VIEWPOINT

Lowering the Bar on the Low-Fat Diet

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The recent revelation that the sugar industry attempted to manipulate science in the 1960s[1] has once again focused attention on the quality of the scientific evidence in the field of nutrition and how best to prevent diet-related chronic disease.

Beginning in the 1970s, the US government and major professional nutrition organizations recommended that individuals in the United States eat a low-fat/high-carbohydrate diet, launching arguably the largest public health experiment in history. Throughout the ensuing 40 years, the prevalence of obesity and diabetes increased several-fold, even as the proportion of fat in the US diet decreased by 25%. Recognizing new evidence that consumption of processed carbohydrates—white bread, white rice, chips, crackers, cookies, and sugary drinks—but not total fat has contributed importantly to these epidemics, the 2015 USDA Dietary Guidelines for Americans essentially eliminated the upper limit on dietary fat intake.[2] However, a comprehensive examination of this massive public health failure has not been conducted. Consequently, significant harms persist, with the low-fat diet remaining entrenched in public consciousness and food policy. In addition, critical scientific questions have been muddled.

The Low-Fat Diet: Intended and Observed Outcomes

In the mid-20th century, individuals in the United States consumed a higher-fat diet, with more than 40% of total calories coming from this macronutrient, and many thought that processed carbohydrates (both starches and sugars) caused weight gain. For instance, virtually all milk intake was whole rather than fat-reduced and fats were used liberally in cooking, sauces, and salad dressings. But this situation changed radically in a few decades, as animal experiments, mechanistic studies, cross-national comparisons, and small trials suggested potential benefits of a low-fat diet.

Fat has an exceptionally high energy density, with 9 calories per gram vs 4 calories per gram for carbohydrate and protein. In addition, many high-fat foods are highly palatable and, in some experimental settings, seemed to induce relatively weak satiety (in other words, they might delay return of hunger less effectively than other foods of similar calorie content). Therefore, some suggested that dietary fat promoted passive overconsumption, termed "high-fat hyperphagia."[3] Physiological studies of that era also suggested that carbohydrate intake was regulated—the glycogenostatic model[4] held that low body stores of glycogen drive food intake—whereas fat intake was not, providing another reason that high-fat/low-carbohydrate diets might lead to overconsumption.

Primarily for these reasons, the prevailing notion emerged that "it was difficult, if not virtually impossible, to overeat on a high-carbohydrate diet"[4] and that replacing fat with carbohydrate would facilitate ad lib weight control. Even added sugar was commonly considered to be innocuous and perhaps protective against obesity by displacing fat from the diet (the "sugar-fat seesaw").[3-5] Cross-sectional epidemiological studies provided some evidence that people who consumed a high-carbohydrate or high-sugar diet weighed less than those who consumed a high-fat diet. Several short-term and poorly controlled clinical trials reported that reducing fat intake, without calorie restriction, produced modest spontaneous weight loss.

Based on this evidence, nutrition-related public policy underwent a rapid change in the late 20th century. The US government advised the public to increase intake of carbohydrates (including 6 to 11 servings of grain products and additional potatoes) and consume all fats (including full-fat dairy, olive oil, nuts, avocado, and fatty fish) sparingly, as exemplified by the Food Guide Pyramid of 1992. To facilitate this change, the Healthy People 2000 goals included a call to the food industry to increase from 2500 items "to at least 5000 brand items the availability of processed food products that are reduced in fat." The food industry followed suit, systematically replacing fat in food products with starch and sugar.

As a result of these efforts, dietary fat decreased to near the recommended limit of 30% total energy. But contrary to prediction, total calorie intake increased substantially, the prevalence of obesity tripled, the incidence of type 2 diabetes increased many-fold, and the decades-long decrease in cardiovascular disease plateaued and may reverse, despite greater use of preventive drugs and surgical procedures. However, other changes in diet (such as meals away from home) and lifestyle (such as physical activity level) may have influenced these trends.

