

RESOURCES

TOOLKIT FOR TEACHERS GRADES 7 - 12

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How well do you know
SUGAR?



— THERE'S MORE TO SUGAR THAN YOU MIGHT THINK —

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How Well Do You Know Sugar?
By Sugar Association, Inc., 2019
Washington, DC
SECOND EDITION





THE BASICS

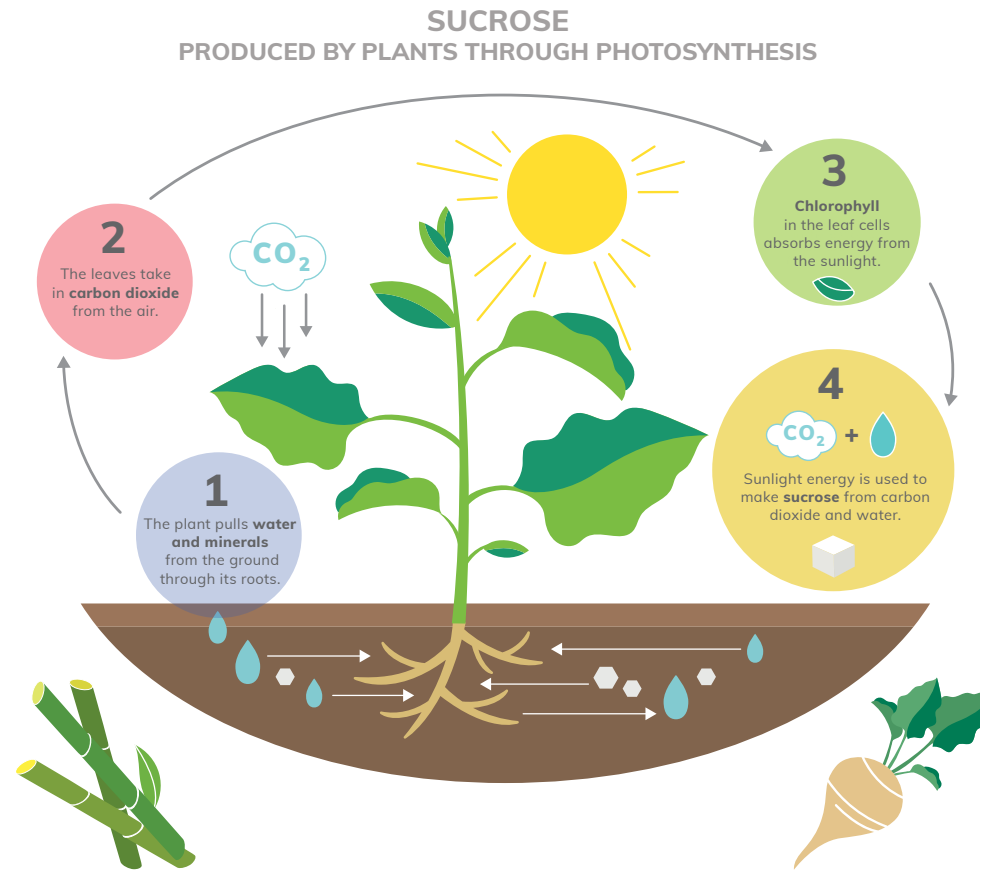
What Is Sugar?

A Closer Look at Its Origin and Structure

You may have heard the term “sucrose” at one point or another—but what is that, really? While it might sound overly technical or even man-made, sucrose is simply the chemical name for sugar, the simple carbohydrate we know and love that is produced naturally in all plants, including fruits, vegetables and even nuts.

Brought to You by Nature

All green plants make sugar or sucrose (sugar’s molecular name) through photosynthesis, the process plants use to transform the sun’s energy into food.



Of all plant types, sugar beets and sugar cane make the greatest quantities of sugar, which is why they are the most efficient choices from which to extract sugar. The sugar that’s extracted from sugar beet or sugar cane plants is identical to the sugar that’s still found intact when you bite into fruits and vegetables. Sugar is completely pure, and contains no preservatives or additives of any kind. That means the sugar we keep in our pantry, the sugar added to bread to help it rise and the sugar in sweet treats we enjoy in moderation is exactly the same as sugar that’s naturally in peaches, almonds, sweet peas and more.¹

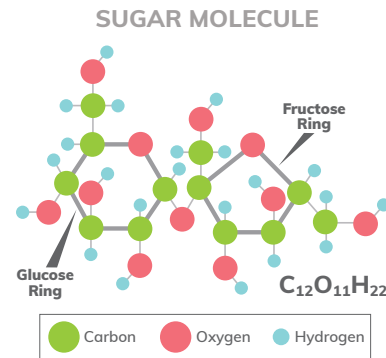


4 MICROSCOPIC VIEW OF SUCROSE CRYSTALS IN POLARIZED LIGHT

Chemical Structure

Sugar is sucrose, but what does it look like? Sugar's chemical structure is quite simple, as far as molecules go. It contains just two molecules, bound together by Mother Nature: one molecule of glucose is bound to one molecule of fructose.

Glucose, fructose and galactose are the three building blocks that make up all forms of carbohydrates. These three simple sugars are also known as monosaccharides. They bond with each other and themselves to make more complex carbohydrates. All carbohydrates are made up of one or more molecules of those simple sugars. No matter how complex a carbohydrate is to start with, once in the body, all carbohydrates are broken down to these three simple sugars: glucose, fructose and galactose.



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

POLYSACCHARIDES (more than 10 monosaccharides linked together)

Starch (glucose polymer)

So, Sugar Is Just a Carbohydrate

Carbohydrates, along with fat and protein, are macronutrients that provide the body with energy. Carbohydrates are found in all plant and dairy foods and beverages that provide your body with calories.

Carbohydrates are the preferred energy source for the body because the majority contain glucose. Glucose is the fuel your brain, organs and muscles need to function and engage in everyday activities.²



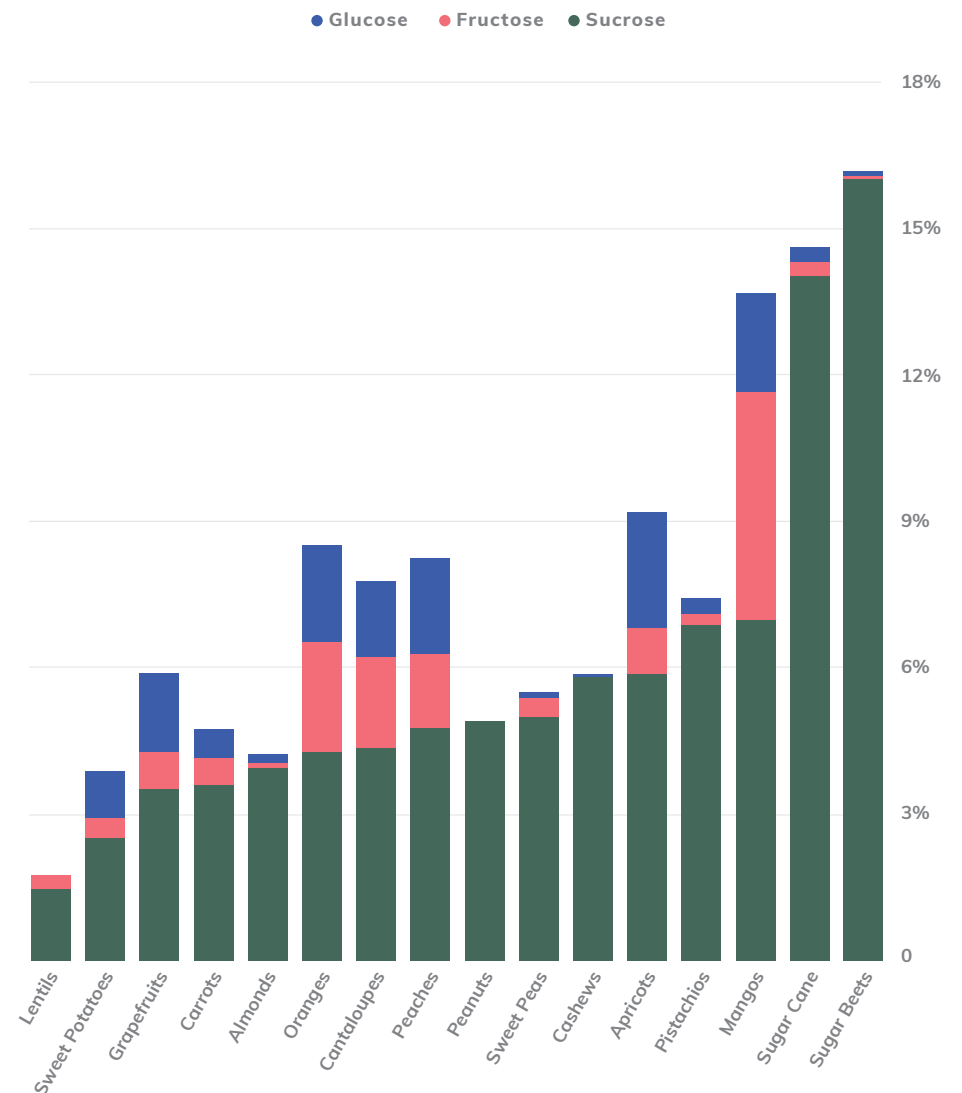
Sugar's Path from Farm to Table

Sugar's Story Starts in the Field

Every day, family farmers plant, harvest and care for sugar beets and sugar cane used to bring the classic sweet flavor—and more—to the foods we enjoy. Many of these sugar beet and sugar cane farms have been passed down for several generations, making sugar growing an important family legacy.

Many fruits, nuts and vegetables contain sugar, with some containing as much as 10% sucrose! However, nothing tops sugar beets and sugar cane, which contain about 16% and 14%, respectively, making them the most efficient way for farmers to grow and harvest sugar.

SUGAR/SUCROSE OCCURS NATURALLY IN FRUITS, VEGETABLES AND NUTS**
*(PER 100 GRAMS, EDIBLE PORTION-RAW)





Sugar beets are a root crop, and they flourish in temperate climates where the soil is rich and the growing season is about 5 months long. They're much larger than the beets you might see in the produce section of the grocery store or the ones grown in backyard gardens, weighing a whopping 3–5 pounds when harvested. Today, sugar beet farms can be found in California, Colorado, Idaho, Michigan, Minnesota, Montana, Nebraska, North Dakota, Oregon, Washington and Wyoming .

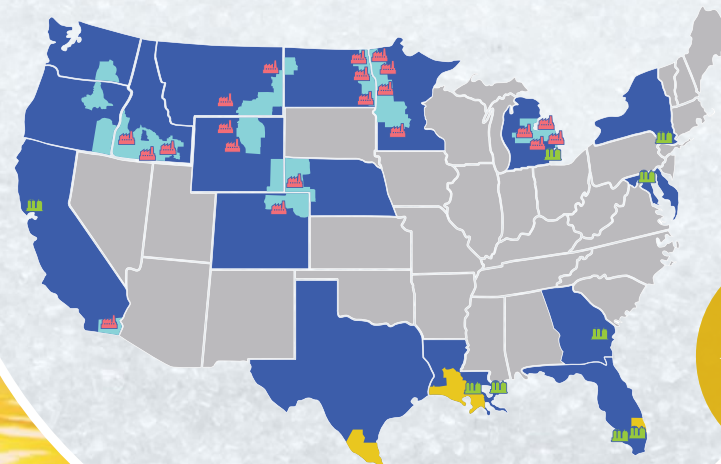


Sugar cane is a tropical grass that grows 10–20 feet high. It's a perennial plant—which means it doesn't need to be replanted every year. When sugar cane is harvested, it's cut just above the root level so new sprouts will grow, ready to be harvested again in 10–12 months. Today, three U.S. states grow sugar cane: Florida, Louisiana and Texas. Raw sugar is refined in California, Florida, Louisiana, Georgia, Maryland, Michigan and New York.

WHERE IN THE U.S. DOES SUGAR COME FROM?



-  sugar beet factory
-  sugar cane refinery
-  sugar beet growth
-  sugar cane growth



Sugar is grown and/or refined in **17 states** across the U.S.

Some raw **cane sugar** is also imported to the U.S. for refining.

Sugar beet factories are located near the farms to **shorten the distance farmers need to travel** with their beets.

At sugar beet factories and sugar cane refineries across the country, the sugar from the plants is **purified** into the sugar shipped to grocery stores and food manufacturers.

Refining and Processing

After sugar is harvested by farmers, it is processed and refined to ensure consistency and quality.

Whether sugar comes from sugar beets or sugar cane, the purification process is similar for each plant and the result is the same pure sucrose.

One difference in processing between the two plants is that sugar beets are processed at a single facility (a sugar beet factory) and sugar cane is refined at two facilities (the process starts at a raw sugar factory and finishes at a refinery).



Little Is Wasted in Sugar Processing

Most of the non-sugar materials generated in sugar processing are used for other purposes, recycled or reused.

- + Molasses, used by bakers, distillers and pharmaceutical companies as well as for animal feed and more, is extracted through the beet and cane sugar refining processes. It takes about four rounds of extraction to remove the molasses to obtain the maximum amount of sucrose.
- + The sugar cane stalk residue, called bagasse, is often used as fuel to run the cane factory. Many sugar cane mills and refineries produce their own electricity, and some even supply power to nearby towns.
- + The sugar beet residue, or pulp, is generally used for animal feed or further processed for use as fiber or other carbohydrate-based products.
- + Carbon chips, used in sugar cane filtration, are recharged (revivified) and reused too.
- + In addition, much of the water removed along the way still contains sucrose (called "sweetwater"), so it's pumped back into the stations to be used again.

History of Sugar

Journey to U.S. Cultivation

Sugar is one of the world's oldest documented commodities. While chewing sugar cane for its sweet taste was likely done in prehistory, the first indications of the domestication of sugar cane were around 8000 BCE. It spread from the Polynesian region across the world, with strides in cultivation and processing along with way (crystallization in 100 CE and large-scale refinement in 1455). Sugar cane was

brought to the Americas in the 15th century. In 1747, German chemist Andreas Marggraf identified sugar in beet roots, and the first sugar beet processing facility was built in Poland in 1801. Sugar beets were brought to the United States shortly after, with the first successful U.S. commercial production of beet sugar in California in 1879. Sugar beets are now grown in 52 countries and sugar cane is grown in 80 countries.³



Types of Sugar

All sugar is made by first extracting sugar juice from sugar beet or sugar cane plants, and from there, many types of sugar can be produced. Through slight adjustments in the process of cleaning, crystallizing and drying the sugar and varying the level of molasses, different sugar varieties are possible. Sugar of varying crystal sizes produce unique functional characteristics that make the sugar suitable for different foods and beverages. Sugar color is primarily determined by the amount of molasses remaining on or added to the crystals, giving pleasurable flavors and altering moisture. Heating sugar also changes the color and flavor (yum, caramel!). Some types of sugar are used only by the food industry and are not available in the supermarket.

