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Special article

In the face of contradictory evidence: Report of the *Dietary Guidelines for Americans* Committee

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A B S T R A C T

Concerns that were raised with the first dietary recommendations 30 y ago have yet to be adequately addressed. The initial Dietary Goals for Americans (1977) proposed increases in carbohydrate intake and decreases in fat, saturated fat, cholesterol, and salt consumption that are carried further in the 2010 Dietary Guidelines Advisory Committee (DGAC) Report. Important aspects of these recommendations remain unproven, yet a dietary shift in this direction has already taken place even as overweight/obesity and diabetes have increased. Although appealing to an evidence-based methodology, the DGAC Report demonstrates several critical weaknesses, including use of an incomplete body of relevant science; inaccurately representing, interpreting, or summarizing the literature; and drawing conclusions and/or making recommendations that do not reflect the limitations or controversies in the science. An objective assessment of evidence in the DGAC Report does not suggest a conclusive proscription against low-carbohydrate diets. The DGAC Report does not provide sufficient evidence to conclude that increases in whole grain and fiber and decreases in dietary saturated fat, salt, and animal protein will lead to positive health outcomes. Lack of supporting evidence limits the value of the proposed recommendations as guidance for consumers or as the basis for public health policy. It is time to reexamine how US dietary guidelines are created and ask whether the current process is still appropriate for our needs.

Introduction

> What is required is less advice and more information.
> —Gerald M. Reaven [1]

There is little disagreement that we have a nutritional crisis in the United States. One manifestation is confusion in the mind of the public as to what constitutes sound principles [2,3]. Recent scientific advances have not led to consensus, but rather to substantial disagreement among experts and further uncertainty for the public. Nutritional health covers a wide range of concerns but foremost in the mind of the public are whether the standing recommendations for lowering fat intake and increasing carbohydrate intake were ever appropriate for the prevention of obesity, diabetes, and cardiovascular disease; whether the regulation of carbohydrates is more important; and what the role of protein, especially from animal sources, should be in the diet. These concerns were raised with the first national dietary recommendations 30 y ago and have yet to be adequately addressed even as the nutritional health of Americans continues to decline.

The 2010 Dietary Guidelines Advisory Committee (DGAC) Report [4], released on June 15, 2010, was expected to address these issues (sections of the report are indicated as part-section number, e.g., B2; pages in the report are denoted, e.g., B2-3.). The DGAC Report had the opportunity to review and evaluate the emerging science, to distinguish between established principles and ideas that are still areas of research or controversy, and to provide clear, consistent information for Americans. Instead,

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the 2010 DGAC Report continues to make one-size-fits-all recommendations that are based on evidence that is weak, fragmented, and even contradictory in nature.

Strong recommendations, weak evidence

Important aspects of the recommendations remain unproven. The DGAC Report provides several examples in the summary of "Needs for Future Research" in each section. In the carbohydrates section, a goal of that research would be to:

> Develop and validate carbohydrate assessment methods. Explore and validate new and emerging biomarkers to elucidate alternative mechanisms and explanations for observed effects of carbohydrates on health [p. D5-43 [4]]. … Studies of carbohydrates and health outcomes on a macronutrient level are often inconsistent or ambiguous due to inaccurate measures and varying food categorizations and definitions.

However, the DGAC Report's summary statement on carbohydrates is unambiguous in the face of these inconsistencies:

> Healthy diets are high in carbohydrates [p. D5-42].

In the absence of research that can explain the mechanisms that would account for a beneficial effect of high carbohydrates on health outcomes, the recommendation must be considered premature.

The protein section includes a call for future research that will:

> Develop standardized definitions for vegetable proteins and improve assessment methods for quantifying vegetable protein intake to help clarify outcomes in epidemiologic studies in this area. … Assessing vegetarian eating patterns and their protein content is complex and current methodologies do not capture critical variations. Therefore, investigators' ability to quantify any possible association with health benefits is limited [p. D4-31].

Yet the DGAC Report's recommendations suggest no such limitations. Americans are told to:

> Shift food intake patterns to a more plant-based diet that emphasizes vegetables, cooked dry beans and peas, fruits, whole grains, nuts, and seeds [p. B3-3].

The admission that health benefits from such a shift remain unknown and the acknowledgement of "potential limitations of [a] plant-based diet for key nutrients" (p. D4-31) would suggest that such a recommendation be made with more circumspection.

The DGAC Report calls for a general increase in whole grain consumption:

> Whole-grain versions of many grain products (such as plain white bread, rolls, bagels, muffins, pasta, breakfast cereals) should be substituted to meet the recommendation that half of grains consumed be whole grains [p. B2-8].

However, the DGAC Report also calls for additional research to:

> Develop definitions for whole grain foods. … there is no consistent way that whole grain foods are defined and determined. Without clear definitions for whole grain foods, it is difficult to compare research studies examining the effectiveness of various whole grains on biomarkers of interest in CVD [cardiovascular disease], diabetes, and obesity [p. D5-43].

Urging an increase in whole grain consumption before the term is consistently defined stymies any practical attempts to apply this recommendation.

