
Sugar's Place in Healthful Eating Patterns:

Enhancing Nutrient Delivery and the Enjoyment of Food

The Sugar Association, Inc.

1300 L Street, NW Suite 1001,
Washington, D.C. 20005
www.sugar.org





In today's food environment, there's an active dialogue surrounding sugar's (sucrose) place in a healthy lifestyle. This scientific summary highlights the latest evidence on how much sugar Americans are actually eating, how it fits into healthful eating patterns, and what the experts have to say about nutrient delivery, body weight and chronic diseases.

You will find there isn't just one answer to every question about the relationship between diet and health. However, the science consistently shows a healthy lifestyle based on moderation, a variety of food choices and physical activity tends to lead to the best outcomes, versus simply cutting one single nutrient or another. This summary starts with the basics on sugar (what is it, after all, and where does it come from?) as well as the important role of sucrose in food science – for example, did you know sugar is an important natural preservative?



Sugar 101

Sugar, or sucrose, is a carbohydrate naturally present in fruits, vegetables and even nuts. Sugar is a product of photosynthesis, the process by which plants convert carbon dioxide, water and energy from the sun into food. Of all plants, sugar is most concentrated in sugar beets and sugar cane, about 16 percent and 14 percent, respectively. The high sugar concentration of these plants makes them ideal for farmers to grow and harvest sucrose. Once separated from the beet or cane, the result is pure sucrose, which is identical to sucrose found in fruits and vegetables and contains no preservatives or additives of any kind.

Though sucrose is sourced from two different plants, the purification process is similar for both. Each plant must be sliced/ground and boiled in order to extract the sugar-laden juice, which is then purified, filtered and crystallized into recognizable sugar granules. The sucrose from sugar cane and beets is the same sucrose naturally found in fruits and vegetables; it is metabolized the same way and the body cannot tell the difference between them.

The energy we get from eating foods like carrots, broccoli, apples, bananas or potatoes comes from starch and one or more molecules of sugars the plant stores. All carbohydrates are made up of one or more molecules of sugars. The family of sugars includes:

Sugars, Broken Down

Monosaccharides

(one-molecule sugars)

Glucose (*dextrose*)

Fructose (*levulose or fruit sugar*)

Galactose (*occurs in milk*)

Disaccharides

(two monosaccharides linked together)

Sucrose

(table sugar) = glucose + fructose

Lactose

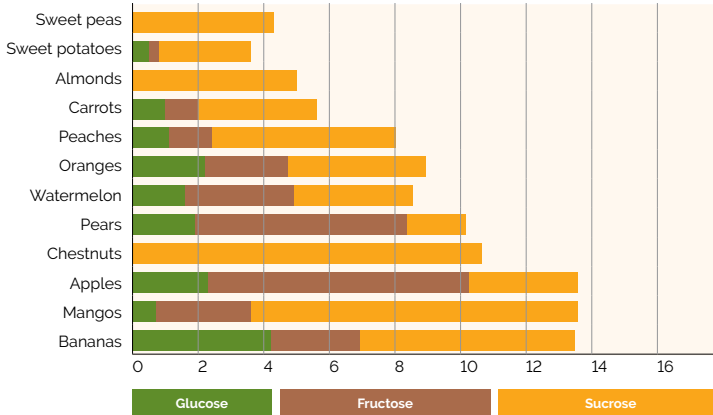
(milk sugar) = glucose + galactose

Maltose

(malt sugar) = glucose + glucose

Sugar/Sucrose occurs naturally in fruits, vegetables and nuts

per 100 grams, edible portion - raw



Source: USDA Nutrient Laboratory, Sugar Content in Selected Foods



Sugar consumption

What are people eating?

Compared to 40 years ago, Americans are consuming more than 450 additional calories each day. In 1970, Americans consumed 2,024 calories; that number increased to 2,481 in 2010 – nearly a 25 percent rise in consumption.¹⁰ Over this same time period, the intake of added sugars (all caloric sweeteners) saw only a slight increase. In 1970, daily consumption was 20.8 teaspoons and four decades later it increased slightly to 22.9 teaspoons, or just over 30 calories. When focusing on sucrose specifically, data shows that Americans are consuming one-third less real sugar (i.e., sucrose) today than in 1970. Similarly, the latest NHANES consumption data estimated a decrease in added sugars by 2.6 teaspoons from 2003-04 to 2011-12.¹¹

The 2015-2020 Dietary Guidelines for Americans (DGA) showed the average American today consumes approximately 270 calories (about 13 percent of calories per day) from added sugars.¹² Based on food pattern modeling, the DGA set a target for no more than 10 percent of calories to be consumed from added sugars. Current intakes are not far off from this target.