White Sugars (contain little or no molasses)

Granulated sugar (Table sugar)

- + “Regular” or granulated sugar is what you typically find in your sugar bowl
- + Granulated sugar is the most common sugar called for in recipes when cooking and baking
- + “Regular” sugar granules are fine because small crystals are ideal for bulk handling and not susceptible to caking

Powdered sugar

- + Powdered or confectioners sugar is simply granulated sugar ground to a smooth powder, mixed with a small amount of cornstarch to prevent caking and then sifted
- + Powdered sugar is often used in icings, confections and whipping cream
- + You can make it at home: blend 1 cup white sugar and 1 tablespoon cornstarch to get 1 cup of powdered sugar

Sanding sugar

- + Used mainly in baking and confectionery as a sprinkle on top of baked goods, sanding sugar can have large or fine crystals
- + This sugar reflects light and gives the products a sparkling appearance

Brown Sugars (contain varying levels of molasses)

Light and Dark Brown sugar

- + Brown sugars are made by mixing white sugar with various amounts of molasses
- + Light brown sugar is often used in sauces and most baked goods
- + Dark brown sugar has a deeper color and stronger flavor than light brown sugar. The rich, full flavor makes it ideal for gingerbread, baked beans, barbecuing and other full-flavored foods
- + Brown sugars tend to clump because they contain more moisture than white sugars, allowing baked goods to retain moisture well and stay chewy

Turbinado sugar

- + Turbinado sugar, sometimes known as Demerara sugar or Raw cane sugar, is a partially processed sugar which retains more of the naturally present molasses
- + It has a blond color, mild brown sugar flavor and larger crystals than brown sugar used in baking
- + Turbinado sugar is the sugar in your packet of “raw cane sugar.” This type of sugar has been processed just enough to make it safe to eat

Muscovado sugar

- + Muscovado sugar, also known as Barbados sugar, is an unrefined cane sugar in which the molasses has not been removed
- + This sugar is very dark brown and has a particularly strong molasses flavor
- + Muscovado sugar crystals are slightly coarser and stickier than regular brown sugar, giving it a sandy texture



Added sugars have been defined by the Food and Drug Administration to include caloric sweeteners that are added to foods and beverages during preparation or processing.⁴ There are many types of sweeteners that can be added to foods and beverages. Sugar added to foods is considered an added sugar.

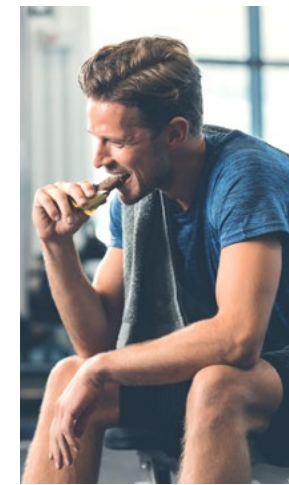
SUGAR AND THE DIET

Everything has a place in moderation. When it comes to sugar, it is an ingredient that plays many roles in nutritious foods and adds pleasure to life with occasional indulgences. It's true: a balanced life is a sweet life.















A Special Ingredient: Why Sugar Is in Foods

Sugar Can Give Foods the Sweet Taste We Know and Love—But There’s Much More to It

Sugar is a special ingredient that provides sweetness and so much more. Have you been surprised to find it in foods that don’t necessarily taste sweet? There’s a reason. Sugar has many functional properties that range from balancing acidity or adding bulk to preventing spoilage. It’s been used in recipes for generations, often for reasons that have little to do with its sweet flavor.



SUGAR’S FUNCTIONAL ROLES IN FOOD BEYOND SWEETNESS

		FLAVOR ENHANCER/ BALANCER, AROMA	BULK	TEXTURE/ MOUTHFEEL	SHELF-LIFE/ MICROBIAL STABILITY	FERMENTATION	FREEZING POINT DEPRESSION	COLOR	MOISTURE RETENTION
Dairy Products 		●	●	●		●			
Whole-Grain, Fiber-Rich Breads & Cereals 		●	●	●	●	●	●	●	
Breads 		●	●	●	●	●	●	●	
Bakery Products 		●	●	●	●		●	●	
Salad Dressings, Rubs and Sauces 		●	●	●	●				
Preserves & Pickling 		●	●	●	●				
Jams & Jellies 		●	●	●	●		●		
Canned Fruits & Vegetables 		●	●	●	●		●		
Prepared Foods 		●	●	●	●		●	●	
Beverages 		●	●	●	●				
Frozen Beverages 		●	●	●		●			
Fermented Beverages 		●	●	●	●				
Ice Cream 		●	●	●		●			
Confectionery 		●	●	●	●		●	●	



“
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.
 ”

DIETARY GUIDELINES FOR AMERICANS, 2015–2020⁵

2015–2020 Dietary Guidelines for Americans: Defining Moderation

Since 1980, the U.S. government has published the Dietary Guidelines for Americans, updating them every 5 years. Each version of the guidelines has included a general recommendation for Americans to moderate intake of sugars. The 2015–2020 Dietary Guidelines for Americans were the first to quantify moderation, recommending Americans limit added sugars to no more than 10% of calories per day (or 50 grams based on a 2000-calorie diet).⁵ This recommendation is based on food pattern modeling (a tool used to figure out how you can meet all of your food group recommendations within calorie needs), and the 10% target is an attempt to help individuals move toward healthy eating patterns within calorie limits. For more information about the dietary guidelines, visit dietaryguidelines.gov.

Consumption Trends

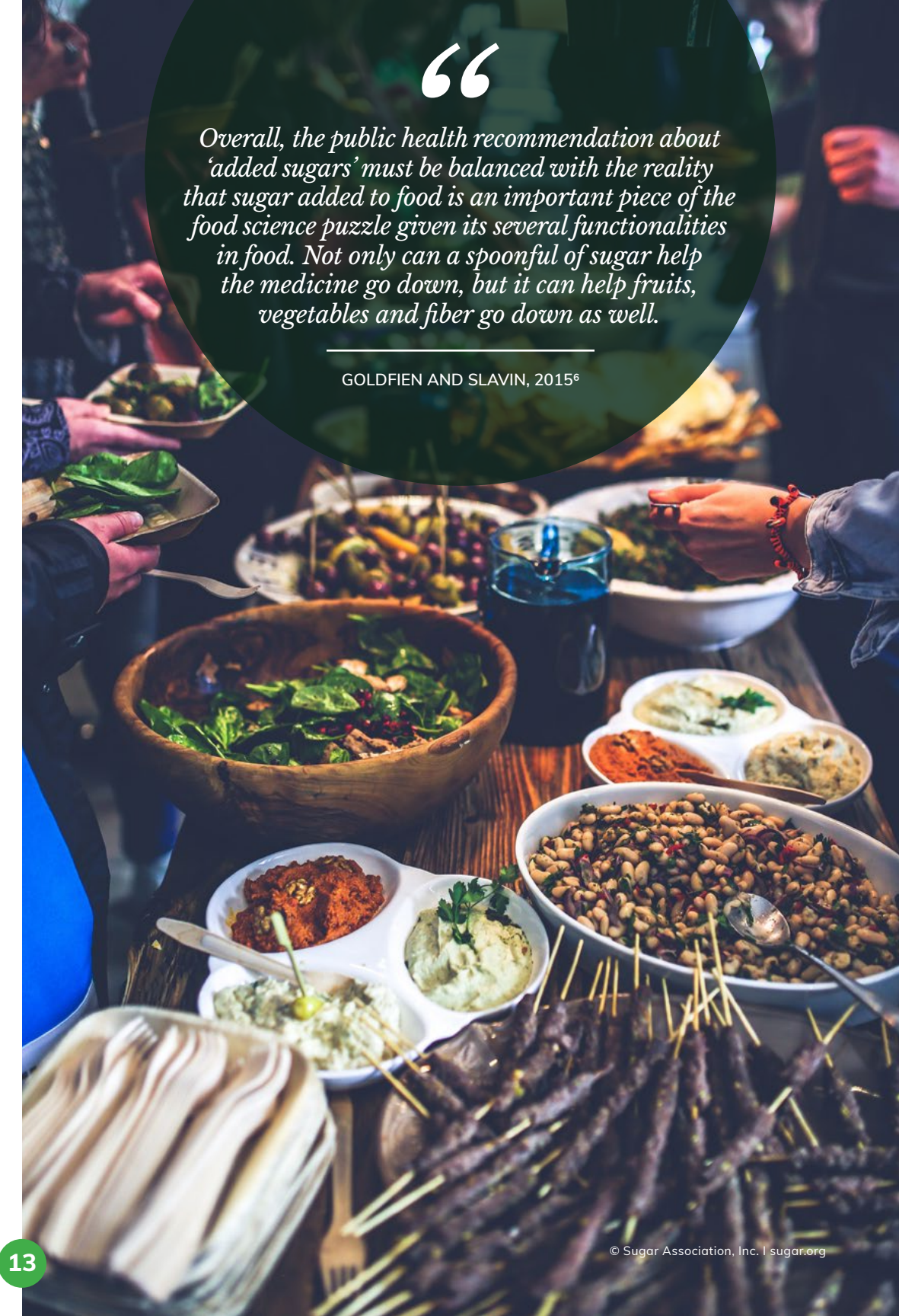
While added sugars consumption increased sharply in the 1990s, consumption has been on a significant decline in the United States for the past 20 years.^{7–12} In 2015–2016, added sugars consumption was reported to be about 13% of total calories, or around 270 calories per day.^{11,12} This is still slightly above the Dietary Guidelines for Americans recommendation of no more than 10% of calories from added sugars per day.

PERCENT OF CALORIES FROM ADDED SUGARS^{7,11,12}

YEAR	% OF CALORIES FROM ADDED SUGARS
1999–2000	18.1
2001–2002	17.1
2003–2004	15.9
2005–2006	14.5
2007–2008	14.6
2009–2010	13.9
2011–2012	14.1
2013–2014	13.4
2015–2016	12.6



Dietary data are frequently reported as total added sugars, a combination of the intakes of all caloric sweeteners: sugar, high-fructose corn syrup, honey, maple syrup and so forth. If we look at just sugar intake, consumption of sugar (sucrose) from sugar beets and sugar cane, there has been a decrease of about 30% from 1970 to 2016, which is a drop from 283 calories (17.7 teaspoons) per day to 193.7 calories (12.1 teaspoons) per day.¹³



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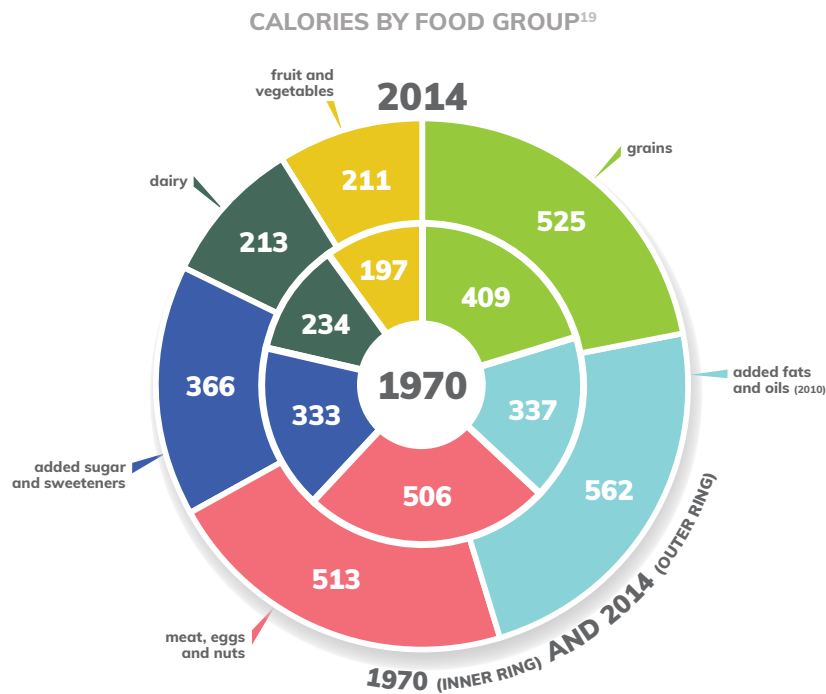
Overall, the public health recommendation about ‘added sugars’ must be balanced with the reality that sugar added to food is an important piece of the food science puzzle given its several functionalities in food. Not only can a spoonful of sugar help the medicine go down, but it can help fruits, vegetables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

GOLDFIEN AND SLAVIN, 2015⁶

Putting Added Sugars and Sugar Intake into Perspective of the Total Diet

We all know that there is a serious obesity problem in the United States. With that in mind, it should come as no surprise that during a 40-year period, Americans' daily consumption went up by more than 450 calories.¹³ Not to mention that as a society, we move a lot less.^{14,15}

In 1970, people were consuming 2024 calories each day. Fast-forward to 2010 (the most recent calorie availability data), and that figure jumped to 2476—nearly a 25% increase in calories. But added sugars didn't make up a very big percentage of the increased intake. Over that same period, added sugars consumption increased by only 12 calories per day (a 4% increase), from 20.8 teaspoons per day to 21.6 teaspoons per day in 2017.¹⁶⁻¹⁸ Calories from added fats and oils have increased by 225 calories per day (a 66% increase) and calories from grains have increased by 116 calories per day (a 28% increase).^{13,19}



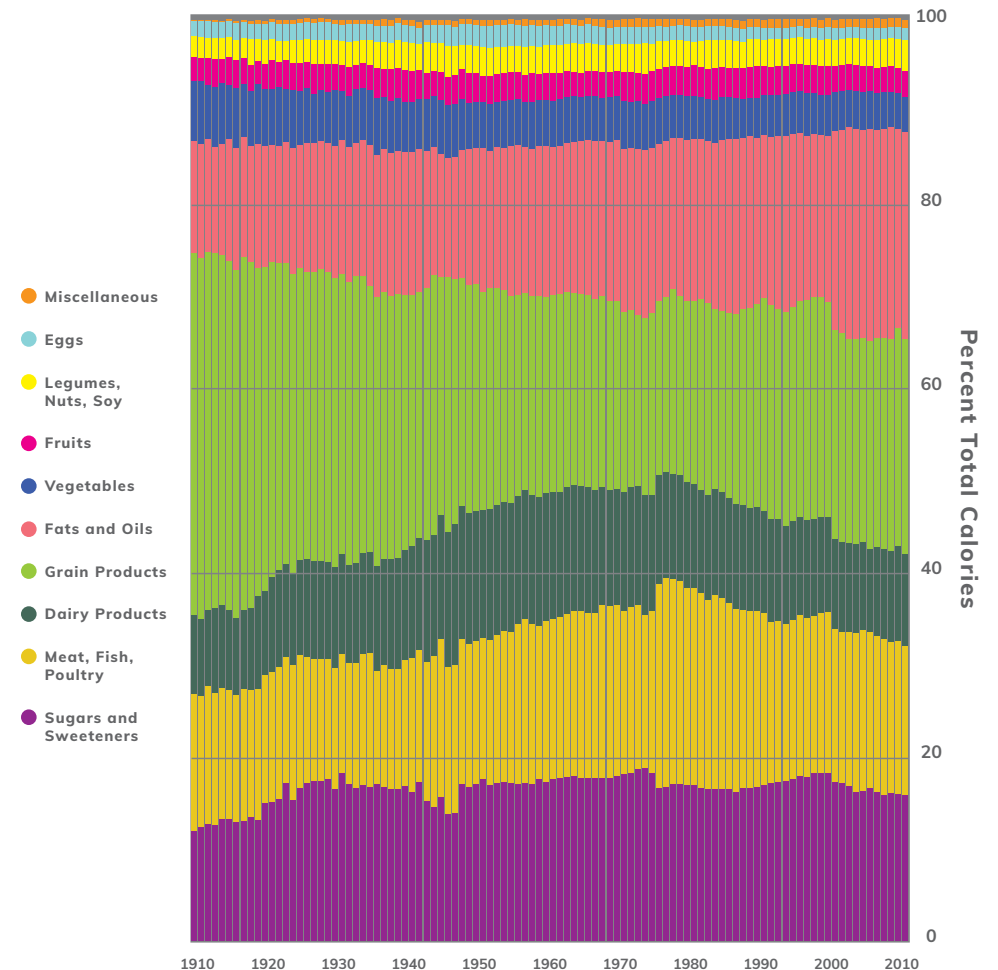
Going Way Back

The U.S. Department of Agriculture has been collecting food supply data for a long time! Looking back over 100 years, sugars and sweeteners made up 11.9% of all calories in the food supply in 1909.

