The scientific basis of recent US guidance on sugars intake[1–4]

Suzanne P Murphy and Rachel K Johnson

ABSTRACT Most fruits and dairy products are high in sugars, and thus naturally occurring sugars are consumed as part of a healthy diet. Sugars are also added to foods during processing or preparation, primarily to enhance taste. Monosaccharides and disaccharides added to foods are chemically indistinguishable from naturally occurring forms. However, concern has been expressed about the apparent increasing consumption of added sugars and their possible role in displacing or diluting nutrients in the diet and contributing to the epidemic of obesity in developed countries. One of the 2000 *Dietary Guidelines for Americans* states, "Choose beverages and foods to moderate your intake of sugars." The Dietary Guidelines Advisory Committee discussed whether to specify *added sugars* rather than the broader term *sugars* but decided that it was not possible to conclude that added sugars per se play a negative role in the public's health. The Dietary Guidelines Advisory Committee issued a call for more definitive studies of the role of sugars in current diets and the potential effect of a reduction in added sugars on both dietary quality and energy intake. The American Heart Association recently released a statement advising consumers to limit sugars consumption. The macronutrient report for the dietary reference intakes addresses many of these same issues; the expert panel concluded that it was not appropriate to set a tolerable upper intake level for added sugars but suggested a maximal intake level of 25% of energy from added sugars because of concerns about reduced intakes of essential micronutrients. *Am J Clin Nutr* 2003;78(suppl):827S–33S.

KEY WORDS Sugars, dietary guidelines, dietary reference intakes

INTRODUCTION

Sugars are a ubiquitous component of our food supply and are consumed as a naturally occurring component of many foods and as additions to foods during processing, preparation, or at the table. A healthy diet of necessity contains at least naturally occurring sugars, because monosaccharides, such as glucose and fructose, and disaccharides, such as sucrose and lactose, are integral components of fruit, vegetables, dairy products, and many grains (1). In addition, sugars add desirable sensory effects to many foods, and a sweet taste promotes enjoyment of meals and snacks.

However, concern has been expressed about a possible detrimental effect of sugars in diets, especially when consumed in large amounts. These concerns can generally be classified into 2 categories: adverse health effects associated with sugars per se and undesirable effects associated with excess energy from sugars, including weight gain and displacement of more nutrient-dense foods.

The 2000 Dietary Guidelines Advisory Committee (DGAC) made numerous changes to the *Dietary Guidelines for Americans*, including the addition of 3 new guidelines (2). Although there were numerous discussions of the guideline for sugars, it was only slightly reworded from the 1995 version (**Table 1**), and a strong plea for better data on the health effects of sugars was made. A short time later, the American Heart Association also released guidelines, including one related to sugars intake (3, 4). Most recently, the Institute of Medicine released a report on dietary reference intakes (DRIs) for macronutrients, including sugars (5). The guidance offered by each of these groups is discussed in the sections that follow.

ISSUES RELATED TO THE SUGARS GUIDELINE CONSIDERED BY THE 2000 DIETARY GUIDELINES ADVISORY COMMITTEE

Should added sugars be distinguished from naturally occurring sugars when offering dietary guidance to the public?

The DGAC's discussion regarding added compared with naturally occurring sugars centered on several issues. First, the 2 types of sugars are indistinguishable chemically and physiologically. Therefore, it was difficult to justify separating them in the guideline. However, a related issue was the nutrient content of the food containing the sugars. On the basis of sources of sugars in the American diet (**Figure 1**; 6), foods providing the highest amounts of added sugars are often foods with a low overall ratio of nutrients to energy content (a low nutrient density; eg, sweetened beverages and desserts), whereas foods with naturally occurring sugars tend to have higher nutrient densities (eg, fruits and dairy products). Focus groups showed that added sugars was a concept that consumers could readily understand and thus an emphasis on added sugars might be likely to lead to behavior changes. A related concern, however, was that the nutrition facts label shows total sugars, not added sugars, and thus consumers would have

[1] From the Cancer Research Center of Hawaii, University of Hawaii, Honolulu (SPM), and the College of Agriculture and Life Sciences, University of Vermont, Burlington (RKJ).