These examples illustrate the general pattern of the DGAC Report: strong recommendations are made with weak and inconclusive evidence to support them. Conclusions rest on evidence-based methodology, embodied in the creation of the Nutrition Evidence Library (NEL). In practice, the methodology and the utilization of the NEL demonstrate several critical weaknesses:

1. Research questions are formulated in a way that precludes a thorough investigation of the scientific and medical literature.
2. Answers to research questions are based on an incomplete body of relevant science; relevant science is frequently excluded due to the nature of the question.
3. Science is inaccurately represented, interpreted, and/or summarized.
4. Conclusions do not reflect the quantity and/or quality of relevant science.
5. Recommendations do not reflect the limitations, controversies, and uncertainties existing in the science.

The initial Dietary Goals for Americans (1977) proposed that Americans increase carbohydrate intake and decrease fat, saturated fat, cholesterol, and salt consumption, recommendations that are carried further in the proposed 2010 guidelines. Thirty years ago, critics argued "that the value of dietary change remains controversial and that science cannot at this time insure that an altered diet will provide improved protection from certain killer diseases" [5]. The proposed recommendations raise these same concerns. What remains of value in the current DGAC Report is substantially undermined by a failure to address these ongoing criticisms.

Macronutrient proportion and health outcomes

A consistent theme in the 2010 DGAC Report is the statement that "very few American children or adults currently follow the US Dietary Guidelines" (p. D1-8) and that "the primary focus should be on reducing excessive calorie intake" (p. B2-3). However, according to the DGAC Report, caloric intake remains within recommended levels, and leisure-time physical activity has increased slightly (pp. D1-1, B2-3). Adult women on average consume at the lowest end of the recommended calorie range and yet are the most overweight/obese (p. D1-4). The macronutrient proportions of the typical American diet fall within recommended ranges (p. D1-1): Americans currently consume less than 35% of their calories as fat and less than 300 mg of cholesterol per day (p. D3-10).

Americans are consuming more calories than in the past, but the increase has not been equally distributed across food groups. The increase in calories in the American diet over the previous 30 y is primarily due to carbohydrate intake (Fig. 1). Average daily calories from meat, eggs, and nuts have increased by about 20 cal since 1970 as average daily calories from flour and cereal products have increased by nearly 10 times that amount

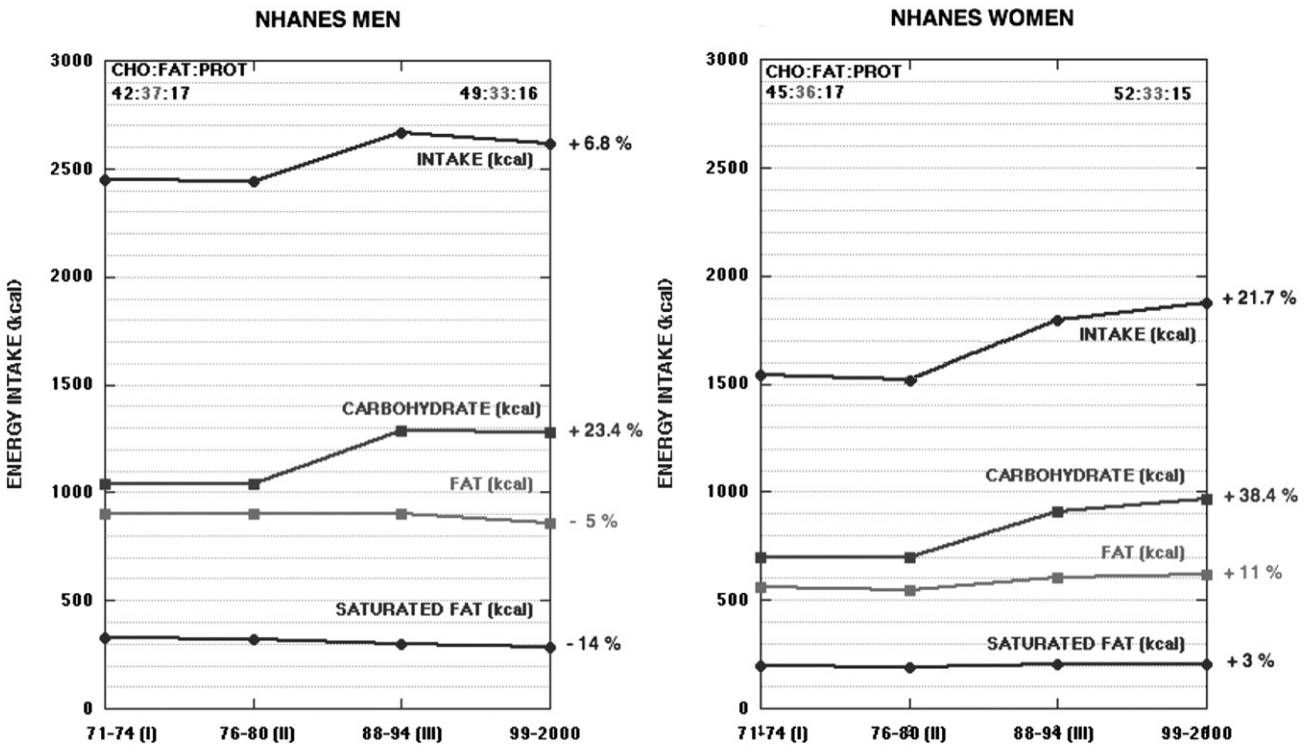

Fig. 1. Energy intake during the epidemic of obesity. Data from the Centers for Disease Control and Prevention [6]. CHO, carbohydrate; NHANES, National Health and Nutrition Examination Survey; PROT, protein.