Over the past century, there have been some ebbs and flows in this percentage, the highest being 18.2% in 1997–1999. However, since the turn of the 21st century, the percentage of calories from sugars and sweeteners has dropped steadily. It is important to note that total calorie intake has come up since 1909, but as a percentage of total calories, total sugars and sweeteners consumption is on the decline.²⁰ The most recent report was published in 2010, and sugars and sweeteners make up even less now.

The calories contributed by major food groups have also shifted over the years. Here's a look at the makeup of the total calories in our diet and the way they've changed since 1909.²⁰

CALORIES CONTRIBUTED FROM MAJOR FOOD GROUPS TO THE U.S. FOOD SUPPLY, 1909–2010²⁰



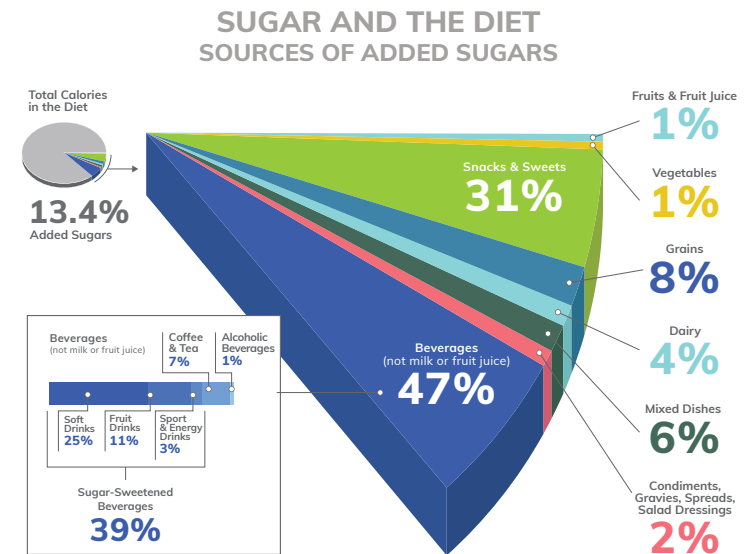
Sugar has benefits that go beyond sweetness or indulgence. Of course, it's a key ingredient in the treats we should enjoy in moderation, but it also has a specific functional role in other foods we might not immediately associate with sugar. It's added to nutritious foods to balance acidity and retain moisture, and it even helps bread rise.

Sources of Added Sugars in the Diet

Added sugars are found in a variety of foods and beverages for different reasons, many times for functions beyond sweetness. Calorically sweetened beverages such as soft drinks, tea and fruit drinks are the main source of added sugars in the diet across all age groups (older than 2 years), making up almost half of added sugars calories (47%). Snacks and sweets are the second main source of added sugars calories, making up close to one-third (31%).¹¹ Also among the top sources of added sugars in the diet are foods that contain important nutrients such as fibers, vitamins and minerals. These foods include ready-to-eat cereal, flavored milk and yogurt.²¹ Sugars are added to these products for functional purposes, including making certain nutritious foods more enjoyable to eat. Because of this, sugar is a key partner in nutrient delivery.²²⁻²⁹

In a recent analysis of people with low and high intakes of added sugars, people on the lower end of added sugars intake chose similar types of foods with added sugars as those on the higher end.²¹ The main differences were in the amounts of specific foods chosen. From this analysis, we can see that many people are enjoying the same types of foods that contain added sugars, but the portion sizes are different.

The 2015–2020 Dietary Guidelines for Americans reported that in 2014 added sugars made up 13.4% of total calories in the diet.^{5,11} Below is the breakdown of where those calories come from.



The 2015–2020 Dietary Guidelines for Americans recommend that we limit our added sugars consumption to 10% of total calories,⁵ making the current average consumption slightly higher than recommended. However, it is important to note that a healthy diet includes up to 10% of calories from added sugars, allowing room for sugars in nutritious foods and occasional sweets and treats. Sugar-containing foods and drinks that don't contribute significant nutritional value should be considered treats and consumed in moderation within caloric needs.

“

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 foods groups in recommended amounts.

DIETARY GUIDELINES FOR AMERICANS, 2015–2020⁵

SUGAR AND HEALTH

The Basics

Sugar, or sucrose, is a carbohydrate. Carbohydrates are the primary source of energy for the human body. In fact, glucose (a product of carbohydrate digestion) is essential to the function of the central nervous system. The essential role of carbohydrates, including sugar, as an important source of fuel for the body is nothing new. Sugar (sucrose), whether intact in fruits and vegetables or in the popular extracted and crystalized form, has been incorporated in the diets of humans throughout all of time. Like many other foods and ingredients, sugars have been the subject of numerous scientific studies, which help deepen the understanding of the impact food choices have on health. And while emerging research will always reveal new information, the scientific evidence consistently shows that a healthy lifestyle based on moderation, a variety of food choices and physical activity tends to lead to the best outcomes when compared to simply focusing on cutting out or adding one ingredient or another.³⁰⁻³⁴ Here we review a few health outcomes and what we know about the role of sugar. It is important to point out that scientific evidence does not support adverse outcomes of sugar intake when sugar is consumed in moderation and as part of a diet where calories are not eaten in excess.

Ab **carbohydrate** noun
car-bo-hy-drate
a macronutrient that includes starches, sugar and other sugars

There has been extensive research focus on soda or other caloric beverages and their role in health outcomes. While these studies provide data on the role that caloric beverages may have in health, these beverages are not a proxy for all the ways that sugar is consumed in the diet and these studies should not be extrapolated to represent the role of sugar in health.

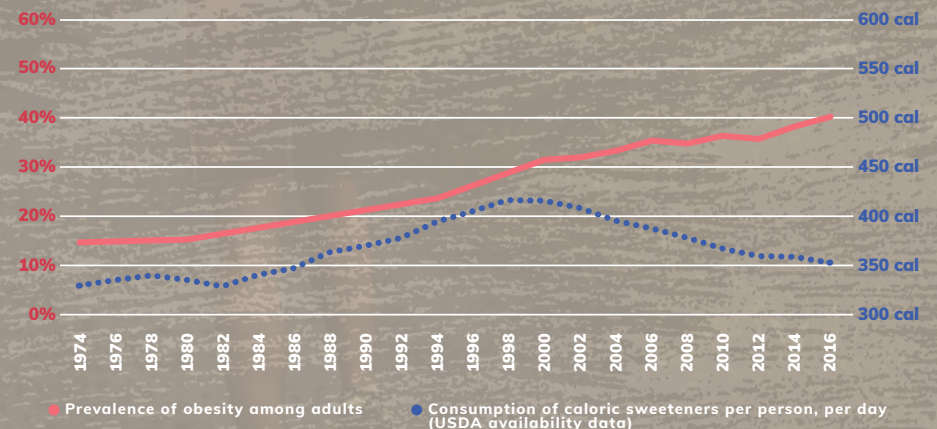
Obesity

The cause of obesity is a complex issue and there are many factors that contribute to obesity, including excess caloric intake, genetics and low physical activity levels, along with other factors. Just like protein, starch, fat, alcohol and other carbohydrates, sugar is a source of calories in the diet. Excess calories from any source, including sugar, can lead to weight gain, increasing the risk of obesity and other chronic diseases. A recent systematic review of the evidence concluded that “if there are any adverse effects of sugar, they are entirely due to the calories it provides.”³⁵ Additionally, three authoritative scientific organizations, including the U.S. Institute of Medicine, European Food Safety Authority, and the U.K. Scientific Advisory Committee on Nutrition, each conducted extensive scientific reviews of “added sugars” and obesity and found no unique role for added sugars in the development of obesity.³⁶⁻³⁸



Data from the past 40 years show that obesity trends do not mirror trends in sugars consumption. Obesity has gone up as sugars intake has gone down. However, total calorie consumption has paralleled the rise in obesity rates.^{13,16-18,39-41}

CONSUMPTION OF ADDED SUGARS AND PREVALENCE OF OBESITY IN THE UNITED STATES, 1974-2016^{16-18,39-41}



Type 2 Diabetes

Over 30 million Americans have diabetes, a condition that causes poor regulation of blood glucose.⁴² Being overweight increases the risk for developing type 2 diabetes, and a diet high in calories from any source contributes to weight gain, according to the American Diabetes Association. While sugar does provide calories and, when eaten in excess of calorie needs can contribute to weight gain, experts agree that “Type 2 diabetes is not caused by sugar, but by genetics and lifestyle factors.”⁴³ A major review of studies examining risk factors for type 2 diabetes demonstrated no effects of increasing sugars intake on diabetes risk. However, this review and others have identified an association between sugar-sweetened beverages (SSB) and higher risk for type 2 diabetes.^{36,44}

Blood glucose is often referred to as “blood sugar”. This can be confusing because sugar isn’t actually traveling through your blood, just glucose is.

Cardiovascular Disease

Heart disease, the single largest cause of mortality in the United States and worldwide, has many underlying risk factors, including dyslipidemia, high blood pressure, inactive lifestyle, obesity, diabetes and cigarette smoking. Nutritional patterns may play a role in several of these risk factors; however, evidence for a specific role of carbohydrates or sugars in cardiovascular disease (CVD) has been heavily debated and not fully settled by scientists. If there is any role of carbohydrates and sugars in CVD progression, it is likely dependent on whether they are consumed as part of calorically abundant diet and eaten in excess of normal ranges.^{36,45} Recent reviews have found that when calories are matched, fructose-containing sugars (like sucrose) do not appear to cause weight gain compared to other forms of macronutrients (other carbohydrates, fats and protein) or impact blood pressure;

however, when sugars provide excess calories, this can lead to weight gain and increases in cardiometabolic risk factors.^{31,46}

Dental Caries

Frequent consumption of foods and drinks that contain fermentable carbohydrates (including sugars, both naturally occurring and added) can increase the risk of tooth decay. Fermentable carbohydrates can be broken down by bacteria in your mouth to produce acid that can lead to tooth decay without proper dental hygiene. While there are many studies on the relationship between amount of sugar consumed, frequency of intake and dental caries, recent reviews^{36,38,47-51} and recommendations^{5,37,52} are mixed on whether there is sufficient evidence to set an upper level of intake of added sugars to reduce risk of dental caries. The best way to protect your teeth is to brush them with fluoride toothpaste twice a day and reduce the amount of time your teeth are exposed to these carbohydrates by consuming sugary foods and drinks at mealtimes.⁵³



New research will always be underway related to the health effects of food choices and it is important 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. The majority of research suggesting an adverse effect of sugar has involved excessive caloric intake, coupled with very high intakes of added sugars.⁵⁴

To simplify the science: by practicing moderation and portion control, there is room to include an appropriate amount of sugar in a healthful lifestyle.

SUGAR MYTHS

Reduced sugar doesn't mean reduced calories. When sugar is removed from a food, other ingredients need to take its place. Compare product labels to see what the entire nutrient package of a product is when making purchasing decisions.

Raw sugar is not healthier than table sugar. Raw sugars, brown sugars and any white sugars are all processed the same in the body. Darker colors are due to varying but small amounts of molasses left on the sugar crystals. The nutrients that are contained in this amount of molasses are so small that they offer no real nutritional value.

Added sugars intake has not increased dramatically over the last several decades. You might be surprised to learn it's on the decline. See page 14 for the specifics.

There is no single ingredient that can replace sugar's flavor and function. Sugar is a natural ingredient that has been in our diets for centuries. Sugar alternatives offer sweetness but can't replicate all of the other important functions that sugar provides such as texture, preservation and so forth. When sugar is replaced, often several ingredients are added.

Sugars aren't hidden in foods. While sugars may be added for functional purposes to foods you may not expect, sugars aren't hidden in foods. The food labels on the back (or side) of the pack always show the list of ingredients (in descending order of weight) and soon all products will also include both the total sugars and added sugars content on the Nutrition Facts Label to help you know the amount of sugars you're consuming in a single serving.

Added sugars aren't simply empty calories that displace intakes of essential nutrients. Adding a limited amount of sugars to foods that provide important nutrients—such as whole-grain cereal, flavored milk or yogurt—to improve their taste, especially for children, makes sugar 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.^{6,55}

Sugars aren't added to foods to make everything taste sweet. Added sugars provide functions beyond sweetness in many foods. See page 12 for specific examples.

Added sugars are not the cause of obesity, diabetes or cardiovascular disease. Scientific evidence suggests that sugar does not directly cause conditions such as obesity or diabetes. See page 16 for more info on sugar and health.

Avoiding added sugars won't prevent cavities. Sugar, whether naturally occurring or added, and any other fermentable carbohydrate can increase the risk of cavities. Other risk factors include poor dental hygiene and lack of fluoridated water or dental products. 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. See page 16 for more info.

Sugar is not addictive. Scientific evidence does not support the idea that sugar (or any other foodstuff) can be addictive.⁵⁶⁻⁵⁸ There are many factors involved in choosing foods and choosing to eat—with psychological and behavioral components not to be overlooked. Certain foods and drinks of course can be pleasurable to consume, but it's important not to confuse this with clinical addiction.

Sugar doesn't make cancer cells grow faster. While there is still a lot about cancer we don't know, according to the Mayo Clinic, "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."⁵⁹ Glucose is found in most carbohydrates but is not synonymous with sugar.

Sugar is not a high glycemic food. Sugar has a moderate glycemic index (GI), similar to that of wheat bread. Sugar's GI is 58, just 3 points above the low GI range (55 or less). High glycemic foods have a GI of 70 or more.⁶⁰

NAVIGATING SUGARS AND SWEETENERS IN FOODS AND BEVERAGES

According to the 2015–2020 Dietary Guidelines for Americans,⁵ a healthy diet includes up to 10% of calories from added sugars, allowing room for sugars in nutritious foods and occasional sweets and treats. It is important to remember that sugar-containing foods and drinks that don't contribute significant nutritional value should be considered treats and consumed in moderation within caloric needs.

History of Nutrition Labeling

The first Nutrition Facts Label was introduced in 1994 following the Nutrition Labeling and Education Act of 1990, which made including nutrition facts on packaged food law. Prior to this, the only mandatory information on these foods was the food's name, quantity, ingredients and the name and address of the manufacturer. Nutrition information was only required on products making a nutrition claim or if they were fortified with vitamins, minerals or protein.

