease.

But can low-GI diets help to reduce weight? Some studies show that low-GI foods seem to make people feel less hungry, an effect that is possibly linked to the smoother rise and fall of blood insulin levels^{11,12}. The spike in insulin triggered by high-GI foods might also direct glucose away from being burned in muscle towards being stored as fat.

But most studies have been based on the consumption of simple foods, rather than the complex mixed meals that we eat in the real world. This is where the picture gets really messy. The total glycaemic load for a particular



meal can depend not just on the carbohydrates present, but also on their interaction with fat and proteins, and even how the meal is prepared¹³.

Sceptics of the relevance of GI to dieting, such as Arne Astrup of the Royal Veterinary and Agricultural University in Frederiksberg, Denmark, argue that it may be impossible to predict the glycaemic load of a mixed meal with sufficient accuracy to be of practical use. But David Ludwig, an endocrinologist at Harvard Medical School in Boston, disputes this view. He believes that the best approach for weight loss is a diet that stresses low-GI carbohydrates and contains moderate amounts of fat — a compromise between traditional low-fat diets and the Atkins low-carb approach.

The jury is still out, pending the results of clinical studies. Ludwig has reported encouraging results in a pilot project involving 16 adolescents¹⁴ and is now carrying out an 18-month trial on 100 obese children, randomly assigned to either a low-GI or a conventional low-fat diet.

findings suggest that behavioural factors may be at least as important in determining weight loss as the proportions of fat, carbohydrate and protein in the diet.

Nutritionists agree that the rising tide of obesity won't be reversed without concerted action by governments and the food industry to promote the consumption of foods that are less energy intensive. Last month, the CDC estimated that between 1971 and 2000, the calorie intake of US men rose 7%, and that of women jumped 22% (ref. 9). Most of this increase can be attributed to a boom in eating out, snacking, the consumption of soft drinks and bigger portion sizes. Twenty years ago, a typical US bagel was 3 inches across and contained 140 calories; now it has twice the diameter and packs a whopping 350 calories.

But if doctors are going to be able to offer sound advice to those who have already become dangerously overweight, more research into dieting will be vital. Foster argues that the public and the media need to change their conception of the problem. Rather than simply asking whether diet A is generally 'better' than diet B, he suggests, we should move towards a situation in which doctors can tailor diets to individuals, depending on their metabolic and behav-

ioural characteristics. Different diets might also have to be used at different stages in a patient's treatment.

"Ideally, five years down the road, with lots of scientific data behind us, we would be in a position to recommend diets tailored to individuals such as, say, diabetics, meat lovers, or those with difficulty sticking to a low-fat diet," says Foster. "This whole idea of one diet wins, one diet loses, seems to say that every overweight person is the same behaviourally and metabolically, and that is just silly."

Declan Butler is Nature's European correspondent.

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