(p. D1-10). In short, the macronutrient content of the diet has shifted in the direction recommended since the 1977 dietary goals. Total and saturated fat intakes have decreased as a percentage of calories—for men, the absolute amount has decreased—whereas carbohydrate intake has increased [6]. Notable from the DGAC Report is the absence of any concern that this shift in macronutrient content may be a factor in the increase in overweight/obesity and chronic disease; the proposed recommendations suggest that this trend should not only continue but also become more pronounced.

Macronutrients: Research questions are formulated in a way that prevents a thorough investigation of the literature

The 2005 Institute of Medicine Macronutrient Report states, "Compared to higher-fat diets, low-fat, high-carbohydrate diets may modify the metabolic profile in ways that are considered to be unfavorable with respect to chronic diseases such as coronary heart disease (CHD) and diabetes" [7]. The DGAC Report precludes the evaluation of the potential impact of high dietary carbohydrate on chronic disease by the way that research questions are formulated. The "Search Plan and Results" for the macronutrient section of the NEL excluded studies that have demonstrated the effect of macronutrient content on any metabolic response beyond weight loss [8–11]. Also excluded were studies on the relation of macronutrient content to health outcomes or risk factors for chronic disease, even when weight was measured [12–14]. The DGAC Report only addresses the relation of chronic disease in regard to "dietary energy density" as measured in calories per gram, disregarding the overall nutrient content of foods entirely. Foods with low energy density are preferred in the DGAC Report, effectively leading to a bias in favor of lower-fat foods. It is the arbitrary exclusion of evidence, however, that decreases the potential for insights into improving the health of Americans.

Macronutrients and weight loss: Science is inaccurately summarized

Obesity and weight control are reasonably a major focus of the guidelines. However, the DGAC Report is hampered in its assessment of this issue by the common but overly simplified concept of weight loss as only a function of "calories in" versus "calories out." In its answer to the question, "What is the relationship between macronutrient proportion and body weight in adults?" the DGAC Report concludes that:

> There is strong and consistent evidence that when calorie intake is controlled, macronutrient proportion of the diet is not related to losing weight [p. D1-47].

The NEL contains evidence that is not consistent with this conclusion; several included studies show that a low-carbohydrate diet can produce significantly greater weight loss than a low-fat diet, even when caloric intake is held constant between diets [15–18]. Figure 2 shows results from a study by Volek et al. [15] demonstrating greater weight loss on a low-carbohydrate diet compared with a low-fat diet, with similar caloric intake. Several studies in the NEL demonstrate equivalent or increased weight loss on low-carbohydrate diets that do not explicitly control calories or impose restrictive eating behaviors [15,19–24]. A full assessment of the science would recognize these departures from the stated conclusion.

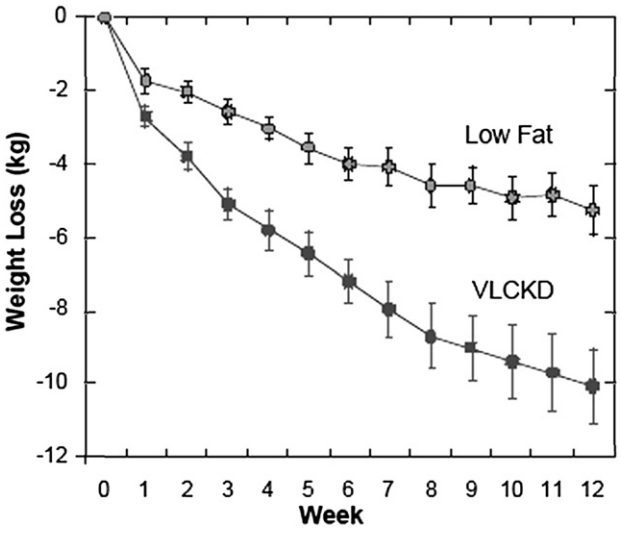

Fig. 2. Weight loss on a VLCKD. Data from Volek et al. [15]. VLCKD, very-low-carbohydrate ketogenic diet.

The DGAC Report goes on to conclude that:

> A moderate amount of evidence demonstrates that intake of dietary patterns with less than 45 percent calories from carbohydrate or more than 35% calories from protein are not more effective than other diets for weight loss or weight maintenance, are difficult to maintain over the long term, and may be less safe [p. D1-47].

This conclusion does not accurately reflect the research reviewed in the DGAC Report:

> This conclusion is based on 36 articles published since 2004. … Twenty studies found no difference in weight loss between diets differing in macronutrient proportion. … Thirteen studies found that lower-CHO [carbohydrate] diets reduced weight significantly more than low-fat or higher-CHO diets. … Four studies found that higher-PRO [protein] diets reduced weight significantly more than lower-PRO or higher-CHO diets [pp. D1-47, 48].