The goal of the Food and Drug Administration's (FDA) Nutrition Facts Label is to "ensure consumers have access to the information they need to make informed decisions about the foods they eat."⁶¹ However, understanding and knowing how to use the information on the Nutrition Facts Label is an essential part of dietary success. While the label is found on almost all products, it is important to look at how each food and beverage fits into an entire day's intake and not just focus on what is in one product. It's also helpful to examine the entire nutrient package of a product and consider how it fits in your total daily diet instead of focusing on one nutrient. History shows us that focusing on a single nutrient, like fat or sugar, is not helpful to achieving a balanced diet or improving nutrient intakes or health.⁶²

“

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

ALICE H. LICHENSTEIN, DSc,
TUFTS UNIVERSITY HEALTH AND NUTRITION LETTER, 2015⁶³

Here is some quick info to help avoid any added confusion when using the label:

Nutrition Facts	
8 servings per container	
Serving size	2/3 cup (55g)
Amount Per Serving	
Calories	230
% Daily Value*	
Total Fat 8g	10%
Saturated Fat 1g	5%
<i>Trans</i> Fat 0g	
Cholesterol 0mg	0%
Sodium 160mg	7%
Total Carbohydrate 37g	13%
Dietary Fiber 4g	14%
Total Sugars 12g	
Includes 10g Added Sugars	20%
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mcg	45%
Potassium 235mg	6%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

- + **Total sugars** This number includes the total of both naturally occurring sugars and added sugars. For example, in strawberry yogurt the naturally occurring sugars come from both the milk and the strawberries, and the added sugars come from the sugars added to balance and enhance flavors.
- + **Added sugars** Added sugars, as defined on page 41, are listed to help you know how much you are consuming. The 2015–2020 Dietary Guidelines for Americans recommend you consume less than 10% of calories per day from added sugars. That is because it is difficult to get the nutrients you need for good health while staying within calorie limits if you consume more than 10% of your total daily calories from added sugars.⁶⁴

- + **Percent daily value** Shown as a general rule, the percent daily value tells you how much a nutrient in a serving of food contributes to a daily diet, based on a target of 2000 calories per day.
- + **Ingredient list** While not technically a part of the Nutrition Facts Label, ingredients are listed in descending order by weight on the back (or side) panel of packaged foods.

“The FDA recognizes that added sugars can be a part of a healthy dietary pattern. But if they are consumed in excess, it becomes more difficult to also eat foods with enough dietary fiber and essential vitamins and minerals and still stay within calorie limits.” Having access to added sugars information on the Nutrition Facts Label increases consumer awareness of the quantity of added sugars in foods. “Consumers may or may not decide to reduce the consumption of certain foods with added sugars, based on their individual needs or preferences.”⁶¹



Sugars? Sugar? Added Sugars?

Understanding exactly what the differences are can be confusing and even a little bit frustrating, especially when there are a lot of inconsistencies in how these terms are used. To clarify, let's take a look at some quick definitions and links to what they actually mean.

Sugars

Sugars is a term referring to a broad category of all mono- and disaccharides: the simplest carbohydrates. Monosaccharides include glucose, galactose and fructose, and disaccharides include sucrose, lactose, maltose and trehalose.¹ Sugars can be naturally occurring (e.g., found in fruits, vegetables, dairy products and nuts); they can be extracted from plants and dairy and added to foods; or they can be made using various plant or dairy ingredients as a starting point.

Sugar

Sugar refers only to sucrose, a disaccharide, made up of two sugars (glucose and fructose) bound together, that is naturally made and found in all green plants. Sugar found in the food supply is harvested from sugar beets and sugar cane.



Added Sugars

Added sugars refers to a category that includes a variety of caloric sweeteners, including sugar and many others sweeteners that are classified as sugars. Added sugars do not include non- and low-calorie sweeteners.

The term “added sugars” was defined by the FDA⁴ in 2016 as sugars that are:

- + added during the processing of foods, or are packaged as such;
- + free, mono- and disaccharides;
- + sugars from syrups and honey; and
- + sugars from concentrated fruit or vegetable juices that are in excess of what would be expected from the same volume of 100% fruit or vegetable juice of the same type.

The FDA definition of added sugars does not include:

- + fruit or vegetable juice concentrated from 100% fruit juice that is sold to consumers; and
- + the fruit component of fruit spreads.

While many whole foods contain naturally occurring sugars (e.g., sucrose, glucose or fructose in fruit and lactose in milk), these are not considered added sugars when found in whole foods. Other sweeteners such as sugar alcohols, low-calorie sweeteners and no-calorie natural sweeteners are also not considered added sugars. Next you'll find more information about and examples of others sweeteners.

Other Sweeteners

On the ingredient list you'll often find other sweeteners, sometimes in combination with sugar for both flavor and functional reasons. These other sweeteners can be caloric (included in "added sugars" on the Nutrition Facts Label), low-caloric or non-caloric. Some examples are included in the chart below. The sweetness and functionality of other sweeteners varies from product to product, so when it comes to ingredient substitution or product reformulation, sugar can't simply be replaced by another single ingredient.

OTHER SWEETENERS

CALORIC	LOW-CALORIC	NON-CALORIC
Brown Rice Syrup	Isomalt	Acesulfame K
Coconut Sugar	Mannitol	Aspartame
Corn Syrup	Monk Fruit	Neotame
Dextrose	Sorbitol	Saccharin
High-fructose Corn Syrup	Sugar Alcohols	Stevia
Honey	Xylitol	Sucralose
Maltodextrin		
Maple Syrup		



There is no substitute for sugar. As a functional ingredient, sugar can't simply be replaced by another single ingredient. Its versatility is unmatched.





BEYOND FOODS: NON-FOOD USES FOR SUGAR

Sugar is a versatile and irreplaceable functional ingredient in food. In addition to providing sweetness, sugar is also used to balance acidity, add bulk or prevent spoilage, among other functional properties. But did you know that sugar is also used in the production of medication, to make bioplastics for planes and can extend the life of your fresh cut flowers? Explore the many uses of sugar that go beyond sweetness and beyond food.

Health

Medicine: Sugar is used to for coating, adding volume or texture and flavoring medicine. It can also act as a preservative and antioxidant.

Soothe a sore throat: Sucking on a lozenge or hard candy increases saliva production, helping keep your throat moist and lubricating the irritation.

Heal wounds: Many of the same properties that make sugar an excellent preservative also make sugar effective in wound healing. When sugar is applied to an open wound, it absorbs the wound's moisture, which prevents the growth of bacteria. While there are records that date back to 1700 BCE, recent research has also been conducted in this area.⁶⁵

Beauty

Sugar is used in cosmetics for its exfoliating and moisturizing properties. Sugar cane extracts are also used in moisturizers and face masks.

Try a sugar body scrub: Sugar scrubs are great for exfoliating. Make your own simple body scrub by mixing sugar with oil (coconut, almond, jojoba or olive all work well) to create a loose paste. Gently rub the paste on your skin and then rinse it off in the shower.

Make lipstick last longer: Sprinkle a little bit of sugar on your lips after applying lipstick, wait a minute, then lick it off. The sugar draws moisture from the lipstick and will extend the color.

Home and Garden

Clean your hands: Do you have greasy or dirty hands from cooking, gardening or working on your car? Put about a teaspoon of sugar into the palm of your hand before washing with soap as usual. The sugar helps cut the grease and acts as an abrasive to scrub the mess away.

Keep cut flowers fresher, longer: Add 3 teaspoons of sugar and 2 tablespoons of vinegar per quart of warm water, then add fresh-cut flowers. The sugar feeds the stems and the vinegar restricts the growth of bacteria. Replace the water every other day.

Keep baked goods fresh: Add a few sugar cubes to the airtight container holding your baked goods. The sugar will absorb the moisture and keep your bread, cakes, cookies, and biscuits fresher, longer.

Combat garden pests: To naturally combat garden pests like nematodes, sprinkle plants and the soil around them with handfuls of sugar. The sugar will feed microorganisms, which will increase the organic matter in the soil while making it a hostile environment for nematodes.

Industrial and Agricultural

Electricity: Sugar cane bagasse is often used to make electricity for the sugar cane mills and refineries. Some factories even supply electricity to nearby towns.

Bioplastics: Sugar cane is used to make bioplastics used in a wide range of rigid and flexible materials, including food and drink packaging, acoustical paneling and airplane parts. A few recent innovations are included below.

- + Legos: Lego started using sugar cane-based polyethylene in its botanical elements such as trees, bushes and leaves at the Billund, Denmark, production plant in 2018.
- + Electric car panels: The honeycomb structured core from sugar cane (PLA) is one of the sustainable materials being used in the body panels of circular electric cars being developed in the Netherlands.

Biofuels: Sugar is used in the production of biofuels like ethanol, an additive in automotive gasoline.

Beer, wine and distilled spirits: Sugar is involved in the fermentation process that produces ethanol in alcoholic beverages.

Ingredients for foods and medicines: Sugar molasses is used in the production of ingredients for foods and medicines.

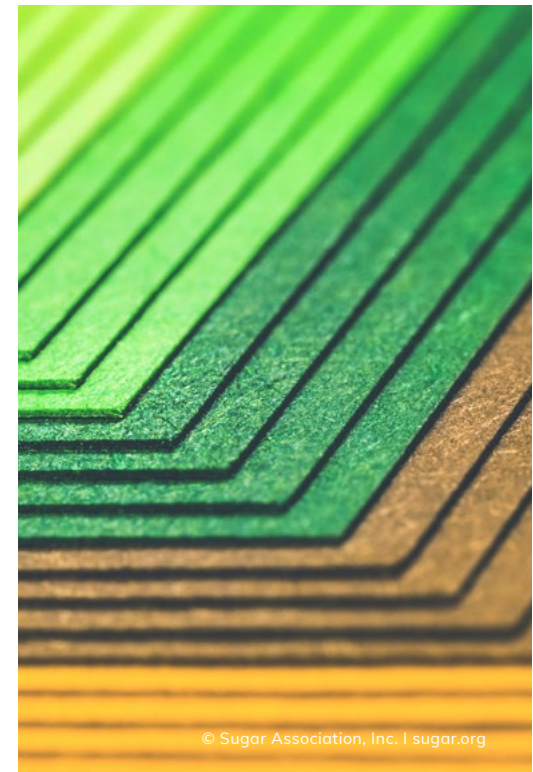
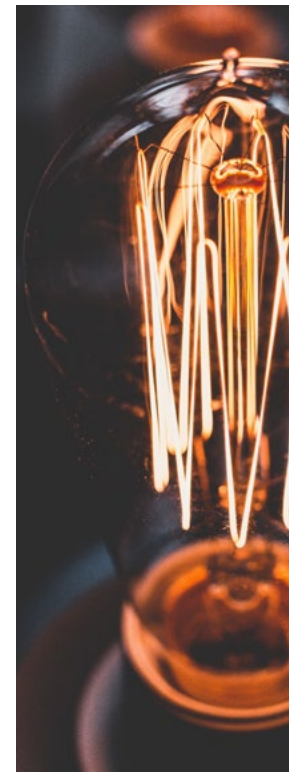
- + Lysine: an essential amino acid used to make medicine. Lysine is used for preventing and treating cold sores and is also found in supplements.
- + Lactic acid: used in prepared foods for preservation and flavor, and also as a curing agent.
- + Citric acid: used in prepared foods for preservation and flavor (sour).
- + Yeast: used in baking and brewing industries.


Paper products: Sugar cane bagasse is used to make:

- + Office products: copy paper, envelopes, cardstock and more
- + Take-out containers: eco-friendly solution to Styrofoam

Cement and glue: Sugar slows the setting of cement and glue.

Livestock feed: Sugar production byproducts and molasses are used as feed supplements for livestock.





Sugar is naturally white. It is simply removed from sugar beet or sugar cane plants and washed to remove the naturally present molasses and other plant materials.

- + Sugar doesn't spoil.
- + Sugar (sucrose) is the standard for the measurement of sweetness and has a relative sweetness score of 100.⁶⁶
- + Sugar has just 15 calories per teaspoon.
- + Sugar is used to mask the bitter taste of medicines. It was one of the first pharmaceutical ingredients used for this purpose and still is today.
- + Ever wonder why even low-fat chocolate milk tastes like whole milk? Sugar serves the dual purpose of increasing the thickness of the milk and enhancing the sweetness of the cocoa.
- + Sugar has healing powers. Many of the same properties that make sugar an excellent preservative also make sugar effective in wound healing. When sugar is applied to an open wound, it absorbs the wound's moisture, which prevents the growth of bacteria. While there are records that date back to 1700 BCE, recent research has also been conducted in this area.
- + Sugar is grown and/or refined in 17 states across the United States
- + All sugar products in the marketplace differ only in crystal size or molasses content. Molasses adds color, flavor and moisture. The darker the brown sugar, the more molasses it has.

FUN FACTS

COOKING AND BAKING FAQS

How can I soften hard white sugar?

Sugar hardens when it is exposed to moisture, like high humidity, and then the surface dries. Break the hardened sugar into manageable pieces with a meat tenderizer or heavy mixing spoon. Toss the pieces into a food processor or blender, and blend until smooth. It's best to keep your sugar in a sealed container.

How can brown sugar be stored to prevent hardening?

Brown sugar hardens when its moisture evaporates. Storing brown sugar in a way that allows the product to retain its natural moisture—in its original plastic bag (closed tightly) or in an airtight container—helps brown sugar stay moist.

If brown sugar hardens, let it stand overnight in a sealed jar with a damp paper towel or apple slice. For a quick fix, heat the needed amount in a 250° F oven for a few minutes, or in a microwave oven on low for 1–2 minutes per cup. The softened brown sugar should be used immediately.

Can I substitute brown sugar for white granulated sugar in recipes?

Yes. While white sugar can be substituted with an equal amount of brown sugar, brown sugar will add a slight molasses flavor to your recipe.

Can I make my own brown sugar?

Yes! Combine 1 tablespoon of molasses with 1 cup of white granulated sugar. Mix well.

Can confectioners (powdered) sugar be substituted for granulated sugar in a recipe?

These products usually are not interchangeable. Confectioners sugar is made up of much finer particles than granulated sugar, and it contains a small amount of cornstarch to prevent caking.

Can I make powdered sugar at home?

Yes! Blend 1 cup of white sugar and 1 tablespoon of cornstarch to get 1 cup of powdered sugar.

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9 misunderstandings about SUGAR

MYTH

Sugar is hidden in food.

FACT

For the past three decades sugar has been found on the ingredient list of many foods and beverages. And for good reason. Unless you cook a lot from scratch, you may not be familiar with all of the functional roles that sugar plays in so many products. Sugar is so much more than the sweet taste we know so well.

Sugar has many functional properties that range from balancing acidity (like in salad dressing and sauces) to preventing spoilage (like in breads, canned vegetables and prepared foods). While sugar may be added to foods for reasons you may not expect, sugar isn't hidden in foods. The food labels on the back (or side) of the pack always show the list of ingredients (in descending order of weight) and soon all products will also include both the total sugars and added sugars content on the Nutrition Facts Panel.



MYTH

“Reduced sugar” always means reduced calories.

FACT

When sugar is removed from a food, there are new ingredients (usually more than one) that need to take its place to replace both the flavor and functionality of sugar. These ingredients often bring the same or even more calories to a product than sugar does. So, before you think less sugar means fewer calories, compare product labels to see what the entire nutrient package of a product is.

Because of the many functional roles sugar can play in a product, reducing sugar in a food product often isn't as simple as just cutting the sugar in the recipe. For example, sugar may be added to a cereal to mask the bitter taste of fiber or added vitamins, increase bulk and lengthen the shelf life. Several ingredients will need to be added to replace all of those functions if you take the sugar out.



That was easy!



MYTH

Making sugar is a complicated process.

FACT

You can actually extract sugar at home. Sugar is simply removed from the plant, washed, crystallized and dried. The same sugar found naturally in the plant is what ends up in your pantry.