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[3] Manuscript preparation supported by ILSI NA.

[4] Address reprint requests to SP Murphy, Cancer Research Center of Hawaii, University of Hawaii, 1236 Lauhala Street, Suite 407, Honolulu, HI 96813. E-mail: suzanne@crch.hawaii.edu.

TABLE 1
Changes in the sugars guideline since 1980

1980: Avoid too much sugar
1985: Avoid too much sugar
1990: Use sugars only in moderation
1995: Choose a diet moderate in sugars
2000: Choose beverages and foods to moderate your intake of sugars

difficulty knowing the added sugars content of a packaged food. Because added sugars cannot be chemically distinguished from naturally occurring sugars, label values for added sugars would be difficult to monitor with current analytic methods.

The DGAC concluded that there was not sufficient scientific justification for including the term *added sugars* in the guideline and settled on a final wording that stated, "Choose beverages and foods that limit your intake of sugars." The wording was later changed by the sponsoring government agencies to, "Choose beverages and foods that moderate your intake of sugars." In the text that follows the guideline, there is an emphasis on added sugars, including 2 boxes: 1 that shows the major sources of added sugars and 1 that lists the various names used for added sugars. In the final section of the DGAC report, there is a call for a better definition of total sugars and added sugars and more research to determine whether there are reasons to distinguish between the 2 in the *Dietary Guidelines*.

Efforts to separate the effects of added sugars from those of naturally occurring sugars have been aided by the availability of the Pyramid Servings Database from the US Department of Agriculture (7), which gives the added sugars content of all foods reported during the 1994–1996 and 1998 Continuing Surveys of Food Intake by Individuals (CSFIIs). However, a complete investigation of the effects of the 2 categories of sugars would require analyses in which their comparative effects on health outcomes were examined. Unfortunately, the primary food-composition tables in use in the United States do not contain composition information for naturally occurring sugars, and thus it is has not been possible to directly compare the effect of these categories of sugars on health outcomes.

What health effects can be directly attributed to sugars in the diet?

Diets that are relatively high in sugars are postulated to be associated with various health problems. At the time of the deliberations, the DGAC concluded that none but the association with dental caries had been conclusively demonstrated. Dental caries are associated with sugars consumption (8), and sucrose is especially cariogenic (9). However, many factors contribute to the development of dental caries, including genetics, dental hygiene, frequency of eating, saliva flow, and exposure to fluoride (10).

A very-low-fat diet (≈20% or less of total energy from fat) accompanied by a high intake of carbohydrate can precipitate metabolic changes that may result in atherogenic dyslipidemia (11). The lipoprotein profile of atherogenic dyslipidemia is characterized by elevated triacylglycerols; small, dense LDLs; and low concentrations of HDLs (12). High-carbohydrate diets (13, 14), especially diets high in sugars (11, 13), have been associated with increased risk of cardiovascular disease. The DGAC extensively discussed the health consequences of diets with differing sugars contents and differing glycemic loads and concluded that additional research was needed before these relations could be used to alter the guidelines.

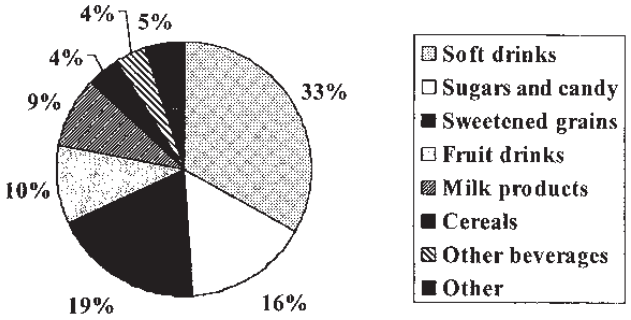

FIGURE 1. Sources of added sugars in the US diet. The key to the pie chart follows the sections clockwise from the soft drinks section. Adapted from data in Guthrie and Morton (6).

