

VIEWPOINT: Very-low-fat diets are superior to low-carbohydrate diets

Evidence shows that very-low-fat diets (not low- or moderate-fat diets) may be easier, not harder, to follow and make more sense physiologically. They should also produce the best weight loss and health outcomes in the long run.

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Patient Care

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For more than half a century, millions of Americans have periodically followed diets that were very low in carbohydrates (and high in protein and fat) in search of the best and easiest way to lose weight. The late Robert C. Atkins' 1998 revision of his 1972 *Dr. Atkins' Diet Revolution* was on the *New York Times* best-seller list for more than 6 years, and many other best-sellers have advocated similar low-carbohydrate diets.¹ Several professional organizations, including the American Dietetic Association (ADA) and the American Heart Association (AHA), have advised against the use of low-carb diets because considerable scientific evidence suggests that diets like these may promote cardiovascular, kidney, and liver diseases, as well as cancer.²

Despite the ostensible health risks of low-carb diets, some people have followed this approach and lost weight. This anecdotal evidence, coupled with successful marketing campaigns, has led even neutral consumer advocates to encourage weight controllers to "add a little fat" to their diets.³ Despite waning interest in this approach, acceptance of the supposed benefits of low-carb dieting still appears routinely in the media and is evident in restaurant menus and on supermarket shelves. Only a careful review of the scientific

literature can determine whether health professionals should recommend or oppose low-carb dieting for their confused overweight patients.

Bravata et al recently identified 2616 articles in professional journals (including 94 empirical studies) pertaining to the efficacy of low-carb dieting.² However, only 6 studies—5 of them published since the Bravata review was completed—have compared low-carb/moderate- to high-fat diets with diets described as "low-fat" using random assignment and evaluations lasting at least 6 months.⁴⁻¹⁰ The authors of 4 of these 6 studies concluded that their low-carb diets helped their overweight participants lose more weight than their low-fat diets.^{4,6,7-9} A critical review of these studies, however, reveals that none provides scientifically valid evidence for this claim. This article presents the basis for this assertion and provides an empirically grounded rationale for recommending very low-fat diets.

Flaws in research designs

Three major flaws in research designs undermine the validity of these studies. First, all 4 of the studies that found some ostensible benefits for low-carb diets used elaborate intervention programs (for example, 18 months of weekly sessions), not dietary instructions alone.^{4,6,7-9} Including the diets within extensive programs confounds the integrity of the independent variable, decreasing internal validity ("diffusion of treatment") and external validity ("multiple treatment interference").¹¹

Second, the administrators of these diet/behavioral programs had far more opportunities for their beliefs or biases to have an impact on outcomes than they would have had in a study, like that of Foster et al, that used a diet intervention alone.⁵ This raises possibilities of investigator and experimenter bias that threaten both internal and external validity ("reactivity of experimental arrangements" and "combination of experimental setting and treatment").¹¹ Two of the 4 studies that supported the supposed differential benefits of low-carbohydrate diets were funded by companies (olive oil and peanut companies and The Dr. Robert C. Atkins Foundation) that had—and still have—major financial allegiances to low-carbohydrate diets.^{6,8} This fact clearly increases the salience of concerns about investigator/experimenter bias, although it by no means impugns the integrity of the researchers.

The third design flaw is the most important: None of the 4 studies that ostensibly found benefits for low-carb diets used a truly low-fat diet (for example, 5%-10% of calories from fat), sometimes referred to as a very-low-fat diet. Thus, these studies actually compared low-carb diets with moderate-fat diets (goals were 20%,⁶ 25%,⁵ and 30%^{4,7,8} of calories from fat; obtained: 29%-33%), thereby creating a "construct validity" problem.¹¹

When is a diet a diet?

Only Foster et al tested the relative efficacy of a diet per se, as it is usually attempted by the millions of people who buy diet books.⁵ This study also yielded no differences between low-carb and low-fat diets at a 1-year follow-up and produced about half the

weight loss in their best group, as compared with the best group of 2 of the other studies.^{4,8} The remaining studies tested dietary instructions within educational and behavioral programs.