Whether sugar comes from sugar beets or sugar cane, the purification process is similar for each plant and the result is the same pure sucrose. In both cases, sugar juice is separated from the plant material, crystallized and dried to produce the sugar we find in our pantries. Just a few simple steps from plant to final product!

MYTH

"Raw" sugar is healthier than table sugar.

FACT

Your body handles sugar the same regardless of what color it comes in. Raw sugars, brown sugars and any white sugars are all processed the same in the body. Darker colors are due to varying but small amounts of molasses left on the sugar crystals. The nutrients that are contained in this amount of molasses are so small that they offer no real nutritional value.



Sugar has only **15** calories per teaspoon

MYTH

Sugar is a high glycemic food.

FACT

Sugar has a moderate impact on blood glucose, similar to that of wheat bread.

Low Glycemic Index: ≤ 55

Table Sugar: 65

High Glycemic Index: ≥ 70

Glycemic index (GI) is a measure of how quickly the starches and sugars in a food or beverage are broken down to glucose and released into the blood stream after a food or beverage is consumed. The GI of sugar is 65, falling in the moderate GI range of 56-69. High glycemic foods have a GI of 70 or more. Simply put, sugar ranks somewhere in the middle of carbohydrate foods when it comes to raising blood glucose.¹

MYTH

Americans consume more added sugars now than ever.

FACT

USDA data show that added sugars intake decreased by more than 15% from 2000 to 2017.

ADDED SUGARS INTAKE
DOWN MORE THAN

15%



While added sugars consumption increased sharply in the 1990s, consumption has been on a significant decline for the past 20 years.² In 2015-2016, added sugars consumption was reported to be 12.6% of total calories, or around 270 calories per day.^{3,4} This is still slightly above the 2015-2020 Dietary Guidelines for Americans recommendation of 10% of calories from added sugars per day.⁵

MYTH

Sugar causes chronic diseases such as obesity, diabetes and heart disease.

FACT

Excess calories from all food and beverages, including sugars, can lead to weight gain, increasing the risk of obesity and other chronic diseases but research does not show a direct link between sugar and any of these conditions.

Scientific evidence consistently shows that a healthy lifestyle based on moderation, a variety of food choices and physical activity tends to lead to the best outcomes when compared to simply focusing on cutting out or adding on ingredient or another; it does not support adverse outcomes of sugar intake when sugar is consumed in moderation and as part of a diet where calories are not eaten in excess.^{6,7,8,9,10}



MYTH

Sugar is addictive.

FACT

All that science tells us is that sugar tastes good and people like eating food that tastes good. Eating something you enjoy increases dopamine in the same way all pleasurable experiences do but addiction and pleasure are not the same thing.

Scientific evidence does not support the idea that sugar (or any other foodstuff) can be addictive.^{11,12,13} There are many factors involved in choosing to eat—with psychological and behavioral components not to be overlooked. Certain foods and drinks of course can be pleasurable to consume, but it's important not to confuse this with clinical addiction



MYTH

Sugar is toxic.

FACT

Sugar is an abundant carbohydrate produced by plants and made up of units of glucose and fructose. Glucose is found in all plant foods and fructose is most abundantly found in fruits. There is no mystery to what sugar is. We do know that it is a sweet energy source that is safe, especially when enjoyed in moderation.

While too much of anything can be bad, sugar (sucrose), whether intact in fruits and vegetables or in the popular extracted and crystallized form, has been safely incorporated in the diets of humans throughout all of time. The essential role of carbohydrates, including sugar, as an important source of fuel for the body is nothing new. In fact, glucose (a product of carbohydrate digestion) is essential to the function of the central nervous system.

Visit sugar.org to learn more about sugar

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SWEETENERS

you might find in your food

There are many different sweeteners in our food supply today that might be used as an alternative to table sugar. Here is some basic information about some of the most popular caloric, low- and non-caloric sweeteners, including real sugar as a comparison.



CALORIC

Sugar	Agave	Brown Rice Syrup	Coconut Sugar	Date Sugar	Dextrose	Fruit Juice Concentrate	High Fructose Corn Syrup (HFCS)	Honey	Maltodextrin
SOURCE: Sugar beet and sugar cane plants	SOURCE: Agave Plant	SOURCE: Rice	SOURCE: Flower of the coconut plant	SOURCE: Dates	SOURCE: Corn or Wheat	SOURCE: Fruit varieties	SOURCE: Corn	SOURCE: Nectar collected by bees	SOURCE: Corn or Wheat
									
SUGARS: Sucrose	SUGARS: Fructose (55-90%), glucose	SUGARS: Glucose, maltose, maltotriose	SUGARS: Sucrose, glucose, fructose	SUGARS: Glucose, fructose, sucrose	SUGARS: Glucose	SUGARS: Sucrose, glucose, fructose	SUGARS: Fructose (55% or 42%), glucose (45% or 58%)	SUGARS: Fructose, glucose	SUGARS: Glucose
Calories per teaspoon: 15	Calories per teaspoon: 21	Calories per teaspoon: 16	Calories per teaspoon: 15	Calories per teaspoon: 11	Calories per teaspoon: 16	Calories per teaspoon: ~16	Calories per teaspoon: 17	Calories per teaspoon: 20	Calories per teaspoon: 15
GI: moderate	GI: low	GI: high	GI: low	GI: low	GI: high	GI: unknown	GI: moderate	GI: low ↔ high	GI: high

SWEETNESS COMPARED TO SUGAR

Standard for sweetness	30-40% sweeter	30% less sweet	Equal sweetness	Less sweet	25% less sweet	Less sweet	120-160 times sweeter	variable	10% as sweet
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<p>PRODUCTION After sugar beet and sugar cane plants are harvested, sugar is removed from the plant through crushing, cutting and boiling. It is then filtered, washed and crystallized to produce the sugar we find in our pantries.</p> <p>NOTES While all green plants make sucrose through photosynthesis, sugar beet and cane plants make the greatest quantities of sugar.</p>	<p>PRODUCTION The leaves of the plant are cut and crushed to extract the sap. The sap is filtered, heated and treated enzymatically to convert the fructans (not very sweet) to fructose and glucose.</p> <p>NOTES Takes about seven years for the sugar content of the plant to reach a reasonable level for harvesting.</p>	<p>PRODUCTION Rice dextrin is produced by removing the hemicellulose, protein and lipid fractions from the brown rice. The rice dextrin then goes through further steps to convert polysaccharides to predominantly monosaccharides.</p> <p>NOTES A mild-flavored sweetener, also known as a maltose-based sweetener or rice malt syrup.</p>	<p>PRODUCTION Made from sap of the coconut blossom. Sap is collected and boiled down to a thick syrup, cooled into blocks and broken into granulated sugar.</p> <p>NOTES Considered a partially refined sugar and is similar in color, flavor and sweetness as brown sugar. May retain a small amount of micronutrients.</p>	<p>PRODUCTION Made from powdering dried dates. Commercial varieties may have a flowing agent added (like oat flour) to help reduce clumping.</p> <p>NOTES Looks a lot like brown sugar but cannot simply replace brown sugar in recipes as it does not dissolve in water or melt, and therefore does not incorporate well into mixtures.</p>	<p>PRODUCTION Dextrose is most commonly produced from cornstarch, though starch can come from any kind of plant. The process involved enzymatic breakdown of the starch polymers to single glucose units, which is similar to how our bodies breakdown starch.</p> <p>NOTES Most commonly used in beer making.</p>	<p>PRODUCTION Made by evaporating most of the water from the fruit puree, concentrating the natural sugar content.</p> <p>NOTES Can contain traces of vitamins and minerals.</p>	<p>PRODUCTION Corn syrup is made from cornstarch. The cornstarch is processed enzymatically by glucose isomerase to convert some of the glucose into fructose. To develop HFCS, this process is taken further to convert more glucose.</p> <p>NOTES The higher fructose variety is often used in soft drinks and the lower fructose version is used more in cakes.</p>	<p>PRODUCTION Produced by bees, honey is harvested by bee keepers and the filtered/processed commercially. Taste, color and flavor all depend on the types of flowers the bees have collected nectar from. Basic commercial honey tends to be a mix of different nectars to help ensure consistency and flavor.</p> <p>NOTES GI ranges are dependent on where the honey has been collected. Commercial honey blends tend to be high (GI>70).</p>	<p>PRODUCTION Produced by processing starch (most commonly corn), using acids or enzymes to break it down.</p> <p>NOTES Commonly added to processed foods to provide bulk and texture and help blend ingredients together.</p>
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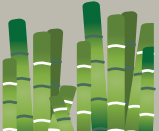









SWEETENERS

you might find in your food



Calorie free? In order for tabletop sweeteners to be used like regular table sugar, they are often mixed with a bulking agent such as maltodextrin or erythritol. These bulking agents add just a few calories when you use these non-caloric sweeteners. One packet of Equal or Splenda contains 4 calories and the sweetness of two teaspoons of sugar.

Source: Barclay A, Sandall P, Schwede-Slavin C. The Ultimate Guide to Sugars and Sweeteners: discover the taste, use, nutrition, science and lore of everything from agave nectar to xylitol. New York, NY: The Experiment, LLC; 2014.

CALORIC		LOW-CALORIC		NON-CALORIC						
Maple Syrup	Molasses	Allulose	Sugar Alcohols	Acesulfame K	Aspartame	Monk Fruit	Neotame	Saccharin	Stevia	Sucralose
SOURCE: Sap of the maple tree	SOURCE: Sugar cane plant	SOURCE: Corn	SOURCE: Corn	SOURCE: N/A	SOURCE: N/A	SOURCE: Monk fruit (a small melon)	SOURCE: N/A	SOURCE: N/A	SOURCE: Stevia plant	SOURCE: N/A
										
SUGARS: Sucrose, glucose, fructose	SUGARS: Sucrose, glucose, fructose	SUGARS: Allulose	SUGARS: Glucose	SUGARS: Glucose	SUGARS: N/A	SUGARS: Mogrosides	SUGARS: N/A	SUGARS: N/A	SUGARS: N/A	SUGARS: N/A
Calories per teaspoon: 17	Calories per teaspoon: 19	Calories per teaspoon: 1.6	Calories per teaspoon: 0.6-8	Calories per teaspoon: 0	Calories per teaspoon: 0	Calories per teaspoon: 0	Calories per teaspoon: 0	Calories per teaspoon: 0	Calories per teaspoon: 0	Calories per teaspoon: 0
GI: low	GI: moderate	GI: N/A	GI: varies	GI: N/A	GI: N/A	GI: N/A	GI: N/A	GI: N/A	GI: N/A	GI: N/A

SWEETNESS COMPARED TO SUGAR

Slightly less sweet	25-50% less sweet	70% as sweet	30-100% as sweet	200 times sweeter	150-250 times sweeter	200-400 times sweeter	8,000 times sweeter	300-500 times sweeter	200 times sweeter	400-600 times sweeter
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<p>PRODUCTION The maple tree is tapped so the sap can be collected in buckets that hang on the tree. The sap is then boiled to reduce the water content, concentrating the sugars.</p> <p>NOTES Contains traces of organic acids, vitamins and some minerals, however not a significant level.</p>	<p>PRODUCTION Molasses is a co-product of sugar refining. It is spun off the raw sugar in a centrifuge. The first spin produces light molasses, while later spins produce darker molasses.</p> <p>NOTES May contain trace amounts of iron, calcium and phosphorus. Sugar beets also naturally contain molasses but it is not used in the food supply.</p>	<p>PRODUCTION Allulose is a "rare sugar" naturally present in wheat, figs and raisins. However, it is manufactured from corn through enzymatic reactions.</p> <p>NOTES Allulose has the same chemical formula as fructose but is arranged differently. It isn't metabolized by the body and may cause GI distress similar to sugar alcohols.</p>	<p>PRODUCTION While sugar alcohols can occur naturally, most are produced industrially from sugars (pentoses and hexoses). Sorbitol and xylitol are hydrogenated with a nickel catalyst. Erythritol is made through fermentation of glucose and sucrose.</p> <p>NOTES Sugar alcohols are considered tooth friendly. Excess consumption of sugar alcohols can cause diarrhea. This is because the body ferments them in the gut.</p>	<p>PRODUCTION Acesulfame K, or aceK, is a potassium salt. It is made by combining acetoacetic acid and potassium.</p> <p>NOTES As a tabletop sweetener, it is always mixed with at least one other ingredient to reduce the sweetness to compare to table sugar. Brand name Sweet One or Sunett.</p>	<p>PRODUCTION Aspartame is a methyl ester of aspartic acid/phenylalanine dipeptide. Typically aspartame is made through chemical synthesis.</p> <p>NOTES Breaks down in the body to aspartic acid, phenylalanine and a small amount of methanol. Brand names are NutraSweet or Equal.</p>	<p>PRODUCTION Monk fruit naturally contains sucrose, glucose and the high-intensity sweetener mogroside. Extracting the mogrosides involves crushing the fruit, adding water, filtering and spray drying.</p> <p>NOTES It is challenging stevia as the next "natural" high-intensity sweetener as it is heat stable, acid stable and soluble in water. Also called Lou Han Guo.</p>	<p>PRODUCTION Neotame is a derivative of the amino acids phenylalanine and aspartic acid.</p> <p>NOTES It is heat stable, so it can be used in baking. Brand name is Newtame.</p>	<p>PRODUCTION Saccharin is a sodium salt, made through the oxidation of o-toluensulfaonamide and or/phthalic anhydride.</p> <p>NOTES It can provide a bitter or metallic aftertaste. Saccharin crosses the placenta and is secreted in breastmilk. It is not metabolized in the body and excreted in the urine. Brand name SweetN' Low or Sweet and Low.</p>	<p>PRODUCTION The leaves are boiled, then the liquid is passed through a resin and washed in alcohol to release the sweet glycosides. These are then re-crystallized to produce the commercial product. Seven glycosides have been extracted, the two most commonly used are stevioside and rebaudioside A (Reb A).</p> <p>NOTES Stevia can leave a bitter aftertaste. Stevia consumer products are often mixed with erythritol or sugar.</p>	<p>PRODUCTION Manufactured through chlorination of sucrose in a multistep synthesis.</p> <p>NOTES When combined with maltodextrins (used as bulking agents) there is a small contribution to energy. It is also stable in heat, so can be used in baking. Brand name Splenda.</p>
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WHAT ARE Added Sugars?



Let's start with the basics. Sugars are the simplest type of carbohydrate. They are easily digested and absorbed by the body. Sugars provide calories, or energy, for the body. Each gram of sugar provides 4 calories.

Carbohydrates, along with fat and protein, are macronutrients that provide the body with energy.



Sugars that contain one molecule (monosaccharides) are small enough to be absorbed directly into the bloodstream. Sugars that contain two molecules of sugar linked together (disaccharides) are broken down in your body into single sugars before absorption. Polysaccharides are longer chains of monosaccharides (more than 10) and are also broken down in the body.

Sugars, broken down

Monosaccharides

- Glucose** (dextrose)
- Fructose** (levulose or fruit sugar)
- Galactose** (occurs in milk)

Disaccharides

- Sucrose** (table sugar) = glucose + fructose
- Lactose** (milk sugar) = glucose + galactose
- Maltose** (malt sugar) = glucose + glucose

Polysaccharides

- Starch** (glucose polymer)

In the body, sugars are broken down into glucose.