A meta-analysis of sugars intake and children's behavior and cognitive performance found little evidence of an association (15). Thus, the DGAC specifically included a statement in the text of the sugars guideline to this effect. On the basis of reviews showing no risk of type 2 diabetes due to sugars consumption (16, 17), no reference to diabetes was made in the text.

Is the intake of added sugars increasing?

Food availability data, used in conjunction with self-reported food consumption data from nationwide surveys, provide scientists and policymakers with information to assess changes in food consumption in the United States. Food availability data (sometimes called disappearance data) are compiled and published annually by the US Department of Agriculture Economic Research Service and measure the flow of raw and semiprocessed agricultural commodities through the US marketing system (18). Food supply data are "used to measure changes in food consumption over time and determine the approximate nutrient content of the food supply" (19). The Economic Research Service adjusts food availability data for a variety of losses and expresses the data in terms of per capita use (19).

Food availability data track caloric sweeteners, which include some sweeteners that are not included in food intake data. For example, sugars used for brewing beer are included. However, this component of caloric sweeteners constitutes a relatively small percentage of the total (< 1% is used by alcoholic beverage manufacturers; J Putnam, personal communication, 2002). According to data from the Economic Research Service, after adjustment for losses, the average annual availability of caloric sweeteners increased by 23% between 1980–1984 and 2000 (J Putnam, personal communication, 2002). Because energy availability also increased during this period, the percentage of energy from caloric sweeteners rose less, from 17.7% in 1980 to 18.9% in 1997 (20).

Estimates of added sugars intakes from self-reported food intake surveys have been derived from the CSFII. Data are provided on both the mean number of teaspoons of added sugars (assuming 4 g sugar per teaspoon) and the mean percentage of total energy intake from added sugars. From 1989–1991 to 1994–1996, mean intakes of added sugars increased from 15.7 teaspoons per day to 20.5 teaspoons per day in all persons older than 2 y. The mean percentage of total energy intake from added sugars increased from 13.2% to 15.8% for the same age group (21). Hence, for the number of teaspoons and the percentage of energy from added sugars, the amounts increased from 1989–1991 to 1994–1996 for the US population as well as for

every sociodemographic group examined (22). Although improved dietary assessment methods may explain a portion of the increase in absolute amounts of added sugars, the percentage of energy is less likely to be influenced because the newer methods result in increased reports of energy as well.

Self-reported dietary intake data have been criticized because of the pervasive problem of underreporting of food intake. It has been shown that low energy reporters mention consuming foods high in added sugars less often than do valid energy reporters (22, 23). Poppitt et al (24) used doubly labeled water to measure total energy expenditure and found that foods high in added sugars are selectively underreported. Hence, added sugars intakes in the US population may actually be underestimated in the CSFIIs.

Another method of evaluating added sugars intake is to examine changes in the consumption of the major source of added sugars. The largest source of added sugars in Americans' diets is regular soft drinks, accounting for one-third of the total added sugars intake (6). There was a 47% increase in annual per capita availability of regular soft drinks, from 28 gallons per person in 1986 to 41 gallons per person in 1997 (25). Food consumption surveys conducted from 1965 to 1996 found that regular soft drink consumption increased 187% for adolescent males and 123% for adolescent females (26). Regular-calorie soft drink intake in food consumption surveys is likely to be underestimated because of selective underreporting of foods and beverages (22).

Although the food availability data and the food intake surveys use different methodology and are not necessarily comparable with each other, the data from these sources indicate that consumption of added sugars has risen among Americans.

Could added sugars play a role in the obesity epidemic?

Obesity has reached epidemic proportions and has been referred to as a pandemic, a worldwide disease (27). The cost of treating obesity-related disorders now exceeds the cost of alcohol- and tobacco-related diseases (28). Hence, interest is high in identifying factors that may be related to obesity in the US population. It is important to state at the outset that there is no direct connection between added sugars intake and obesity unless excessive consumption of sugar-containing beverages and foods leads to energy imbalance and the resultant weight gain (29).