It is not clear what "moderate amount of evidence" means in this context; 47% of the cited studies demonstrate that low-carbohydrate or high-protein diets, whether hypocaloric or otherwise, are in fact *more* effective. A responsibly worded summary would acknowledge these contradictory findings.

Low-carbohydrate diets: Science is inaccurately represented

Low-carbohydrate diets are not recommended because they are "difficult to maintain over the long term." Table 1 presents data from studies and meta-analyses included in the NEL showing that attrition rates are, if anything, lower for low-carbohydrate diets compared with low-fat diets [25–31]. An appropriate summary on adherence would state this. The DGAC Report suggests that the diet recommended in the current guidelines is difficult to follow (pp. D1-8, B3-4); the evidence demonstrates that some Americans may find a low-carbohydrate diet less so.

Table 1
Comparison of attrition rates between low-fat and low-carbohydrate diets

Study	Attrition (%)	
	Low-fat diet	Low-carbohydrate diet
Yancy et al., 2004 [25]	45	24
Gardner et al., 2007 [26]	22	12
Samaha et al., 2003 [27]	47	33
Dansinger et al., 2005 [28]	50	48
Brehm et al., 2003 [29]	26	15
Foster et al., 2003 [30]	43	39
Tay et al., 2008 [31]	18	20

Low-carbohydrate diets: Conclusions do not reflect quantity and/or quality of relevant science

The DGAC Report's conclusions also maintain that diets that stray from the recommended guidelines "may be less safe," a claim made about low-carbohydrate diets for 40 y without supporting data. The DGAC Report relies on two studies that "found that diets lower in carbohydrate and higher in protein were associated with increased total and cardiovascular mortality" [32,33] (p. D1-49). Both studies have considerable flaws. In Lagiou et al. [32], which the NEL gives a "neutral" quality rating, dietary assessment was made at baseline and total and cardiovascular mortalities were determined up to 12 y later, a significant weakness. The study by Trichopoulou et al. [33] is a cohort study where the study population was distributed into quartiles according to low-carbohydrate/high-protein diet score. The investigators noted that, "In our study population, consumption of carbohydrates, even at the low extreme of the distribution, was higher than that advocated by the prescribed low-carbohydrate diets and few individuals consumed more than 20% of their energy from proteins" [33]. A similar conclusion was reached by Lagiou et al. [32].

More studies in the NEL demonstrate that low-carbohydrate diets *improve* CVD risk markers than demonstrate the opposite. The DGAC Report cites two studies that found increased low-density lipoprotein cholesterol in the low-carbohydrate arm. Six studies from the NEL that are not mentioned in the conclusions of the DGAC Report demonstrate the reliable increase in high-density lipoprotein cholesterol and the reliable and usually dramatic decrease in triacylglycerols that occur in response to carbohydrate restriction [19–21,31,34,35]. One of these [19] is a meta-analysis of 13 studies that compared the weight-loss effects of low-carbohydrate diets against low-fat diets. The NEL summary of this meta-analysis concludes:

- There were significant differences between the groups for weight, high-density lipoprotein cholesterol, triglycerides, and systolic blood pressure favoring the low-carbohydrate diet.
- There was a higher attrition rate in the low-fat as compared with the low-carbohydrate groups suggesting a patient preference for a low-carbohydrate/high-protein approach [in contrast to the statement from D1-47 that they are "difficult to adhere to"].
- Evidence from this systematic review demonstrates that low-carbohydrate/high-protein diets are more effective at 6 months and are as effective, if not more, as low-fat diets in reducing weight and cardiovascular disease risk up to one year.

An objective assessment of the evidence from the NEL does not suggest the conclusive proscription against low-carbohydrate diets given in the DGAC Report's conclusion; unsubstantiated dangers are exaggerated and consistent benefits are omitted.

Dietary fat and health outcomes

Prevention of chronic disease by manipulation of dietary fat and carbohydrate is a primary focus of the DGAC Report, although, as described above, evidence on the effects of macronutrient proportion on diseases is excluded. The section, "The Influence of Dietary Fats on Cardiovascular Disease (CVD) And Other Health Outcomes," asks the question, "What is the effect of saturated fat intake on increased risk of cardiovascular disease or type 2 diabetes [T2D], including effects on intermediate markers such as serum lipid and lipoprotein levels?" (p. D3-15).

Effects of saturated fat: Answers based on an incomplete body of relevant science

The DGAC Report concludes that:

> Strong evidence indicates that intake of dietary SFA [saturated fatty acids] is positively associated with intermediate markers and end point health outcomes for two distinct metabolic pathways: 1) increased serum total and LDL [low-density lipoprotein] cholesterol and increased risk of CVD and 2) increased markers of insulin resistance and increased risk of T2D. Conversely, decreased SFA intake improves measures of both CVD and T2D risk. The evidence shows that 5 percent energy decrease in SFA, replaced by MUFA [monounsaturated fatty acids] or PUFA [polyunsaturated fatty acids], decreases risk of CVD and T2D in healthy adults and improves insulin responsiveness in insulin resistant and T2D individuals [p. D3-15].