Recent research suggests that the focus on dietary fat reduction has directly contributed to this growing burden of chronic disease.[2,6-9] In contrast to older, cross-sectional designs, high-quality prospective observational studies consistently show that total fat intake does not predict change in body fat, after controlling for confounding and reverse causation. Some foods previously relegated to the top of the pyramid because of high fat content (nuts, full-fat yogurt) are associated with lower rates of weight gain than common high-carbohydrate foods (processed grains, potato products, sugary beverages).[9] Moreover, meta-analyses of clinical trials report that low-fat diets are inferior to comparisons controlled for treatment intensity, including low-carbohydrate diets,[6] Mediterranean diets, and all higher-fat diets. Of particular importance, the major low-fat diet studies, such as the Women's Health Initiative clinical trial and Look Ahead, failed to reduce risk

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for heart disease despite use of lower-intensity control conditions. In contrast, the PREDIMED study was terminated early when cardiovascular disease incidence decreased more rapidly than expected in the higher-fat diet groups compared with the low-fat control. Consistent with these findings, men and women adhering to low-fat/high-carbohydrate diets had higher, not lower, rates of premature death, although the type of dietary fats consumed importantly modified risk.[7]

One reason for the apparent failure of low-fat diets is that they may elicit biological adaptations—increasing hunger, slowing metabolic rate, and other hallmarks of the starvation response—that antagonize ongoing weight loss. Preliminary studies suggest that the reduced insulin secretion with low-carbohydrate and low-glycemic-index diets may attenuate these adaptations, facilitating long-term weight-loss maintenance and reducing diseases associated with hyperinsulinemia (the carbohydrate-insulin model).[8]

Lessons Unlearned

The focus on replacing dietary fat with carbohydrate did not achieve intended public health goals and arguably produced harm, but these adverse outcomes have not been clearly and consistently acknowledged. Consequently, many people in the United States still actively avoid eating fat. Indeed, national nutrition policy continues to promote fat reduction in schools (eg, by banning whole milk and allowing sugar-sweetened nonfat chocolate milk), in government food procurement programs, and in the line item for total fat on the Nutrition Facts label. According to a recent report regarding the sugar industry, the adverse cardiovascular effects of added sugar remain largely underrecognized because of an industry-sponsored research program in the 1960s and 1970s "that successfully cast doubt about the hazards of sucrose while promoting fat as the dietary culprit in CHD [coronary heart disease]."[1]

Some experts maintain that there has long been consensus on the components of a healthful diet; that the low-fat diet recommendation was intended all along to increase consumption of vegetables, fruits, and whole grains rather than processed carbohydrates; and that responsibility for any adverse outcomes resides with the food industry for marketing unhealthful low-fat processed foods and the public for succumbing to this marketing. But these arguments disregard calls to increase consumption of all carbohydrates, irrespective of quality (including sugar), explicitly because of their lower energy density than fat[3-5]; the pyramid's emphasis on bread, cereal, and other processed grain products; the government's call for thousands of new reduced-fat processed foods; marketing schemes involving industry, nutrition societies, and government officials that promoted low-fat food products of exceedingly low quality (eg, the now defunct Smart Choices Program); and ongoing topics of major controversy, for instance related to optimal macronutrient ratio, food processing, saturated fat, and fructose. Furthermore, encouraging intake of produce should not be conflated with reducing dietary fat. The Mediterranean diet illustrates how use of olive oil and other palatable fats in cooking and salad dressings can promote vegetable consumption.

Another suggestion has been to curtail funding for macronutrient-focused diet research because weight loss in one notable study (the DIRECT trial) was only moderately greater with a very low-carbohydrate vs low-fat diet, disregarding the reduced cardiovascular disease risk in that and other studies.[10] In fact, studies of alternative diets have received very little funding compared with research into the low-fat diet. Consequently, most such studies have substantial limitations, including low intervention intensity and poor differentiation between diet groups. With adequate funding, including for innovative methods to promote long-term dietary adherence, the evident superiority of low-carbohydrate diets demonstrated in meta-analyses[6] may increase further in magnitude.

Trial and error is inherent to the scientific process and examples abound in biomedical research of fundamentally important discoveries arising from failure. Nutritional science is particularly complex because of numerous, interacting components of diet, changing composition of the food supply, and important biological differences among individuals, affecting response. For more than 40 years, obesity prevention and treatment focused on reduction of dietary fat, consistent with the energy balance model of weight control. But this model, which considers all calories alike to the body, now faces challenge from the carbohydrate-insulin model and other approaches (eg, emphasizing macronutrient quality) that take into account the metabolic effects of food. The differences between and lessons from these 2 fundamentally distinct dietary models hold promise for science and public health and should be carefully evaluated, beginning with a frank accounting of past and current dietary recommendations and comprehensive measures to mitigate persisting harms from the low-fat diet era.

ARTICLE INFORMATION

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