- Glucose in the blood (often called "blood sugar") is the primary source of energy for the body.
- Glucose can be used immediately or stored in the liver and muscles for later use.

In foods and beverages, sugars are used to sweeten, preserve, and improve other attributes like texture, color and browning capability.

Sugars are found naturally in all plant and dairy foods and beverages and are also added to foods and beverages for taste, texture and preservation. These sugars that are added to foods and beverages during the processing of foods are considered **ADDED SUGARS** as defined by the FDA. Added sugars do not include low- and non-caloric sweeteners.

The term "added sugars" was defined by the Food and Drug Administration (FDA) in 2016 as: sugars that are added during the processing of foods, or are packaged as such, and include sugars (free, mono- and disaccharides), sugars from syrups and honey, and sugars from concentrated fruit or vegetable juices that are in excess of what would be expected from the same volume of 100 percent fruit or vegetable juice of the same type.

Some specific examples of FDA's definition of added sugars include:

- agave nectar
- brown rice syrup
- brown sugar
- confectioner's powdered sugar
- coconut sugar
- corn syrup
- dextrose
- fructose*
- glucose*
- high-fructose corn syrup
- honey
- invert sugar
- lactose*
- malt syrup
- maltose*
- maple sugar
- molasses
- nectars (e.g. peach nectar, pear nectar)
- raw sugar
- rice syrup
- sucrose*
- sugar
- white granulated sugar

**also naturally occurring sugars founds in whole foods*

The Dietary Guidelines for Americans recommend limiting added sugars to no more than 10% of calories.¹ This is a target to help individuals move toward healthy eating patterns within calorie limits.

1. U.S. Department of Health and Human Services, U.S. Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th ed. Available at: <https://health.gov/dietaryguidelines/2015/guidelines/>. Published December 2015.



@MoreToSugar

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Contact us at sugar@sugar.org

the
Sugar
association

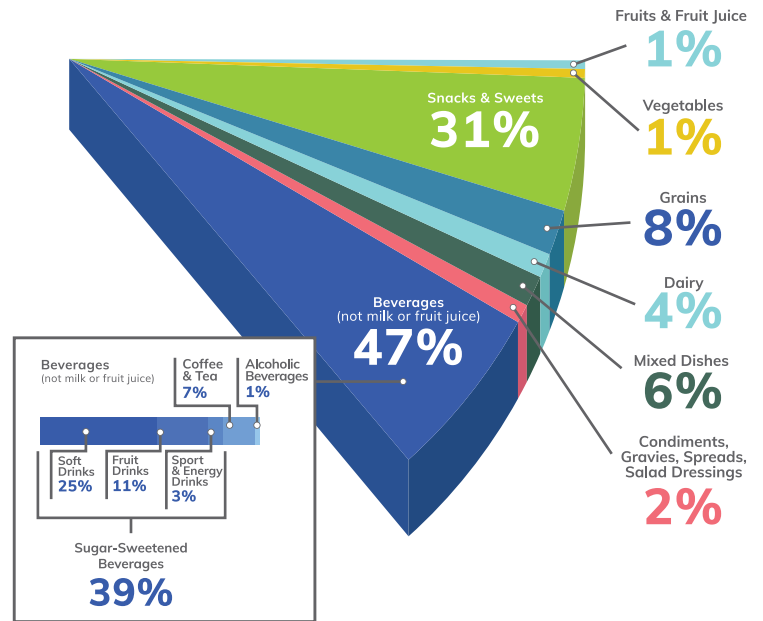
FACTS ABOUT SUGAR INTAKE

In the past **15 years**, added sugars intake in the United States has decreased by nearly **25%**, from 21 teaspoon equivalents per day to 16.1 teaspoon equivalents per day.¹

Calorically sweetened beverages such as soft drinks, tea and fruit drinks are the main source of added sugars in the diet across all age groups (older than 2 years), making up almost half of added sugars calories.² While these beverages continue to be the largest contributor to added sugars intakes, there has recently been a significant decline in calorically sweetened beverage consumption since 1999.³

In 2016, added sugars was reported to be about 12.6% of total calories, just slightly above the 2015-2020 Dietary Guidelines for Americans recommendation of 10% of calories from added sugars per day.^{1,2,4}

SUGAR AND THE DIET SOURCES OF ADDED SUGARS⁴



PERCENT OF CALORIES FROM ADDED SUGARS^{1,2,5}

YEAR	% OF CALORIES FROM ADDED SUGARS
1999-2000	18.1
2001-2002	17.1
2003-2004	15.9
2005-2006	14.5
2007-2008	14.6
2009-2010	13.9
2011-2012	14.1
2013-2014	13.4
2015-2016	12.6

Added sugars are found in a variety of foods and beverages for different reasons, many times for functions beyond sweetness.

BREAKING DOWN THE NUMBERS

SUGAR SERVING SIZE

2 teaspoons in a serving	30 calories in a serving	8 grams in a serving
15 calories in a teaspoon	4 grams in a teaspoon	4 calories per gram

INTAKE RECOMMENDATIONS

According to the 2015-2020 Dietary Guidelines for Americans,⁴ a healthy diet includes up to 10% of calories from added sugars, allowing room for sugars in nutritious foods and occasional sweets and treats. In a 2000 calorie diet this equates to 200 calories, 50 grams, or 12.5 teaspoons

A LITTLE HISTORY...

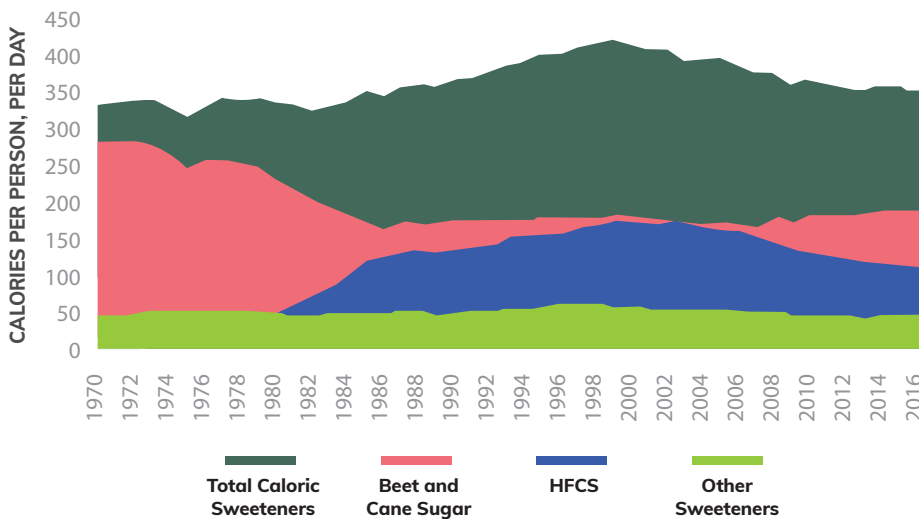
In the 1990s, added sugars consumption increased sharply as soda consumption increased and manufacturers raced to reformulate and develop new products during the “low-fat era.” Removing fat from a product requires replacing it with something. The same is true of removing sugar. Data has shown the seesaw effect of restricting individual nutrients only leads to caloric over compensation with another, whether sugar for fat or vice-versa.^{6,7}

HOWEVER – since 1999 added sugars consumption has been on a significant decline in the United States.^{1,2,5}

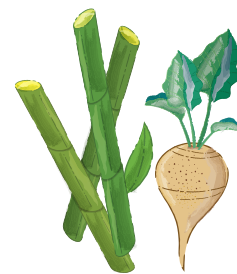
As long as dietary data have been collected, added sugars intake has never been below 10%.⁸



CONSUMPTION OF CALORIC SWEETENERS IN THE UNITED STATES, 1970-2016⁷



Intake data for total added sugars is a combination of the intakes of all caloric sweeteners including sugar, high-fructose corn syrup, honey, maple syrup and others.



Sugar from sugar beets and sugar cane along with high-fructose corn syrup are the biggest contributors to total added sugars.

WHERE DO THESE NUMBERS COME FROM?

What We Eat in America (WWEIA) captures U.S. dietary intakes as a part of National Health and Nutrition Examination Survey (NHANES). This survey is conducted every two years in partnership with the United States Department of Agriculture (USDA) and Health and Human Services (HHS) to assess the health and nutritional status of Americans.

Loss-Adjusted Food Availability is another proxy for estimating intake. This number is calculated using food and nutrient availability for consumption and considers estimated loss or waste. The downward trend in availability mirrors the NHANES consumption estimates.

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3. Beverage Digest Fact Book, 23rd Edition. Zenith International; May 2018.
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WHERE IN THE U.S. does sugar come from?

6 Quick Facts

1

Sugar is grown and/or refined in **17 states** across the U.S.

2

Sugar beets grow best in places where the **temperatures are generally cooler.**

5

Sugar beet factories are located near the farms to **shorten the distance farmers need to travel** with their beets.

6

Some raw **cane sugar** is also imported to the U.S. for refining.

3

At sugar beet factories and sugar cane refineries across the country, the sugar from the plants is **purified into the sugar** shipped to grocery stores and food manufacturers.

4

Sugar cane is grown in **warmer, tropical climates.**



sugar beet factory



sugar beet growth



sugar cane refinery



sugar cane growth















SUGAR BEET PROCESSING



SUGAR CANE REFINING



SUGAR'S FUNCTIONAL ROLES IN FOOD BEYOND SWEETNESS

		FLAVOR ENHANCER/ BALANCER, AROMA	BULK	TEXTURE/ MOUTHFEEL	SHELF-LIFE/ MICROBIAL STABILITY	FERMENTATION	FREEZING POINT DEPRESSION	COLOR	MOISTURE RETENTION
Dairy Products		●	●	●		●			
Whole-Grain, Fiber-Rich Breads & Cereals		●	●	●	●	●		●	●
Breads		●	●	●	●	●		●	●
Bakery Products		●	●	●	●			●	●
Salad Dressings, Rubs and Sauces		●	●	●	●				
Preserves & Pickling		●	●	●	●				
Jams & Jellies		●	●	●	●			●	
Canned Fruits & Vegetables		●	●	●	●			●	
Prepared Foods		●	●	●	●			●	●
Beverages		●	●	●	●				
Frozen Beverages		●	●	●			●		
Fermented Beverages		●	●	●		●			
Ice Cream		●	●	●			●		
Confectionery		●	●	●	●			●	●

WHAT IS

MOLASSES?

MOLASSES IS A CO-PRODUCT OF SUGAR REFINING AND PROCESSING.

Molasses, the thick, dark brown syrup you might buy at the grocery store, is found naturally in sugar beet and sugar cane plants. During the refining process, it is separated from the sugar crystals by spinning the sugar in a centrifuge.



Molasses is not as sweet as sugar but is used in many recipes for its rich flavor and moisture. Sugar beet molasses and sugar cane molasses have different flavors and consistencies and are not used interchangeably. Sugar cane molasses is primarily used for sweetening and flavoring foods while sugar beet molasses is not very sweet and is primarily used for animal feed and other commercial and industrial uses.

Sugar is a minimally processed ingredient. It is simply removed from the plant, washed, crystallized, spun and dried. The spinning step is where the molasses is separated from the sugar crystals.



Molasses comes in a variety of levels of sweetness, from the sweet and moderate flavor of confectionery/all-purpose molasses to the strong-flavored blackstrap molasses.

1 Tbsp of molasses has 58 calories



Molasses from sugar cane has been used since as early as 500 B.C.E. in India

Up until the 1880s, molasses was the most popular sweetener in the US



Sugar cane molasses is what makes brown sugar brown

Each stalk of sugar cane produces 6 teaspoons of molasses



Each sugar beet is made up of about 3.7% molasses

Molasses adds a broad range of flavors to foods from caramel to licorice



Food Uses of Molasses

- Key ingredient in the distillation of rum
- Dark rye breads or other whole grain breads
- Cookies and pies
- Gingerbread
- Barbecue sauces
- Beer styles such as stouts and porters
- Home-made vinaigrette
- Jerky Processing
- Yeast production



Industrial Uses of Molasses

- Ingredient in animal feed
- Fermentation source in the production of ethanol and other chemicals
- Industrial production of vinegar and citric acid
- Mixed with salt to de-ice roads
- Added to soil to promote microbial activity
- Minor component of mortar for brickwork



Real sugar comes from sugar beets and sugar cane plants.



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Learn more at sugar.org
Contact us at sugar@sugar.org

the Sugar
association

April 2020



THERE'S A LOT OF MISINFORMATION OUT THERE.

Learn to separate fact from fiction.

DON'T BE FOOLED:

myth

Sugar makes kids hyperactive.

fact

Research shows that sugar doesn't change kids' behavior—they're just excited.¹

myth

Americans consume more added sugars now than ever.

fact

USDA data shows that added sugars intake decreased by more than 15% from 2000 to 2017.²⁻⁴

myth

Sugar is a food with a high glycemic index.

fact

Sugar has a moderate glycemic index, similar to wheat bread.⁵

TIPS:

Always check the source.

Articles rely on the author's interpretation of reference materials. Look deeper and see where the information is coming from, because it's not always reliable. Be wary if there are no sources listed.

Look for overly persuasive language.

Is the author using strong negative or positive words, or is the point of view neutral? Extreme language is a giveaway that the trustworthiness of the content could be questionable. Don't be convinced by someone else—convince yourself with facts.

Do some searching.

Search the article title to see who else is writing about this topic so you can get a variety of perspectives. Also, check to see whether the author has health credentials, and be cautious if the author is trying to sell you something.



**A BALANCED LIFE IS
A SWEET LIFE.**

Visit sugar.org to learn more sugar facts.



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There's more to sugar.

¹Wolraich ML, Wilson DB, White JW. The effect of sugar on behavior or cognition in children. A meta-analysis. *Journal of the American Medical Association*. 1995;274(20):1617-1621.

²U.S. Department of Agriculture Economic Research Service. *Sugar and Sweeteners Yearbook Tables*, Table 51 (Refined cane and beet sugar: estimated number of per capita calories consumed daily, by calendar year). Available at: <https://www.ers.usda.gov/data-products/sugar-and-sweeteners-yearbook-tables.aspx>. Updated September 6, 2018. Accessed November 26, 2018.

³U.S. Department of Agriculture Economic Research Service. *Sugar and Sweeteners Yearbook Tables*, Table 52 (High fructose corn syrup: estimated number of per capita calories consumed daily, by calendar year). Available at: <https://www.ers.usda.gov/data-products/sugar-and-sweeteners-yearbook-tables.aspx>. Updated September 6, 2018. Accessed November 26, 2018.

⁴U.S. Department of Agriculture Economic Research Service. *Sugar and Sweeteners Yearbook Tables*, Table 53 (Other sweeteners: estimated number of per capita calories consumed daily, by calendar year). Available at: <https://www.ers.usda.gov/data-products/sugar-and-sweeteners-yearbook-tables.aspx>. Updated September 6, 2018. Accessed November 26, 2018.

⁵Foster-Powell K, Holt SH, Brand-Miller JC. International table of glycemic index and glycemic load values: 2002. *American Journal of Clinical Nutrition*. 2002;76(1):5-56.