This conclusion is based on an incomplete body of relevant science. Only studies that measure the effects of SFA in the presence of recommended levels of dietary carbohydrate are included in the "Search Plan and Results" section of the NEL; studies with a low-carbohydrate intake are specifically excluded [15,35–40]. No mention is made of a recent large meta-analysis that found there is no substantial evidence for concluding that dietary saturated fat is associated with an increased risk of heart disease [41]. Not discussed are basic science studies demonstrating that *plasma* saturated fat, the presumed cause for concern, is substantially determined by dietary carbohydrate [40,42].

Table 2 presents the effect on cardiovascular risk markers of total and saturated fat [15,26–28,43,44]. The data, from studies and meta-analyses included in the NEL and elsewhere, show that when participants switched from their habitual diet to a low-carbohydrate diet (<45% of calories), neither total fat nor saturated fat consumption changed significantly, whereas positive changes occurred in cardiovascular risk markers. These findings are inconsistent with concerns regarding fat, specifically saturated fat. A comprehensive assessment of the science would necessarily result in a conclusion that addresses this inconsistency.

Effects of saturated fat: Science is inaccurately represented or summarized

The conclusion of the DGAC Report suggests that the replacement of SFA with monounsaturated fatty acids or PUFA creates unequivocally positive cardiovascular risk factor outcomes; this is not the case. Studies cited by the DGAC Report demonstrate increases in atherogenic lipoprotein levels or triacylglycerols, decreases in high-density lipoprotein cholesterol, and varied metabolic responses to lowered dietary SFA in subpopulations [45–48]. These controversies and uncertainties with regard to SFA are not included in the DGAC Report.

Citing a meta-analysis by Jakobsen et al. [49] as evidence of "a significant inverse association for PUFA (with 5% substitution for SFA) and coronary events" (p. D3-16), the DGAC Report misrepresents the actual findings of the meta-analysis. The NEL summary shows this association was weak overall and significant only for women younger than 60 y. The meta-analysis [49] also showed that for all men in the study and for women at least 60 y of age, there was no significant association between substitution of PUFA for SFA and risk of coronary events or coronary death. An accurate summary of this meta-analysis and the additional controversies and uncertainties in the science suggest that evidence associating dietary SFA with increased risk of CVD is inconclusive.

Diabetes and fat: Science is inaccurately represented or summarized

With regard to diabetes, the DGAC Report concludes that:

> The growing data to support a risk of T2D from SFA consumption supports the need for fat-modified diets in persons with pre-diabetes, including those with metabolic syndrome, and those with established diabetes [p. D3-15].

This statement shows the same disregard for physiologic mechanisms as before: all effects of saturated fat are measured in the presence of recommended (high) levels of carbohydrate intake. Because digestible dietary carbohydrate is the primary source of exogenous glucose, discounting the role of carbohydrate in the risk of T2D shows a troubling disregard for physiologic mechanisms. Regulating carbohydrate intake remains a primary strategy for achieving glycemic control [50], yet no studies with decreased carbohydrate intake were included.

The DGAC Report focuses instead on numerous studies investigating possible associations between T2D and SFA (p. D3-18). Two of these studies were, according to the DGAC Report:

> … methodologically strong review articles including one which evaluated 15 trials, 9 trials in 358 non-diabetic participants and six trials in 93 participants with T2D (Galgani, 2008), and one reviewing 14 prospective cohort and 5 cross-sectional studies (Hu, 2001) [p. D3-17].

However, 12 of 15 studies reviewed in Galgani et al. [51] found no effect relating to fatty acid type on insulin sensitivity, and Hu et al. [52] concluded that "dietary recommendations to prevent Type II diabetes should focus more on the quality of fat and carbohydrate in the diet than quantity alone." Remaining studies are limited in their value for general application by multiple intervention factors applied simultaneously [53,54], small sample size [55,56], or assessment of subsets of various SFA or other specific fatty acids [57–59]. Similar studies showed mixed or inconclusive results [60–62].

The studies gathered in the NEL do not provide sufficient evidence to conclude that a decrease in dietary saturated fat will lead to positive health outcomes.

Dietary carbohydrate and health outcomes

The data in Figure 1 show that the increase in calories during the previous 30 y is almost entirely due to carbohydrate. The effectiveness of carbohydrate restriction for weight loss and improved markers of chronic disease when compared in head-to-head trials with low-fat diets continues to be newsworthy.