Year	Sugar Intake (tsp)	Obesity Prevalence
1970s	20.8	14.5%
2014	22.9	37.9%
Percent Increase	10%	161%

Counting Calories

Sugar has just 15 calories per teaspoon.

15
calories per tsp of sugar



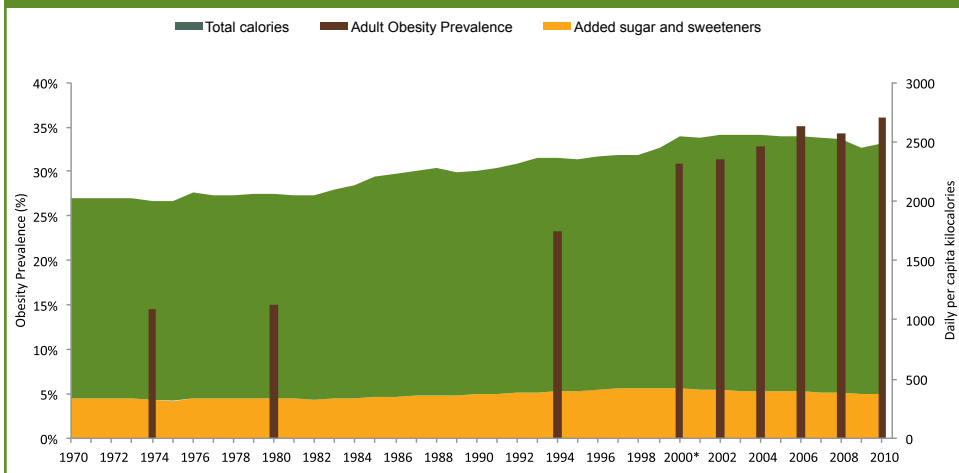
21
calories per tsp of honey



“Choose a healthy eating pattern at an appropriate calorie level to help achieve and maintain a healthy body weight, support nutrient adequacy and reduce the risk of chronic disease. To meet nutrient needs within calorie limits, choose a variety of nutrient-dense foods across and within all food groups in recommended amounts.”

– 2015-2020 Dietary Guidelines for Americans

Daily per capita Total Calories and Calories consumed from Added Sugars, 1970-2010^{13,14,15}



Nutrient delivery

Sugar is often viewed as a source of calories that people don't need, while the important role it plays in a nutrient-dense diet is regularly overlooked. Sugar helps increase the palatability of nutrient-dense foods such as yogurt, and whole grain and fiber-containing breads and cereals, making it a key partner in nutrient delivery. For example, the sweetness and thickness that sugar adds to fat-free chocolate milk increases its palatability for kids, which provides important shortfall nutrients such as calcium, potassium and vitamin D.¹



Food functionality

In addition to enhancing the flavor of foods, sugar has important functions in baking, cooking, texture enhancement and preservation.

In baking, sugar helps foods such as bread form a brown crust, known as the Maillard reaction. It also regulates yeast in the fermentation process that helps bread rise. Once the bread comes out of the oven, sugar's hygroscopic tendency (its ability to absorb moisture) keeps baked goods fresh and naturally increases shelf life.

In cooking, sugar balances sour, bitter and spicy components in foods, such as spaghetti and barbeque sauces. It also balances acidic elements in pickling liquids, salad dressings and rubs.

Sugar maintains the color and strengthens fibers of fruits and vegetables in the presence of heat and enhances smoothness, flavor and mouthfeel of dairy products. It helps stabilize egg white foams in meringues and soufflés to achieve the right texture.

In jellies, sugar helps prevent spoilage by inhibiting bacterial cells through water repositioning; because of this quality, there is no need for artificial preservatives. The same principle is applied to baked goods and cereals to keep these foods fresh.

"Sugars consumed in nutrient-poor foods and beverages are the primary problem to be addressed, not simply sugars themselves. Consumed within recommended calorie amounts, sweetness can offer an effective tool to promote consumption of nutrient-dense foods and beverages."