Professionally conducted weight-control programs are far more likely to help people lose weight than self-help approaches.¹² In fact, a meta-analysis showed that the single best predictor of weight loss is length of treatment.¹³ Longer treatments also produced much more weight loss in studies that experimentally compared longer to shorter treatments.¹⁴ These effects of amount of contact with professionals emerge almost regardless of the content that is focused on within the sessions.¹⁵ Apparently, participation in such programs helps weight-controllers set goals, monitor and evaluate their behaviors, and generally stay motivated, optimistic, and focused on change. These findings indicate that the 5 low-carb studies under consideration here that embedded the diets within educational/behavioral programs must attribute some of their effects to the programs themselves, not the diets.

Investigator and experimenter bias

Investigators' hypotheses can intentionally or unintentionally affect the manner in which the experimental protocol is specified and delivered and the accuracy of data gathering and analyses. Similarly, experimenters (in these studies, dietitians) can affect recruitment and retention of participants.

In the present set of studies, the researchers and dietitians probably knew that publication, notoriety, and subsequent funding may have depended on finding benefits for low-carb diets. The enthusiasm of the dietitians who administered the programs could have varied according to condition, quite possibly unintentionally, thereby affecting attrition and recruitment for evaluations. In fact, the attrition in some of the low-fat groups was as much as 400% higher than the usual attrition rate for related behavioral programs that used low-fat or very-low-fat diets (80% versus 20%) and was significantly higher in low-fat compared with low-carb groups in 3 of the 6 studies.^{6,7,8,15} This suggests the possibility of differential enthusiasm for the treatments.

Research on investigator and experiment bias has revealed some dramatic effects, including studies showing that experimenters' computational errors favor investigators' hypotheses 75% of the time.¹⁶ The authors of the 2 studies under review here that received financial support from companies with vested interests in low-carbohydrate diets based their conclusions favoring low-carb/moderate-to-high fat diets on potentially flawed analyses.^{6,8}

First, the "primary analyses" of McManus et al were conducted using a "low-fat" group in which 67% (20 of 30) subjects analyzed had dropped out of the program.⁶ Thus, they almost certainly were no longer following the low-fat approach when they were counted as "low-fat" dieters. This group was compared with a higher-fat group comprising 25 active participants and only 6 dropouts. Forty additional dropouts were not "available for measurements." Based purely on research showing the powerful impact of active

participation in weight-loss programs, 67% of the low-fat group included in the primary analyses would be expected to fare poorly, compared with 19% of the low-carb group.¹³ This differential subject attrition, one of the primary threats to internal validity, was statistically very significant ($P < .001$) but ignored by the authors. When the researchers compared only current participants (excluding dropouts), the groups did not differ in weight loss.

The quality and outcomes of the manipulation checks in the study by Yancy et al raise questions about the nature of the independent variable (the distinctiveness and characterizations of the diets).⁸ The Atkins' (low-carb) diet group was instructed to consume less than 20 g/d of carbohydrates—a severely restricted level of carbohydrate consumption. The authors noted that carbohydrate consumption under 40 g/d (twice the allowed level) should have been readily detected by urinary dipstick tests. However, only 19 of 59 (32%) participants included in analyses had observed trace levels of ketones. Since the vast majority of those assigned to the low-carbohydrate diet failed to restrict their carbohydrate consumption enough to be detected at twice the allowed level, it seems problematic to consider this group to be a "low-carbohydrate diet group."

Perhaps the researchers considered their dietary assignments to be successful based on analyses of the diets reportedly consumed by participants. Unfortunately, only 20 out of 119 (17%) of participants were selected (not randomly assigned: 13 low-carb dieters, 7 low-fat dieters) for analyses of their diets. No measure of the reliability of these dietary assessments was reported.

Even if participants had followed Yancy et al's dietary manipulation exactly as intended, these researchers, like McManus et al, largely ignored the potential impact of differential subject attrition.^{6,8} The Yancy study did not acknowledge the McManus study or others showing that dropouts often fail to lose weight, compared with those who stay in treatment.^{13,15} The McManus and Yancy low-fat participants prematurely discontinued treatment almost twice as often (43%) as their low-carbohydrate groups (24%). Unlike McManus et al, however, Yancy et al did not analyze the data separately for completers only. Without taking into account the likely poorer performance of the greater number of dropouts in the low-fat group, Yancy et al may have inadvertently skewed the results in favor of their low-carbohydrate group.