Table 2
Cardiovascular risk markers decrease and absolute fat and saturated fat are constant

Study	Study duration	Total fat (g/d)		Saturated fat (g/d)		Markers of cardiovascular risk (% change)		
		Habitual	End of study	Habitual	End of study	LDL	HDL	Triacylglycerol
Gardner et al., 2007 [26]	12 mo	76	79	27	27	+1	+9	−23
Samaha et al., 2003 [27]	6 mo	77	74	NR	NR	+4	0	−20
Dansinger et al., 2005 [28]	12 mo	78	81	26	27	−5	+7	−1
Brehm et al., 2005 [43]	4 mo	87	88	NR	NR	−2	+16	−37
Yancy et al., 2010 [44]	48 wk	105	107	34	38	−2	+10	−19
Volek et al., 2009 [15]	12 wk	97	100	34	37	+4	+11	−51

HDL, high-density lipoprotein; LDL, low-density lipoprotein; NR, not reported

With the established biochemistry of the glucose–insulin axis, dietary carbohydrate is a topic of increasing relevance to a public battling obesity and diabetes.

The DGAC Report describes it thus:

> The role of carbohydrates in the diet has been the source of much public and scientific interest. These include the relationship of carbohydrates with health outcomes, including coronary heart disease (CHD), type 2 diabetes (T2D), body weight, and dental caries [p. D5-1].

The results of their evidence review were conclusive: "No detrimental effects of carbohydrates as a source of calories on these or other health outcomes were reported" (p. D5-1). The evidence is not discussed, however, and there is no further debate regarding carbohydrates per se.

Dietary fiber and whole grains: Conclusions do not reflect the quantity and/or quality of science

The section on carbohydrate begins its evaluation of dietary carbohydrates with the question, "What are the health benefits of fiber?," a question that presumes that health benefits have already been established. In fact, evidence supporting the health benefits of fiber with regard to obesity, diabetes, and bowel health is limited, as acknowledged in the American Dietetics Association (ADA) position paper on which much of the fiber information in the DGAC Report is based [63].

The ADA position paper also found:

> … fair evidence (Grade II) that "dietary fiber from whole foods or supplements may lower blood pressure, improve serum lipids, and reduce indicators of inflammation [p. D5-9].

The ADA library provides summary worksheets used to reach this conclusion; most of the summarized studies are funded by industry, as is the study published in 2009 by De Moura et al. [64] on whole grains cited by the DGAC Report (p. D5-9). This is not an inherent criticism of the conclusions, but the DGAC Report expresses concern about the influence of industry on studies pertaining to eggs and cholesterol (p. D3-47); no concern is voiced in regard to whole grains or fiber. The study by De Moura et al., ironically, shows that if the Food and Drug Administration definition of whole grain is used, there is insufficient scientific evidence to support a claim that whole grain intake decreases the risk of CVD, in direct contradiction of the DGAC Report's conclusion (p. D5-11). A fundamental flaw in the DGAC Report's support of whole grain and fiber intake is that these terms are defined inconsistently, and their definitions appear to be shaped to promote processed carbohydrate foods as "healthy."

Glycemic load/index: Answers based on an incomplete body of relevant science

Based on the same physiologic principle as total carbohydrate decreases, the glycemic index (GI) and the glycemic load (GL) were designed to measure the impact of food on blood glucose levels. In practice, the GI/GL cannot always be reproduced consistently from person to person or even in the same person at different times. Glycemic impact can vary with a food's ripeness, physical form, preparation, and foods with which it is consumed; research discussing the limitations of the GI/GL is not noted in the DGAC Report [65,66]. The GI/GL is frequently proposed as an alternative to carbohydrate restriction, although the literature is clear that total carbohydrate intake has a more significant and consistent effect on glucose, insulin levels, and markers of CVD. Most recently, Westman et al. [67] compared a very low-carbohydrate diet with a diet based on the GI (Fig. 3). The GI-based diet had been shown by Jenkins et al. [68] to be superior to the kind of high-fiber diet recommended by the DGAC Report. Comparison of the two trials (Fig. 3) shows the low-carbohydrate diet to be more effective at controlling hemoglobin A_{1c} and improving markers of cardiovascular risk. With regard to T2D, a high-cereal diet has limited benefits. A GI-based diet is better, but a low-carbohydrate diet has the most beneficial impact.

The DGAC Report proposes to investigate the relation between the GI/GL and chronic diseases such as CVD and diabetes (p. D5-21) although the NEL "Search Plan and Results" excluded studies whose participants were diagnosed with either condition, including 24 studies on the effect of the GI/GL on participants with T2D. The experimentally established association between carbohydrate intake and diabetes, with improved glycemic control being positively related to decreased carbohydrate intake, suggests this is a serious flaw.

Type 2 diabetes mellitus is fundamentally a disease of carbohydrate metabolism. The repeated demonstration that an increase in the absolute amount of digestible carbohydrates is detrimental to glucose control makes the DGAC Report's continued emphasis on grains especially troubling. According to the DGAC Report:

> Although the IOM [Institute of Medicine] set an Acceptable Macronutrient Distribution Range (AMDR) for carbohydrate of 45 to 65 percent of total calories, it is very difficult to meet dietary fiber recommendations at the low end of this range … [p. D5-4].