—American Academy of Pediatrics²

"Overall, the public health recommendation about 'added sugars' must be balanced with the reality that sugar added to food is an important piece in the food science puzzle given its several functionalities in food. Not only can a spoonful of sugar help the medicine go down, but it can help fruit, vegetable and fiber go down as well."

—Goldfein KR, Slavin JL. 2015

"Added sugars provide sweetness that can help improve the palatability of foods, help with preservation and/or contribute to functional attributes such as viscosity, texture, body, color and browning capability."

— 2015-2020 Dietary Guidelines for Americans



Sugar and body weight

Obesity is a serious problem in need of a solution, but that solution is far more complex than one ingredient. Data from the past 40 years show obesity trends do not mirror trends in sugar consumption. Excess calorie consumption, combined with sedentary living, is a major contributing factor to the obesity epidemic, independent of any single food or nutrient consumed. A recent systematic review concluded, "If there are any adverse effects of sugar, they are due entirely to the calories it provides."³

One of the largest studies to compare the effects of diets composed of different macronutrients on weight loss found that a reduction in calories, regardless of macronutrient source, promoted long-term weight loss. The findings of this study reinforce both the complexity of energy balance and the problem with oversimplified solutions that focus on a single nutrient.⁴

Using data from an ongoing health study, researchers examined the diets of more than 100,000 people in the United Kingdom. They found obesity was more strongly associated with total energy intake than any individual macronutrient (fat, carbohydrate or protein), with fat being the biggest contributor to calorie intake and having the strongest association with obesity. There was a positive, but weak, correlation between obesity and absolute energy derived from sugar. However, after controlling for calories, fat remained positively associated with obesity, while sugar was negatively associated.⁵

Three scientific organizations, including the Institute of Medicine, European Food Safety Authority (EFSA), and the United Kingdom Scientific Advisory Council on Nutrition, each conducted extensive scientific reviews of the evidence on added sugars and obesity and found no unique role for added sugars.^{6,7,8} An additional review by EFSA concluded there is an inconsistent relationship for high intake of sugars and weight gain compared to that of starch. However, data shows sugar-sweetened beverage-specific intake may lead to weight gain.⁹



Scientific review on sugar and chronic disease

Sugar has been an important ingredient in people's diets for centuries. Like other foods and ingredients, it has been the subject of numerous scientific studies, which helps deepen the understanding of the impact food choices have on health. While emerging research will always reveal new information, it is important to put new research into context within the enormous body of existing nutrition science when evaluating the role sugar (i.e., sucrose) plays in chronic diseases such as cardiovascular disease (CVD), type 2 diabetes, cancer and dental caries.

The best way to put science into context is to consider reviews and position statements from major authoritative bodies.

A major review by the Scientific Advisory Committee on Nutrition in the U.K. concluded, "Randomized controlled trials examining cardiovascular risk factors, body weight, inflammatory markers and risk factors for type 2 diabetes demonstrate no effects of increasing sugars intake." When looking at the total dietary carbohydrates (which includes sugars) in the diet, "The evidence from both prospective cohort studies and randomized controlled trials indicates that total carbohydrate intake appears to be neither detrimental nor beneficial to cardio-metabolic health, colorectal health and oral health."¹⁶ However, the review did identify an association between sugar-sweetened beverages (SSB) and higher risks for both dental caries and type 2 diabetes mellitus.

In relation to type 2 diabetes, total sugars intake does not show causation. In fact, prospective studies show a negative association between sucrose intake and diabetes risk.¹⁷ The American Diabetes Association states that sugar is not different than starch with respect to blood glucose and lipid level when consumed up to 35 percent of calories.¹⁸ In terms of diabetes, obesity remains the most substantial risk factor for development, and in parallel, living a sedentary lifestyle also contributes to the risk associated with obesity.¹⁹



Will consuming added sugars lead to heart disease?

A report from the Institute on Medicine on dietary carbohydrates concluded that intake of carbohydrates, including sugars, is not considered an independent risk factor for cardiovascular disease.²⁰ Additionally, the FDA recognizes that “U.S. consensus reports do not support a cause-and-effect relationship between added sugars consumption and risk of obesity or heart disease.”²¹ Within the target consumption range of 10 percent, it is possible for added sugars to be a part of a healthy diet.

Does eating too much sugar cause type 2 diabetes?