Furthermore, the use of linear mixed-effects models to project expected weight losses (instead of analyzing the data actually obtained) may have capitalized on the well-known effect of low-carbohydrate diets to produce initially greater weight losses.⁹ Also, as Yancy et al noted, their use of projected values depended on the assumption that including dropouts would not affect the meaning of the results ("noninformative dropouts"). In weight-control research, however, dropouts lose less weight than completers.^{13,15} Therefore, including these dropouts "informed" the outcomes, thereby perhaps violating an assumption of the analyses.

This argument gains support by calculating the impact on the results of including the dropouts. The low-carbohydrate dieters were projected to lose 85% more weight than

those assigned to the low-fat group at the 24-week point. When dropouts are deleted from these projections (counting them as losing no weight in both diet conditions), the discrepancy between groups decreases substantially. The projected difference decreases by 236% (from 85% to 36%), quite possibly rendering the actual differences between groups nonsignificant.

When is a low-fat diet a low-fat diet?

The biggest problem in the studies that supposedly favored low-carb diets was the failure to use truly low-fat diets. Samaha et al used a moderate-fat goal, 30% calories from fat, in their "low-fat" group.⁷ They reported a baseline level of fat consumption by that group of 33% of calories from fat (68 g/d) and even after "six months of dietary counseling," this group averaged the same percentage of calories from fat (33%; 57.8 g fat). Data in McManus et al also showed minimal changes and moderate levels of fat consumption at baseline (31%) and follow-up (30%) in the low-fat group.⁶ Brehm et al and Yancy et al used low-fat goals of about 30%, and they both reported 29% fat consumption during the program.^{4,8}

In their extensive review of the efficacy of popular diets, Freedman et al categorized the level of fat consumption obtained in these 4 studies as "moderate-fat."¹⁶ Current evidence suggests that the moderately high levels of fat consumption achieved in these studies should not have helped weight-controllers succeed.^{17,18} In a review of dietary interventions, Barnard et al reported that "only very stringent dietary manipulations led to effective change."¹⁹ They found that the 3 studies that clearly produced the greatest changes in diets limited "dietary fat to no more than 10% of energy," not the 25% to 30% of calories from fat used by almost all of the other 27 studies in their review and obtained (29%-33%) by the studies under discussion here. Freedman et al also asserted that "data support the contention that those consuming low-fat, low-calorie diets are most successful in maintaining weight loss."¹⁶

Stice's survey of 396 adolescents also illustrates the differential benefits of very-low-fat compared with low/moderate-fat diets.²⁰ He found that only those who followed a very stringent approach lost weight; those who reported following more moderate diets actually gained weight. Weight-controllers in Jeffery et al also found a low-fat approach easier to use and more palatable than a calorically restricted diet without limits on fat.²¹ (It's easier to eat no potato chips at all than just one.) The data from both these studies and the Barnard et al review support Barnard's conclusion: "Higher limits on fat intake, which may be selected in hopes of maximizing the acceptability of prescribed diets, may actually discourage a greater degree of dietary change."¹⁹

Lowering levels of fat consumption is crucial

Other analyses of the impact of macronutrients on weight change support the view that moderate (and certainly high) fat consumption can inhibit weight loss and maintenance of reduced weight. The extensive review of the efficacy of low-carb diets in Bravata et al showed that "among obese patients, weight loss was associated with longer diet duration,

restriction of caloric intake, but not with reduced carbohydrate content".² The Freedman et al review also found no support for the benefits of reducing carbohydrate content, without restricting calories, on weight loss.¹⁶

For example, Harris et al studied 157 weight-controllers over 18 months and found that reducing the percentage of calories from carbohydrates (and protein) did not affect weight loss.²² In contrast, eating very little fat, and specifically minimizing consumption of beef, hot dogs, and sweets, did predict weight loss (as it did in Holden et al).²³ Reducing calories from fat actually predicted weight loss even better than change in total calories (as it did in Jeffery et al).²¹

In a remarkably similar vein, but with children as the focus, Gazzaniga and Burns found that a group of obese children ate much more fat and many fewer carbohydrates than their lean peers.²⁴ Even after statistically adjusting for total energy intake, physical activity, and metabolic rates, obese children still ate more fat and fewer carbohydrates.