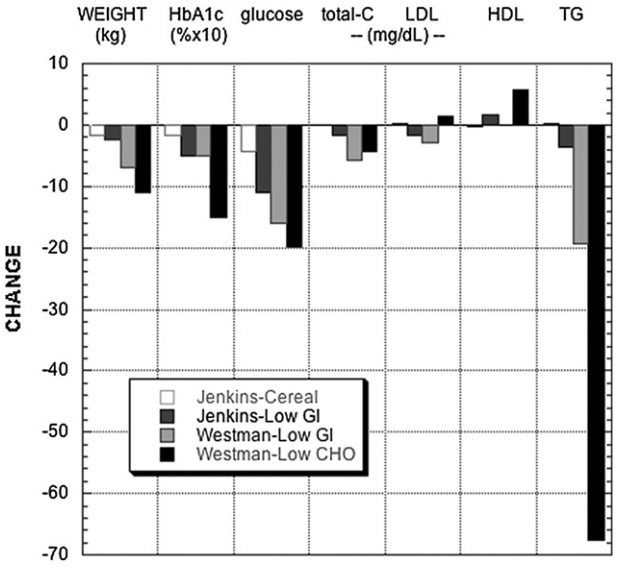

Fig. 3. Comparison of a high-cereal diet and two low-GI diets with a very-low-carbohydrate diet. Data from Jenkins et al. [68] and Westman et al. [67]. ©2008 Richard D. Feinman, used with permission. CHO, carbohydrate; GI, glycemic index; HbA1c, hemoglobin A_{1c}; HDL, high-density lipoprotein; LDL, low-density lipoprotein; TG, triacylglycerol; total-C, total cholesterol.

In essence, the public is being told that decreasing carbohydrates is not advisable because it would necessarily restrict fiber intake, although support for the benefits of fiber intake is limited and inconclusive. We are expected to accept, without substantial evidence or a clear biological mechanism, that an increase in fiber intake from 15 to 25 g/d will be more beneficial to a person with T2D than a decrease in the overall digestible carbohydrate content of the diet.

Dietary protein and health outcomes

For the first time, the DGAC Report makes the case for protein as the most important macronutrient in the diet (pp. D4-1, 3). The DGAC Report establishes the role of protein and protein quality in human health, discussing the essentiality of nine amino acids, which must be obtained from the diet, and the conditional essentiality of another six, pointing out that a dietary source of these amino acids may also be necessary (p. D4-1). The DGAC Report concludes that:

> Protein quality varies greatly and is dependent on the amino acid composition of the protein and the digestibility. Animal sources of protein, including meat, fish, milk, and egg, are the highest-quality proteins. Plant sources can be combined to form more complete proteins if combinations of legumes and grains are consumed [p. D4-30].

Although animal sources provide the highest-quality protein, Americans are advised to shift to a more "plant-based" diet (p. B3-3) and "consume only moderate amounts of lean meats, poultry, and eggs" (A2).

Animal versus plant protein: Recommendations do not reflect limitations and uncertainties of the science

The DGAC Report explores a possible relation between the intake of animal protein products and CHD, CVD, T2D, and prostate, colorectal, and breast cancers. The DGAC Report concludes that 1) moderate evidence found no clear association between intake of animal protein products and blood pressure, 2) limited inconsistent evidence suggests that mainly processed meat may have a link to T2D, 3) there is insufficient evidence to link animal protein to body weight, 4) there are inconsistent positive associations between colorectal cancer and intake of, mainly, red and processed meat, 5) there is limited evidence that animal protein products are associated with prostate cancer incidence, and 6) there is limited evidence that shows no association between intake of animal protein products and overall breast cancer risk (p. D4-6).

Despite concluding that the evidence is "moderate, limited, insufficient and inconsistent" on any relation between animal protein consumption and negative health outcomes and at the same time asserting that animal sources provide the highest-quality proteins, the DGAC Report cautions Americans about the increased animal protein content of their diets. The two main considerations are the quantity/quality/preparation of animal protein foods and the fact that animal protein contains saturated fat (p. D4-6). The concern about an inherent increase in saturated fat implies that dietary SFA are associated with health risks, which, as above, has not been demonstrated, and requires that a direct effect of animal protein on CVD, CHD, elevated cholesterol levels, and other chronic-disease markers can be demonstrated. In direct studies where protein intake is increased, particularly if accompanied by a decrease in total carbohydrate, markers for CVD and CHD are improved, hemoglobin A_{1c} is decreased, and blood glucose and insulin levels are normalized [69–74]. Concerns are raised that fat associated with animal protein may increase calorie levels (p. D4-6) but similar concerns are raised about plant-based proteins: "Plant products can be combined to improve protein quality, but the number of calories that must be consumed to get adequate intakes must be considered" (p. D4-3).

The DGAC Report acknowledges that plant protein confers no specific health benefits (p. D4-11) and may in fact present nutritional inadequacies (p. D4-16). The argument for the importance of protein in the diet is convincing but insufficient evidence to support the substitution of plant sources of protein is presented.

Salt: Recommendations do not reflect limitations and uncertainties of the science

There is probably no more telling example of the limitations of the DGAC Report than the recommendations on salt. The DGAC Report states that a "strong body of evidence has documented that in adults, as sodium intake decreases, so does blood pressure" (p. D6-2). Strong evidence is what is needed to make dietary recommendations but that evidence is lacking. A Cochrane review, for example, concluded that "intensive interventions, unsuited to primary care or population prevention programs, provide only minimal reductions in blood pressure during long-term trials" [75]. Another recent meta-review questioned the sustainability of the blood pressure–lowering effect over time [76]. Further evaluations to assess effects on morbidity and mortality outcomes are needed for populations as a whole and for patients with elevated blood pressure [77].