Food intake surveys show that over the past 2 decades Americans have increased their total energy intake, although at least part of the increase is probably due to better dietary assessment methods. Much of this increase has been in the form of carbohydrates, primarily from soft drinks (6, 30, 31). Energy intake has been positively associated with consumption of nondiet soft drinks in US children and adolescents (32). In addition, overweight children have been shown to consume a higher percentage of energy from soft drinks than do lean children (33).

Ludwig et al (34) followed a cohort of 548 ethnically diverse Massachusetts schoolchildren for 19 mo. After adjustments were made for baseline anthropometrics, demographics, other dietary intake variables, physical activity, television viewing, and total energy intake, increased consumption of sugar-sweetened beverages was a factor independently associated with an upward change in body mass index in children. The researchers concluded that for each additional serving of sugar-sweetened beverages consumed, the odds of becoming obese increased by 60%. This study showed an association between sugar-sweetened beverages and the onset of childhood obesity. However, it did not prove causality. The authors speculated that the association is related to evidence that people consuming carbohydrates in liquid form compared with solid form do not compensate for the energy, which promotes positive energy balance (35).

The DGAC concluded that a link could be suspected between the intake of sugars and body mass index but that it had not been shown consistently. More recent studies support this link but it is still not possible to conclude that there is a cause-and-effect relation. Furthermore, it is difficult to draw conclusions from studies when intake is self-reported because individuals underreport both energy intake and the intake of foods high in added sugars (22–24). Because underreporting is greater among overweight adults and adolescents (36–38), any associations between sugars intake and body size are likely to be masked. Thus, a definitive answer to the question is not likely to emerge from national survey data.

When energy expenditure was measured by doubly labeled water, obese adolescents did not report a higher percentage of energy from high-calorie foods (such as candy, chips, soda, baked goods, and ice cream) than did nonobese adolescents (39). However, because the high-calorie foods were self-reported, an underreporting bias may still exist. Only a study in which the subjects are confined and all food intake is carefully measured can resolve these issues.

Does sugars intake negatively affect nutrient adequacy?

The DGAC debated extensively about whether total sugars and added sugars have affected the adequacy of Americans' diets. Several additional articles were published on this issue after the committee's deliberations concluded, and these influenced the decisions of the panel considering the DRIs for macronutrients (5), as discussed in a later section.

Bowman (40) examined data from the 1994–1996 CSFII and showed that persons with > 18% of their total energy intake from added sugars had the lowest mean intakes of all micronutrients (especially vitamins A, C, and B-12; folate; calcium; phosphorus; magnesium; and iron). Forshee and Storey (41) also used the 1994–1996 CSFII database to determine the effect of added sugars on the diet quality of children and adolescents. They used a different research design than Bowman used and incorporated added sugars, carbohydrates minus added sugars, protein, fat, alcohol, age, and sex as independent variables in a multivariate regression model. Added sugars were positively associated with servings of grains and lean meat and with the percentage of the recommended dietary allowance (RDA) of vitamin C, iron, and folate. In contrast, added sugars were negatively associated with servings of vegetables, fruit, and dairy products and with the percentage of the RDA of vitamin A and calcium. However, the authors believed these associations were small from a practical perspective. Ballew et al (42) examined the effect of beverage choices on US children's nutrient intakes and found that soft drink intake, the major source of added sugars for US children (6), was negatively associated with vitamin A, calcium, and magnesium intakes.

Johnson et al (43) examined the nutritional consequences of sugar-sweetened flavored-milk consumption by school-aged children and adolescents in the United States. Sweetened dairy products contribute 10.6% of the total added sugars intakes for children aged 6–11 y, 7.2% for adolescent females, and 6.2% for adolescent males (6). Sweetened dairy products include flavored milks as well as ice cream and flavored yogurt. Hence, the contribution of flavored milks to total added sugars intakes would be

lower than the above percentages. Flavored milk intake was positively associated with calcium and phosphorus intakes and had no association with intakes of added sugars and total fat. Children who consumed flavored milk had higher total milk intakes and lower soft drink and fruit drink intakes. Thus, added sugars in nutritious foods such as dairy products may increase intakes of at-risk nutrients such as calcium.