Bite-Sized Tips on Portion Control

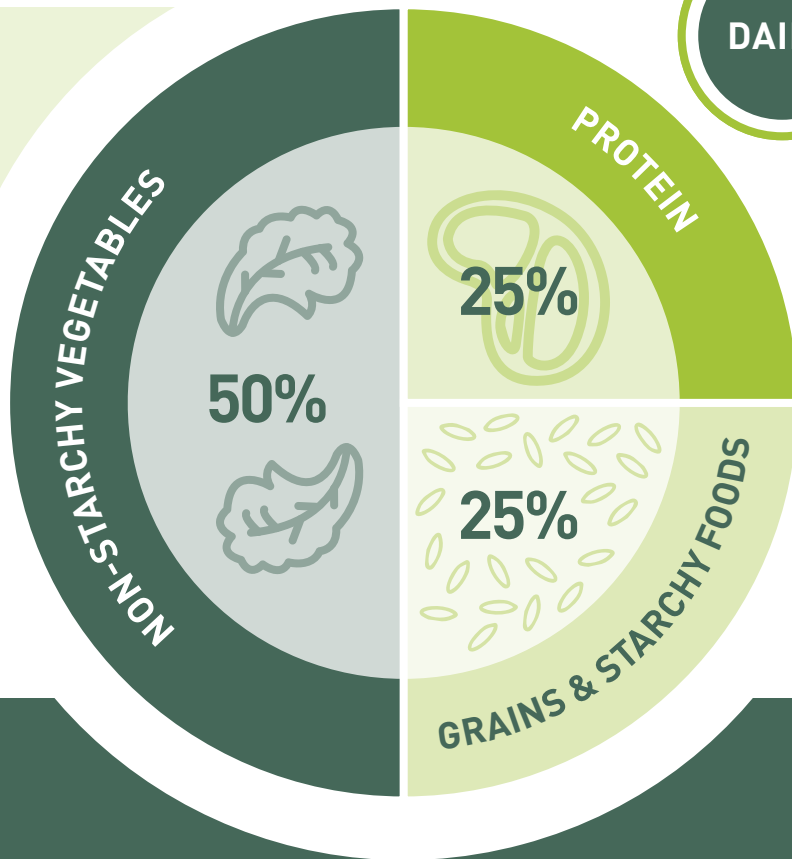
Build a balanced plate and keep portions in check

Portioning your plate

Make your plate great with half (50%) non-starchy vegetables, one-quarter (25%) protein and one-quarter (25%) grains and starchy foods. Include a serving of fruit and/or dairy as your carbohydrate goals allow.¹

FRUIT

DAIRY



Portions for discretionary calories

It's a common myth that people with diabetes have to avoid sugar entirely. Sweets in moderation and nutritious foods with added sugars can be part of a healthy diet, as long as the total carbohydrates fit within your daily goal.²

No measuring cups in sight? Use these everyday items instead!³



1/2 cup

Ice cream



Lightbulb = 1/2 cup



1 oz.

Dark chocolate



Pair of dice = 1 oz.



1 Tbsp.

Jam, sugar, maple syrup, honey



Tip of thumb = 1 Tbsp.

Portion control tips

Keep portions in check with these tips and tricks!



Use smaller plates and bowls for meals and snacks.



Serve yourself using a measuring cup to know exactly how much is going on your plate.



Keep food off the counters and in your pantry. Out of sight, out of mind.

¹ American Diabetes Association

² Joslin Diabetes Center

³ Cleveland Clinic



Real Sugar

FROM THE FIELD TO THE TABLE



**Real
Sugar**

STEAM Materials for Grades 7-12

▶▶▶ Science, Technology, Engineering, Art and Math

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TEACHER KEY

One Sweet History... (p2)

If you put 2 teaspoons of sugar in your coffee every day for a year, at \$5.00 per teaspoon how much would you spend in that year?

\$3,650

Where Does Sugar Come From? (p4)

Sugar beet growing states: **California, Colorado, Idaho, Michigan, Minnesota, Montana, Nebraska, North Dakota, Oregon, Washington, Wyoming**

Sugar cane growing states: **Florida, Louisiana, Texas**

Sugar: Captured Sunshine (p6)

Labels from top to bottom: **Sun, Air, Leaves, Leaves, Stalk, Soil, Root Bulb**

A Closer Look at Sugar (p8)

Letters, words and numbers should be matched as follows:

C – Carbon – 12
H – Hydrogen – 22
O – Oxygen – 11

From the Field to the Table (p10)

Down

1. Filtered
2. Cosettes
4. Raw
5. Centrifuge
7. Color
9. Naturally

Across

3. Absorbs
6. Evaporated
8. Transform
10. Pulp

It's Sweet to the Environment (p12)

- | | |
|----------------|-----------------|
| 1. Nature | 7. Utilize |
| 2. Co-products | 8. Fodder |
| 3. Value | 9. Molasses |
| 4. Residue | 10. Responsible |
| 5. Caretaker | 11. Bagasse |
| 6. Green | 12. Environment |

Sugar: More Than Just Sweet Taste! (p14)

Which category of foods or beverages leverages the most functions of sugar?

Whole-grain, fiber-rich breads & cereals and breads

Match the following amounts of sugar with the types of bakery product and the resulting texture.

More sugar – Cake – Fluffy

Less sugar – Roll – Dense

The sugar in a recipe contributes to browning of food. This reaction is called the **Maillard reaction** and is the result of sugar reacting with the protein in the food.

A Sweet Part of a Balanced Diet! (p18)

How many total sugars are in one serving of this yogurt? 11 grams

How many added sugars are in one serving of this yogurt? 7 grams

If 10 grams of added sugars = 20% daily value, how many grams of added sugars = 100% daily value?
50 grams

One Sweet History...

In Spanish they call it “azucar.” “Sucre” is the French word for it, while Germans say “zucker.” It’s called many things in many places, but as long as it’s been around, and it’s been a while, Americans have always called it “sugar.”

Real sugar comes from sugar beet and sugar cane plants. Sugar is one of the world’s oldest documented **commodities**, and at one time it was so valuable that people locked it up in what was called a sugar safe.

SUGAR’S OLD AND ILLUSTRIOUS TIMELINE

8000 BCE While chewing sugar cane for its sweet taste was likely done in prehistory, the first indications of **domestication** of sugar cane were in Papua New Guinea. In the beginning, sugar cane was valued for the sweet syrup it produced. As people migrated to different parts of the world, the good news spread, and eventually, sugar cane plants were found in Southeast Asia, India and Polynesia.



500 BCE A new form of sugar was discovered – sugar crystals! The major breakthrough in ancient **technology** occurred in India, when sugar cane juice was boiled until crystals developed.

325 BCE “Honey without bees?” Could this be true? This is how sugar was first described to Alexander the Great. As his empire spread across Asia and into Africa and Europe, so did the **cultivation** of sugar cane.



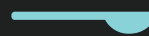
Like honey, sugar is a naturally occurring sweetener, and they have around the same calories per teaspoon – sugar has 15 and honey has 20.

200 BCE A Chinese emperor heard about India’s secret for manufacturing sugar, and he sent his **emissary** there to learn about this sweet sensation. Sugar cane was planting roots around the world.



1493 Christopher Columbus is credited with introducing sugar cane to the New World, but that was old news in places like Southeast Asia where sugar had already been making life sweeter for over 8,000 years.

1500 Sugar is a scarce luxury in Europe at this time. One teaspoon of sugar cost as much as \$5.00!



Today a teaspoon of sugar costs about one half of one cent (\$0.005).

1747 A new source for sugar was found. As luck would have it, a German scientist named Andreas Marggraf discovered that sugar crystals could be extracted from the sugar beets used to feed cows.



1751 Closer to home, Americans first planted sugar cane in Louisiana, and another U.S. industry was born.

1800 Sugar beets proved to be an **indispensable** resource during the war between France and England when the English stopped the flow of sugar to Europe. By 1811, the French emperor, Napoleon, issued a decree forcing peasant farmers to plant sugar beets. Two years later, France produced 35,000 tons of sugar in over 340 factories.

1838 The first U.S. sugar beet factory was built by David Lee Child in Northampton, Massachusetts.

GLOSSARY

commodity – *n.* a raw material or primary agricultural product that can be bought and sold

cultivation – *n.* the use of land for growing plants

domestication – *n.* the cultivation of a plant for food

emissary – *n.* a person who is sent on a mission as a representative for someone else

indispensable – *adj.* absolutely necessary

technology – *n.* the use of scientific knowledge to make work easier



SUGAR CANE



SUGAR BEETS

Sugar's Journey to U.S. Cultivation



In the 1500s a teaspoon of sugar cost \$5.00. Today a teaspoon of sugar costs about one half of one cent (\$0.005)!

Answer this question and you may be surprised at how much things have changed.

If you put 2 teaspoons of sugar in your oatmeal every day for a year in the 1500s, at \$5.00 per teaspoon how much would you spend in that year?

\$ _____



One Sweet History

Where Does Sugar Come From?

MAP
IT OUT!

Have you ever thought about where sugar comes from? If you think it comes from the grocery store, you're right, but before it's on the grocery shelves, it's in plants that are grown on farms across the United States.

U.S. farmers produce a lot of sugar (the sixth largest **yield** in the world), but many other countries produce real sugar, too. The largest producers of sugar from sugar beets are the European Union, Russia, U.S. and Turkey. The countries that produce the most sugar from sugar cane are Brazil, India, Thailand and China.

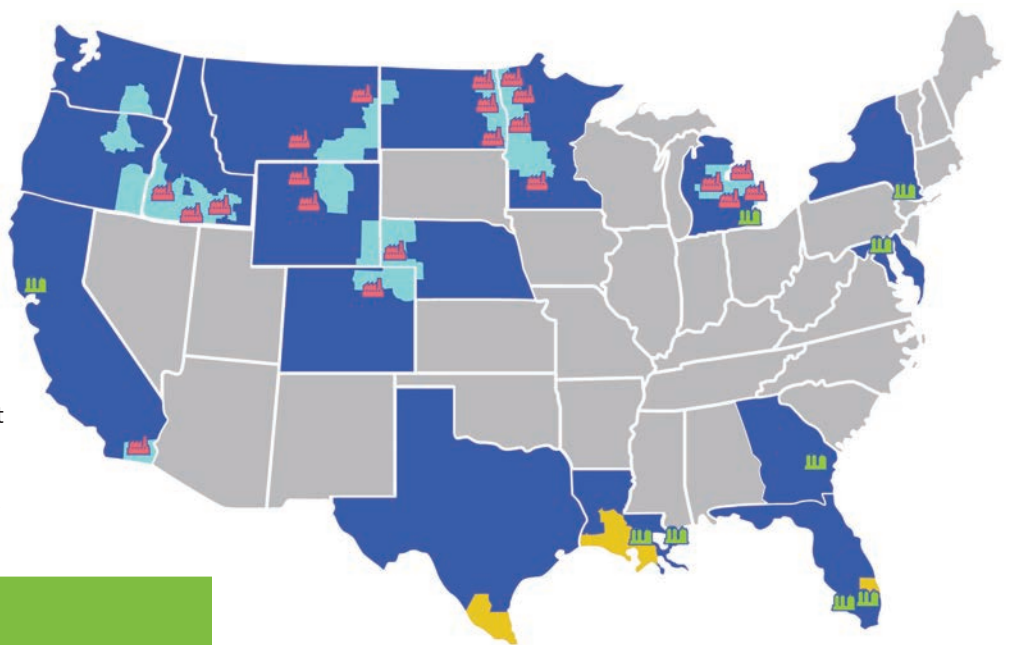
In the U.S., sugar beets and sugar cane are grown in 14 states. Our **diverse** climate allows sugar farmers to grow sugar cane in some regions, while other areas provide the perfect conditions for growing sugar beets.

Sugar beets are a root crop, and they typically flourish in places where the temperatures are generally cooler. Farmers in Colorado, Idaho, Michigan, Minnesota, Montana, Nebraska, North Dakota, Oregon, Washington and Wyoming plant the seeds when things are warming up in the spring and harvest the **mature** sugar beets in the fall, before the temperatures drop too low. In California, sugar beets are grown over the mild winter and harvested in the spring.

Sugar cane, on the other hand, is a tropical grass and is grown around the world in a region near the equator known as the tropical belt. A tropical climate is warm and has year-round **temperate** weather. The temperatures rarely dip below freezing. Three states in the U.S. grow sugar cane: Florida, Louisiana and Texas. Additionally, raw sugar (both domestic and imported) is refined in California, Florida, Louisiana, Georgia, Maryland, Michigan and New York.



The next time you see the sugar in your pantry, you may wonder, “cane or beet?” Regardless of the kind of plant or where it was grown, you can be sure it is the same as the real sugar that has been safely consumed by people all over the world for thousands of years.



GLOSSARY

diverse – *adj.* of several or many kinds; different
mature – *adj.* fully grown or developed
temperate – *adj.* having a climate that is not too hot or too cold
yield – *n.* an amount produced

 **sugar beet factory**  **sugar cane refinery**
 **sugar beet growth**  **sugar cane growth**

For more information about crops and climate, go to <https://www.usda.gov/topics/farming/crop-production>

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Create a colorful and informative visual aid to accompany any report or project by labeling the states where sugar cane and sugar beets grow. Choose the colors you will use for your map, and don't forget to include them in your map key.



MAP KEY



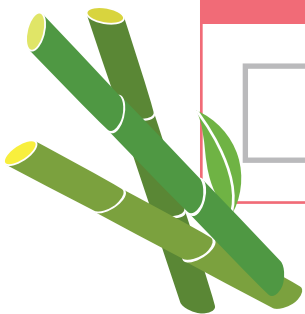
sugar beet
growing states



sugar cane
growing states



non-sugar
growing states



Sugar: Captured Sunshine

You've probably heard of solar energy, but have you ever heard of sugar energy? Well, guess what? That's what sugar is – pure and simple – it's the plant's energy!

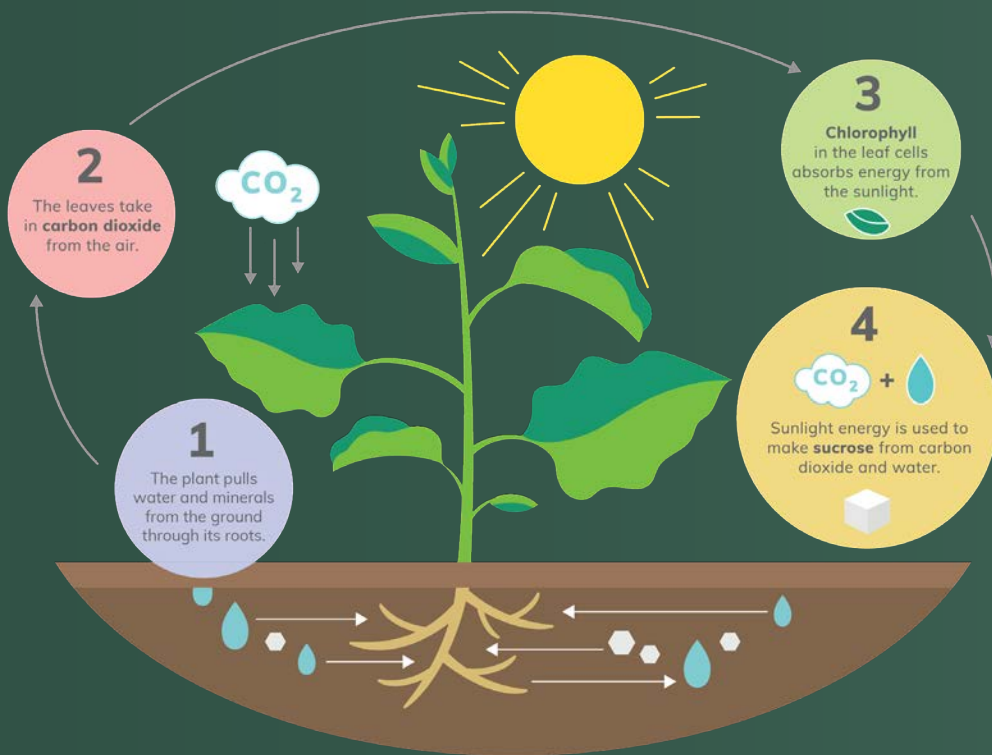
All green plants make sugar through photosynthesis. Photosynthesis is the process plants use to transform the sun's energy into sugar, their stored food and energy supply.