This is not to say that there is no evidence *for* decreases of salt intake but a major review would not express doubts or call for more study if the body of evidence in favor of restrictions was genuinely strong. Stepping back, we have to ask what general feature of the health profile of the country is being addressed by a call for a decrease in salt consumption; some fraction of the

population has hypertension, and they are or should be counseled to be in the care of a physician who can offer dietary advice and medication.

The case for dietary reduction emphasizes the salt added to food in processing by manufacturers (pp. D6-3, D6-18). However, salt lost from food losses and wastage has never been quantified and may amount to anywhere from 27% to 50% [78,79]. By design, many foods and food-manufacturing processes use considerably more salt than the final consumer ingests. As a result, there is no accurate assessment of the amount and sources of salt actually consumed.

The DGAC Report brings up relevant points on salt consumption that may be significant for Americans with moderate renal impairment and hypertension, conditions that are increasing in parallel with insulin resistance and the metabolic syndrome. However, the current sweeping recommendations for population-wide sodium restrictions that disregard uncertainties in the science and variations in individuals may undermine the public's confidence in those recommendations, which are of unquestioned value.

Summary: What can be done?

Is there nothing of value in the DGAC Report? On the contrary, there are valuable suggestions made regarding improving nutritional literacy and cooking skills; restructuring the food environment, including farmers, agricultural producers, and food manufacturers; and improving the availability of affordable fresh produce. However, none of these recommendations makes sense in the context of nutritional guidance that is not based on sound scientific principles and demonstrable results. Reforming the food environment must begin with a re-evaluation of 30 y of nutritional policy that was originally implemented without a thorough and unbiased evaluation of the science.

It is of interest to consider the opinion of the American Medical Association (AMA) with respect to the first implementation of dietary guidelines [80]. In an editorial, it was stated:

> We believe that it would be inappropriate at this time to adopt proposed national dietary goals as set forth in the Report on Dietary Goals for the United States. The evidence for assuming that benefits to be derived from the adoption of such universal dietary goals as set forth in the Report is not conclusive and there is potential for harmful effects from a radical long-term dietary change as would occur through adoption of the proposed national goals.

The guidelines recommended at that time show great similarity to the current recommendations:

> The Report sets forth six dietary goals of the United States. These goals are as follows:
> 1. Increased carbohydrate consumption to account for 55% to 60% of energy (caloric) intake.
> 2. Reduce overall fat consumption from approximately 40% to 30% of energy intake.
> 3. Reduce saturated fat consumption to account for about 10% of total energy intake; and balance that with polyunsaturated and monounsaturated fats, which should account for about 10% of energy intake.
> 4. Reduce cholesterol consumption to about 300 mg/day.
> 5. Reduce sugar consumption by about 40% to account for about 15% total energy intake.
> 6. Reduce salt consumption by 50% to 85% to approximately 3 gm/day

In the three decades since, carbohydrate consumption has increased; overall fat, saturated fat, and cholesterol consumption have decreased to near or below targeted levels; caloric intake remains within recommended levels; and leisure-time physical activity has increased slightly (pp. D1-1, D3-10, B2-3). At the same time, scientific evidence in favor of these recommendations remains inconclusive, and we must consider the possibility that the "potential for harmful effects" has in fact been realized. Notably, "the prevalence of overweight and obesity in the US has increased dramatically in the past three decades" (A4); the number of Americans diagnosed with T2D has tripled [81].

The AMA concludes:

> The Report suggests that the incidence of heart disease, cancer, hypertension, diabetes, obesity and tooth decay could be reduced by making qualitative and quantitative changes in "the American diet." The goals are laudable; however, the American Medical Association believes that there are insufficient data to recommend such changes in the diet on a nationwide scale.

Laudable as the goals were, the application of those recommendations has constituted a population-wide dietary experiment that should be brought to a halt. Lack of supporting evidence limits the value of the proposed recommendations as guidance for the consumer or as the basis of public health policy. We ask whether the Dietary Guidelines for Americans process as it stands should continue or whether there might not be better alternatives.

It is time for public health leaders, scientists, and clinicians to stop blaming Americans for not following the recommendations in the Dietary Guidelines for Americans and instead to re-examine the process used to formulate the US dietary guidelines and determine whether or not it is still appropriate for our current needs.

We ask whether it would be preferable to convene an impartial panel of scientists consisting of biochemists, anthropologists, geneticists, physicists, etc., who are not directly tied to nutritional policy. Such a panel would be able to hear all sides in the debate with few preconceived notions. Recommendations issued by this group would be more likely to be moderate, circumspect, and established on a complete and accurate assessment of available science rather than a narrow perspective of accepted nutritional practice. Public health nutritional policies produced from such recommendations may then serve the honorable intentions of those first dietary goals "to maximize the quality of life for all Americans" [5].

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