Associations among nutrient intakes and consumption of the major food and beverage sources of added sugars were examined recently for US children with the use of data from the 1994–1996 CSFII (44). This study found that as intakes of sugar-sweetened beverages, sugars and sweets, and sweetened grains (cakes, cookies, pies, etc) increased, the percentage of the DRIs for calcium and iron decreased, intakes of saturated fats increased, and dairy servings decreased. As the consumption of sweetened dairy products and presweetened cereals increased, the percentage of the DRI for calcium increased. Among adolescents, as intakes of presweetened cereals increased, the percentage of the DRIs for iron and folate increased. The fortification of breakfast cereals with key nutrients no doubt contributes to these associations. Thus, consumption of sweetened dairy products and presweetened cereals appeared to have a positive effect on nutrient intakes, whereas the consumption of sugar-sweetened beverages, sugars and sweets, and sweetened grains reduced the intake of key nutrients and food groups (44). For those whose energy needs will not be exceeded by the additional energy from sugars, the addition of sugars to nutritious foods may be a strategy for increasing nutrient intakes.

The emerging research seems to indicate that when examined in its entirety, added sugars intake has a dilutional effect on the intakes of some critical micronutrients (40, 41). When the major food and beverage sources of added sugars are examined separately, their effect on diet quality is very different. Food and beverage sources that are generally nutrient poor appear to adversely affect diet quality, whereas food and beverage sources that carry other key nutrients in addition to the added sugars appear to positively affect diet quality (44).

The DGAC also considered whether a maximum amount of sugars intake could be recommended to consumers to avoid nutrient dilution. The food guide pyramid is often cited as giving guidance on an optimal amount of added sugars to consume (45). However, this is not technically accurate. The developers of the food guide pyramid determined recommended numbers of servings of foods from 5 main food groups (grains, fruit, vegetables, dairy, and meats) at each of 3 energy intake levels (1600, 2200, and 2800 kcal/d) that would supply enough nutrients to meet most of the 1989 RDAs (45). Then the energy content of the lowest-fat alternatives in each group was determined and summed across the recommended servings of each food group. The difference between the total energy of the diet (eg, 1600 kcal/d) and the energy content of the recommended food group servings (eg, 1220 kcal/d) was available for discretionary intake of fats, sweets, and alcohol (or, preferably, for additional intake of foods from the 5 food groups). Of these "extra" calories (380 kcal/d, in the example), it was assumed that consumers would choose to add fat to their foods up to the maximum recommendation of 30% of energy from fat. After these calories from fat were added to the total diet, any remaining extra calories were available for sugars consumption. For the lowest level of energy intake (1600 kcal/d), only 6 teaspoons (24 g, or ≈90 kcal) of added sugars would fit. For the highest level of energy intake (2800 kcal/d), it would be possible to have 18 teaspoons of added sugar. However, it is obvious that this should not be considered a recommended intake of sugars or even a maximum intake of sugars. A person who chooses a diet with only 25% of energy from fat would have additional calories that could be consumed as sugars. Persons who include alcohol in their diets would have fewer calories left to consume as sugars. Thus, this type of calculation does not lead to a maximum recommended sugars intake that can be applied across all diets. The DGAC concluded that it was not possible to make specific recommendations regarding a maximum amount of sugars intake without further examination of typical dietary patterns.

There was substantial interest in the apparent displacement of milk consumption by soda consumption, leading many members to suggest that soda consumption, especially among children and adolescents, is associated with poor calcium status. However, it is still unknown whether children who drink soda would actually consume milk if the soda was not available or not allowed. Some children may drink soda because they do not like milk and would instead switch to water or another beverage of low nutrient density. Thus, an intervention study that examines the effect of limiting access to sweetened beverages is needed, and if diets indeed improve in an intervention group compared with a control group with no intervention, then meaningful conclusions can be reached. The DGAC suggested that more data are needed to answer this question with assurance.