As would be expected from these results, highly successful adult weight-controllers consume much less fat than average Americans and about 10 times the level of carbohydrates recommended by Atkins.²⁵ Weight-loss programs that counsel people to eat like this have produced among the most promising outcomes in long-term evaluations.²⁶

Animal and physiologic research also supports the benefits of truly low-fat diets compared with moderate-fat diets. Several studies showed that animals fed high-fat diets gained weight much more readily than those fed diets much lower in fat.²⁷ Boozer et al also found that high-fat diets not only promote weight gain but also inhibit weight loss.²⁸ They compared several groups of rats whose food was restricted to 75% of the calories in their baseline diets. The rats that were fed high-fat, restricted-calorie diets (45% fat) failed to lose weight, compared with rats that consumed diets of the same restricted calorie level that were moderately high in fat (28%) and low in fat (12%). Three human studies also found that much-lower-fat diets resulted in weight loss even when total calories were not reduced, an effect never obtained with low-carb diets.¹⁶

Bessesen et al demonstrated a method through which high-fat diets inhibit weight loss.²⁹ They found that when obese rats consumed dietary fat, it was transported to storage in fat cells and away from muscle cells much more so than was the case in lean rats. This pattern was accentuated for formerly obese rats. Formerly overweight people also show a differential sensitivity to fat at the cellular level.³⁰ They may also have greater physiologic sensitivity (insulin secretion, salivation) to the presence and even the thought of highly palatable high-fat food.³¹ Consuming high-fat foods may also encourage overeating by increasing appetite and decreasing satiety to a greater extent than low-fat foods.³² This may occur because eating such foods may stimulate the endogenous opioid peptide system.

Consuming a high-fat diet also induces heightened sensitivity to leptin, leads to increases in ghrelin, and inhibits the transportation of insulin into the brain, all of which probably

increase eating and weight gain.¹⁶ In fact, a recent study showed that a very low-fat/high-carbohydrate diet (15% calories from fat, 65% carbohydrate, 20% protein) failed to trigger the type of increase in ghrelin (a potent orexigenic signal) that is typically seen when people lose weight by restricting calories in higher-fat diets.³³

Why were truly low-fat diets not used in these studies?

This evidence raises questions about why these researchers chose "low-fat" dietary levels (actually "moderate-fat" diets, according to Freedman et al) that were 50% to 100% higher than genuinely "low-fat" or "very-low-fat" levels.¹⁶ Part of the answer is that the current evidence, while compelling, remains somewhat controversial and circumstantial. Definitive treatment outcome studies that clearly favor very-low-fat diets have not yet emerged, although the evidence certainly points in that direction.

The reliance on tradition (actually, myths) provides another explanation. For decades, major professional groups that focus on diet and health (such as the AHA and ADA) have advocated moderation as the key to success in weight control. Extreme approaches, or so the myth goes, will not work because they induce feelings of deprivation and binge eating. Yet, the scientific evidence shows that more stringent goals for fat consumption seem easier (not harder) to implement consistently, make more sense physiologically, and produce the most promising results.

Implications

Perhaps the greatest irony in the current low-carb craze pertains to the overwhelming scientific evidence showing that self-help and other minimal interventions (for example, diet books and instructions alone) rarely help people lose much weight. Yet, publications in prestigious journals with favorable editorial commentaries, public relations campaigns, anecdotal claims, sales of millions of books, and countless stories in the media have prompted literally thousands of papers addressing this issue.^{2,16}

It is time for diet to be put in its place. A diet is just one element that can facilitate weight loss only when weight-controllers sustain major efforts to transform their lifestyles (activity level, stress management, focusing, and commitment). Furthermore, even when extracting the contribution of diet on weight loss, the possible long-term risks of low-carbohydrate/high-fat diets and some noteworthy short-term adverse effects (such as significantly increased GI distress, headaches, and muscle weakness) should discourage the use of such diets.⁸ Unless valid scientific research shows reliable and differential weight loss and other benefits for low-carb diets, which seems unlikely at this juncture, the recommended pathway to successful weight control should include a very-low-fat diet, not a low-carb/high-fat diet.

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