As stated by the American Diabetes Association, being overweight increases the risk for developing type 2 diabetes, and a diet high in calories from any source contributes to weight gain.²² Research, including an observational study done by the British Journal of Nutrition (2014) has shown a positive association between the intake of sugary drinks and type 2 diabetes.²³

Does sugar make cancer cells grow?

There is still a lot about cancer we don't know. According to the Mayo Clinic, “Sugar doesn't make cancer grow faster. All cells, including cancer cells, depend on blood sugar (glucose) for energy, but giving more sugar to cancer cells does not speed their growth. Likewise, depriving cancer cells of sugar doesn't slow their growth.”²⁴

If I avoid added sugar I won't get cavities, right?

Sugar, whether naturally occurring or added, and any other fermentable carbohydrate can increase the risk of cavities. However, there are other things that can contribute to risk of cavities including poor dental hygiene and lack of fluoridated water/dental products.²² The most effective way to reduce cavities is to reduce the amount of time sugars and starches are in contact with the teeth, drink fluoridated water, and brush and floss teeth regularly.

Why do studies show negative health consequences of SSB, but not total sugars intake?

A 2016 Commentary from the Canadian Journal of Diabetes calls into question the conflicting results between SSB and total sugars intake data. While studies show SSB are associated with chronic diseases such as metabolic syndrome, diabetes, heart disease, etc., similar analyses have not been able to show the same conclusions for total sugars intake. The article also points to unhealthy lifestyle behaviors associated with SSB intake, which may attribute to higher incidence of chronic disease²⁶.

It is important to recognize that new research will always be underway related to the effects of food choices on health and to consider the level of evidence each study provides when documenting the relationship between food choices and the development of certain disease states. Separating the contributions of specific foods from related dietary and lifestyle factors is difficult and a constant challenge for researchers. To simplify the science, by practicing moderation and portion control, there is room to include an appropriate amount of sugar in a healthful lifestyle.



Looking at patterns

Taking a whole diet approach – versus targeting a specific macronutrient such as fat, protein or carbohydrate – is one way to help reduce obesity in the United States and worldwide. As the data tell us, undue focus on single dietary components is ineffective and misses the larger picture of how people actually eat.

A healthy diet stems from nutrient density and a variety of food choices. When striving for weight control, concentrating on a balanced method is key to eliminating extreme dieting behaviors. Additionally, the inclusion of daily physical activity in parallel with nutrient-dense food choices is an important component of weight control and chronic disease prevention.

Sugar-sweetened foods are one of life's pleasures and contribute to the enjoyment of eating. Extreme restriction of a single nutrient such as sugar may lead to a whiplash between dietary extremes. Most popular fad diet strategies are prone to a 'seesaw' effect; they typically focus on reduction of a single nutrient, which subsequently leads to a sharp increase in another.

Instead of an overly restrained philosophy, the adoption of a rich and historic, culture-focused eating pattern connects to the joy of eating, without the associated guilt or deprivation from classic fad dieting behaviors.²⁷ Focusing on balance that incorporates moderate consumption of all nutrients, including sucrose, can lead to a more positive relationship with food and a healthier lifestyle.

"Rather than trying to isolate a single dietary culprit, we should focus on the whole picture."

– Alice H. Lichtenstein, DSc; Tufts University Health & Nutrition Letter²⁸

"Strong evidence shows that it is not necessary to eliminate food groups or conform to a single dietary pattern to achieve healthy dietary patterns."

– Scientific Report of the 2015 Dietary Guidelines Advisory Committee²⁹

"A positive emphasis on nutritional value, variety, appropriate portion, and encouragement for a steady improvement in quality will be a more effective approach for improving nutrition and health than simply advocating for the elimination of added sugars."

– American Academy of Pediatrics 2015 Policy Statement



Tools you can use

There are many resources available to stay up-to-date on sucrose-specific news and general nutrition science developments. For more information, visit:

- » The International Food Information Council (IFIC) www.foodinsight.org
- » The Academy of Nutrition and Dietetics (AND) www.eatright.org
- » The American Society for Nutrition (ASN) www.nutrition.org
- » MyPlate www.choosemyplate.gov
- » The American Diabetes Association (ADA) www.diabetes.org
- » The Mayo Clinic www.mayoclinic.org
- » The American Academy of Pediatrics (AAP) www.aap.org
- » The World Sugar Research Organization (WSRO) www.wsro.org

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