THE 2000 AMERICAN HEART ASSOCIATION GUIDELINES ON SUGARS

The 2000 American Heart Association *Dietary Guidelines*, released after the 2000 *Dietary Guidelines for Americans*, recommend avoiding excessive intakes of foods high in sugars and replacing sugars with starches (3). In 2002 the American Heart Association also released a statement for healthcare professionals on sugars and cardiovascular disease. The statement outlined several reasons for limiting sugars consumption, including short-term studies showing consistent adverse effects of sugars consumption on HDL and triacylglycerol concentrations, contributions of high-sugars foods to increased calorie consumption and possible weight gain, and the link between diets high in added sugars and nutritional inadequacy. The American Heart Association committee concluded that no data suggest that added sugars intake per se is advantageous and some data suggest that it may be detrimental. Taken in total, the studies indicate that high sugars intake (eg, >20% of energy from sucrose) should be avoided because sugars have no nutritional value other than to provide calories (4).

THE DIETARY REFERENCE INTAKES AND SUGARS

DRIs for macronutrients were released in September 2002. The report included recommendations for carbohydrates, including sugars and added sugars (5). The RDA for carbohydrate was set at 130 g/d for both adults and children. This was based on the average minimum amount of glucose used by the brain. This intake is typically exceeded to meet energy needs while consuming acceptable intakes of fat and protein. There was no evidence that any of the RDA for carbohydrate needs to be provided as sugars.

The panel extensively reviewed the literature examining potential adverse effects of overconsumption of sugars. This included the available data on dental caries, behavior, cancer, risk of obesity, and risk of hyperlipidemia. The panel concluded that there

TABLE 2
Percentage of persons reporting diets containing >25% of energy from added sugars, third National Health and Nutrition Examination Survey[1]

Age group	Both sexes	Males	Females
		%	
4–8 y	12.9	—	—
9–13 y	—	21.2	21.2
14–18 y	—	19.6	30.1
19–50 y	—	15.2	21.4
≥51 y	—	9.4	8.7

[1] Calculated from reference 5.

was insufficient evidence to set a tolerable upper intake level (UL) for sugars. A UL for sugars was not set because of the limitation in the UL definition that requires a specific endpoint for an adverse effect from excessive nutrient intake.

The panel suggested a maximal intake level of 25% of energy from added sugars because of concerns about inadequate intakes of certain essential micronutrients. It must be emphasized that 25% of energy from added sugars should not be interpreted as a recommended intake level. The report included an exhaustive review of the peer-reviewed literature on the risk of micronutrient inadequacy related to both total and added sugars intake. In addition, the report examined the median intakes of various micronutrients at every 5th percentile of added sugars intake by using data from the third National Health and Nutrition Examination Survey. Although the trends were not consistent for all age and sex groups, reduced intakes of calcium, vitamin A, iron, and zinc were observed with increasing intakes of added sugars, particularly at intake levels exceeding 25% of energy. For example, among females aged 14–18 y, when added sugars intakes were >25% and <30% of total energy intake, mean calcium intake was 647 mg and 0% of the girls exceeded the adequate intake of 1300 mg/d for calcium. On the other hand, when added sugars intakes were >10% and <15% of total energy intake, mean calcium intake was 938 mg and 11% of the girls exceeded the adequate intake for calcium. The percentage of the population consuming >25% of their energy from added sugars varied greatly among different age and sex groups (**Table 2**). The percentage of individuals exceeding the suggested maximal intake level was greatest for girls aged 14–18 y (30.1%), whereas the lowest percentages were for men and women aged ≥51 y (9.4% and 8.7%, respectively). Suboptimal intakes of selected micronutrients also occurred at very low added sugars intakes (0–5% of total energy intake). Further examination of the dietary patterns for individuals with these very high and very low intakes of added sugars would be worthwhile.

Added sugars were emphasized by the panel because the effect of total sugar intake on micronutrient intake was not as great as for added sugars. This can occur because of the abundance of added sugars in energy-dense, nutrient-poor foods, whereas naturally occurring sugars are primarily consumed from fruit, milk, and dairy products that also contain essential micronutrients.

RESEARCH RECOMMENDATIONS RELATED TO SUGARS AND HEALTH

The DGAC made the following recommendations related to sugars and health (2):

1) Conduct prospective studies to evaluate short- and long-term benefits of adherence to the *Dietary Guidelines*. Specifically related to the sugars guideline, prospective cohort studies might be conducted to examine intakes of sugars at an initial time and then follow the participants to collect data over time on morbidity and mortality from chronic diseases. Ideally, biomarkers of early stages of these diseases could be used as outcome measures.

2) To address these same issues more definitively, intervention studies should be conducted to evaluate the role of the *Dietary Guidelines* in promoting improved health. It would also be useful to examine whether limiting the intake of beverages and foods high in added sugars would increase the consumption of more nutrient-rich beverages and foods, particularly those of high calcium content. For example, if children drink fewer soft drinks, will that necessarily result in increased milk consumption? This type of research would require a randomized intervention study to provide a definitive answer.

3) Population studies might be conducted to assess health outcomes related to the intake of different levels, types, and sources of dietary carbohydrates. Several recommendations related to using national nutrition survey data to examine sugars intake were made: *a*) Determine the best statistical methods to use to study nutrient displacement issues, especially to determine whether the observed inverse relation between intakes of foods and beverages high in added sugars and intakes of more nutrient-rich beverages is real or an artifact. *b*) The terms *added sugars* and *total sugars* need to be clearly defined and should both be reported by national surveys. Resulting analyses of these data could then help to determine whether it is meaningful to distinguish between the 2 when studying health outcomes. *c*) Because food intake, and probably sugars intake, is underreported, it is difficult to study associations between total or added sugars and body fatness. The role of underreporting (especially differential underreporting) in masking relations should be investigated more thoroughly.

CONCLUSIONS

Although a sugars guideline has been included in each of the *Dietary Guidelines for Americans* since 1980, it may be time to take a broader look at this guideline. There is a paucity of studies that give definitive answers about the negative health consequences of consuming sugars, and even the association with dental caries is mitigated by advances in dental care. Large clinical trials that could reveal other possible effects are not likely to occur. From the existing evidence, we conclude that the most likely consequences of sugars consumption beyond the levels described by the food guide pyramid are overconsumption of energy and micronutrient inadequacies. However, excess energy from any source, not just from sugars, is detrimental to the maintenance of a healthy body weight. For example, Kant (46) examined the association between consumption of energy-dense, nutrient-poor foods and energy intakes by using the database of the third National Health and Nutrition Examination Survey. Energy-dense, nutrient-poor foods include foods that are normally associated with the tip of the food guide pyramid: visible fats (butter, margarine, etc), nutritive sweeteners and sweetened beverages (sugar, syrup, candy, and carbonated and noncarbonated sweetened drinks), desserts (cookies, cakes, pies, ice cream, etc), and salty snacks (chips). Consumption of energy-dense, nutrient-poor

foods was positively associated with total energy intakes (47). Likewise, consumption of foods with a high energy density (kcal/g) and a low nutrient density (nutrients/kcal) has the potential to displace needed nutrients in a diet. Although no UL was set for added sugars intake, the DRI macronutrient panel suggested a maximal intake of 25% of energy for the express purpose of avoiding the low nutrient intakes associated with an intake of added sugars above this level. Thus, a guideline that communicates the desirability of choosing foods with a high nutrient density (preferably not solely from fortification nutrients because many of the other healthful components of foods from the food guide pyramid—eg, carotenoids, flavonoids, fibers—may still be missing) might be more effective than advice that specifically identifies sugars as being responsible for overconsumption of energy and nutrient displacement. Perhaps we need a simple message that communicates the desirability of choosing foods with a high ratio of nutrients to energy.

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