The recipe is pretty easy and contains just four natural ingredients:

- **carbon dioxide**
- soil
- sunshine
- water

This powerful combination is all green plants need to make sugar (or **sucrose**, sugar's molecular name).

PHOTOSYNTHESIS



Sugar exists naturally in almost every fruit and vegetable, but two special plants are packed full of sugar. Sugar occurs in the greatest quantities in sugar cane and sugar beets.



Sugar Beet

A sugar beet is a root crop and grows underground, protected by the soil. The sucrose that is created by the plant is stored in its root. The beet stays in the ground until it matures and weighs 3-5 pounds. A mature beet contains about 16% sucrose.



Sugar Cane

Sugar cane is a tropical grass that grows 10-20 feet high. The sucrose produced through photosynthesis is stored in the thick stalks or canes. A stalk of sugar cane contains around 14% sucrose.

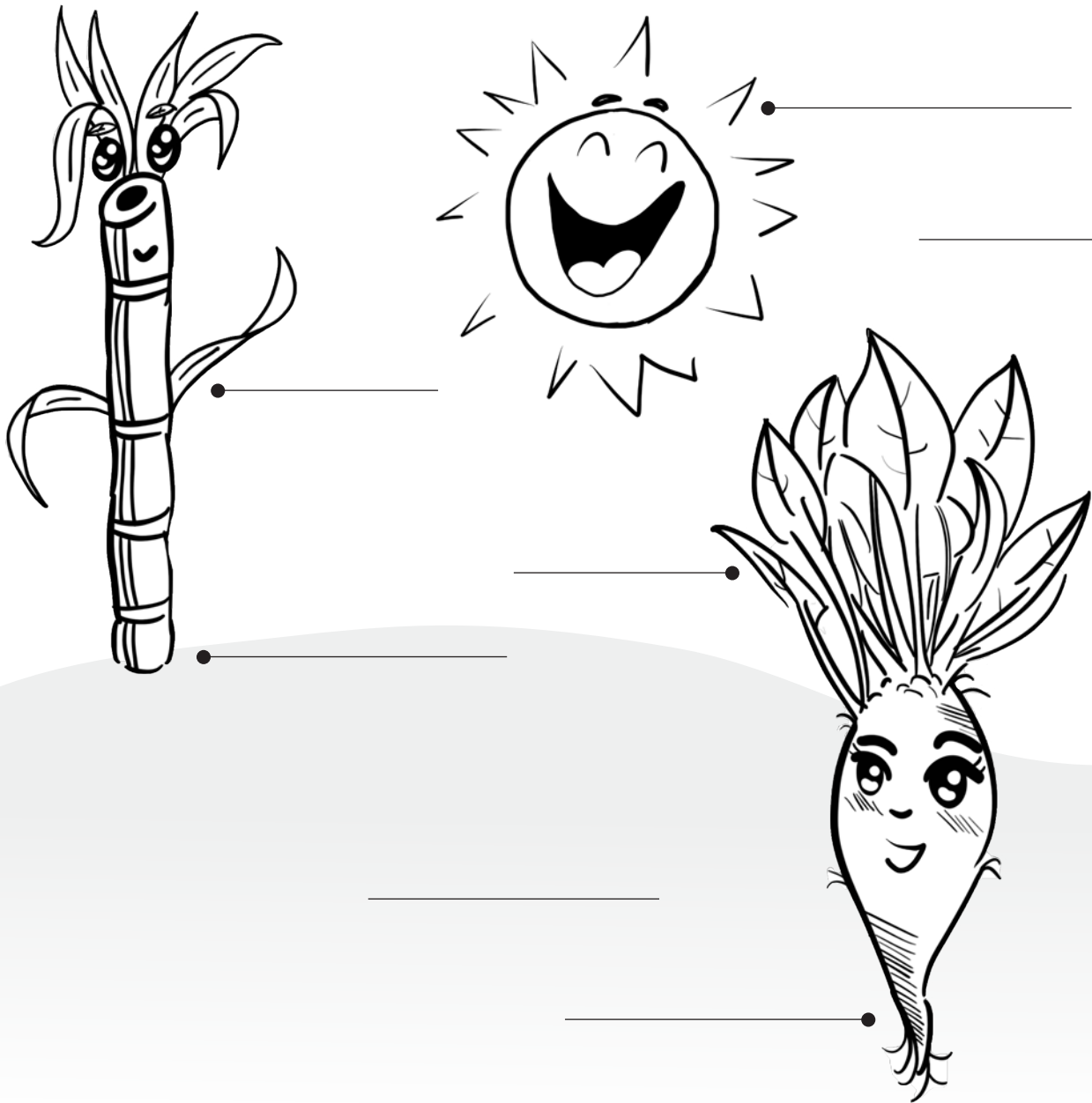
GLOSSARY

carbon dioxide – *n.* a natural, colorless, odorless gas

chlorophyll – *n.* a green substance in the leaves of plants which helps plants make sugar from elements in air and water

sucrose – *n.* a compound which is the chief component of beet and cane sugar.

Complete this diagram to help you identify and remember the parts of the sugar beet and sugar cane plants. Use the key below to color different parts of the plants as indicated. Use the word bank to fill in the blanks.



Color Key

YELLOW	Where plants get energy.	BROWN	Where plants get water and minerals.
GREEN	Where chlorophyll is located.	TAN	Where sugar is stored in plants.
LIGHT BLUE	Where plants get carbon dioxide.		

Word Bank

One of these words can be used twice.

- Sun
- Air
- Leaves
- Stalk
- Soil
- Root bulb



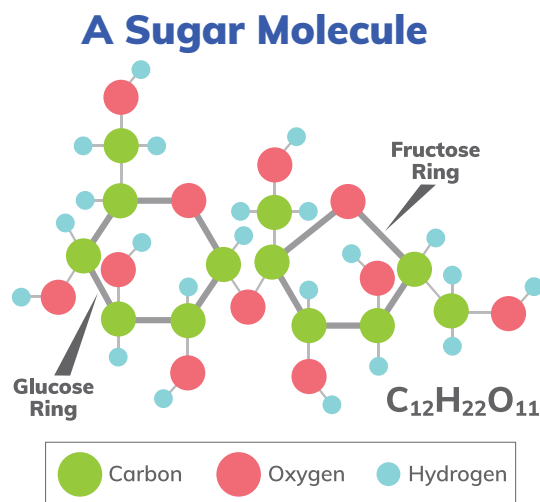
A Closer Look at Sugar

<<< Sugar crystals under a microscope



Is that some sort of secret code? There's really no mystery. It's simply the scientific code for a sugar **molecule**, the most **abundant**, pure, **organic** substance in the world.

Sugar, or sucrose, is a naturally occurring crystalline **carbohydrate**. Carbohydrates are the foundation of our food chain. They are the chief form in which plants store energy. The energy we get from eating carrots, broccoli, apples, bananas or potatoes comes from the carbohydrates the plant has stored in its roots, seeds, leaves, stems or fruit. When sugar is **refined**, it is simply extracted from the plant and remains in its natural form. The sugar in your pantry is identical to the sugar that's still found intact when you bite into fruits and vegetables.



Sucrose is made from a combination of carbon, hydrogen and oxygen **atoms**. The right combination of these atoms makes glucose and fructose, the two molecules bound together by Mother Nature to make sucrose.

While you can't see a carbohydrate, you can see a sugar **crystal**. A sugar crystal is made from thousands of sugar molecules bonded together. It's what you see when you look at a granule of sugar.

GLOSSARY

abundant – *adj.* in great amounts; plentiful
atom – *n.* the smallest unit of a chemical element
carbohydrate – *n.* a substance, such as sugar, made up of carbon, hydrogen and oxygen. Carbohydrates are made by green plants.
crystal – *n.* a solid substance with sides and angles that naturally form a regular pattern

molecule – *n.* the smallest particle into which a substance can be divided and still remain the same substance
organic – *adj.* of or coming from living things
refined – *adj.* free of impurities; purified

Making Sugar Crystals

Suggested for middle school students with supervision

Materials you'll need:

- 1 piece of cotton string
- 1 pencil or stick
- 1 paper clip
- 1 glass jar
- sauce pan
- measuring cup
- 1 cup water
- 2 cups sugar
- additional sugar (amount will vary)



Tie a short piece of cotton string to the middle of a pencil or stick. Attach the paper clip to the loose end of the string for a weight. Next, moisten the string slightly and roll it in a bit of sugar. Lay the pencil across the top of the jar with the string hanging down inside.

In a sauce pan, heat the water and dissolve 2 cups of sugar in it. Let it cool. Heat the sugar-water solution a second time and dissolve as much of the additional sugar as you can.

Pour the solution into the prepared jar and leave it undisturbed for a couple of days. You should start seeing crystals grow as the water evaporates.

Molecular Formula

In the “secret code” that represents sugar there are three letters. Below, match each of those letters to the correct element and the number of each in one molecule of sugar.

C

Hydrogen

11

H

Oxygen

12

O

Carbon

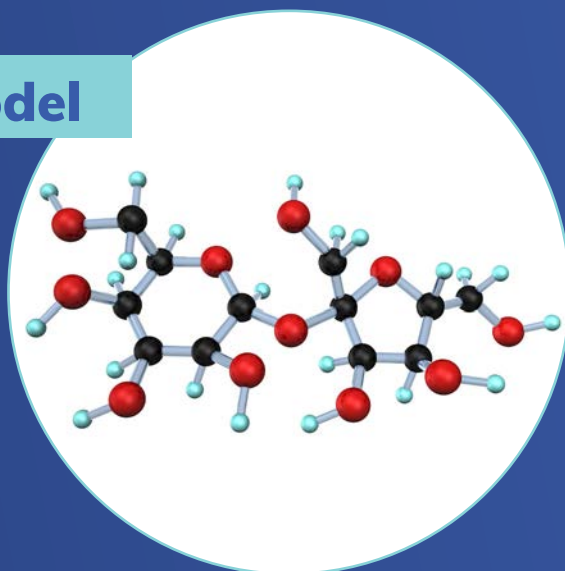
22

Molecule Model

Suggested for high school students

To make a sugar molecule come to life, construct a 3-dimensional model. What a cool science project!

Use the picture to the right as your guide.



Materials you'll need:

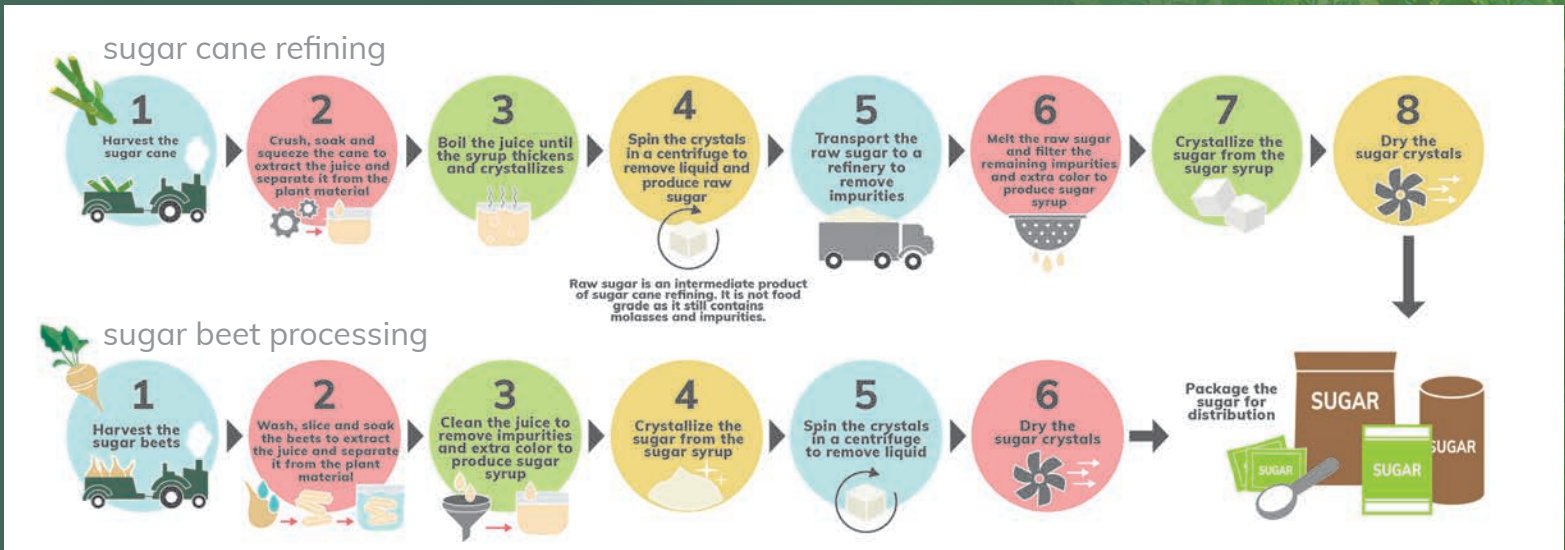
- Styrofoam balls or gumdrops – 3 colors
- 45 toothpicks

Hint:

Remember – use one color for each element: carbon, hydrogen and oxygen.

From the Field to the Table

Real sugar comes from sugar beets and sugar cane plants grown on a farm, but how does it get from the field to your pantry? Fortunately, nature has taken care of making the sugar; the beets and cane do that through photosynthesis. We just have to **extract** and **purify** the sugar (sucrose) from the plants. The purification process is similar for each plant, and the result is the same pure sucrose. One difference in processing between the two plants is that sugar beets are processed at a single facility (a sugar beet factory) and sugar cane is refined at two facilities (the process starts at a raw sugar factory and finishes at a refinery).



SUGAR BEET PROCESSING

From the field, sugar beets are delivered to sugar beet processing facilities located near the farms. The beets are cleaned and sliced into thin strips called cossettes (they look a bit like French fries). The cossettes are washed in hot water and this water **absorbs** the sugar, creating a sugar juice. This juice contains the sugar that will eventually find its way to your kitchen pantry. After the sugar juice is drawn off, the beet pulp is left behind. The juice is cleaned to remove the non-sugar particles (like any leftover plant materials) by carbonation and **filtration**. The filtered juice is boiled to evaporate the water and form a thick syrup, something like pancake syrup. Workers repeat this process to ensure that the syrup is pure. Again, the syrup is boiled, and this is when sugar crystals begin to form. The sugar crystals are spun in a centrifuge, a machine that works like the spin cycle on your washing machine, to remove the syrup. As it spins faster and faster, the liquid spins off and leaves the naturally colorless sugar crystals. After one more hot bath, the sugar crystals are dried and then packaged. The next stop is the grocery store shelf.

CO-PRODUCTS OF SUGAR PROCESSING

BEET PULP is a co-product of sugar beet processing. It is processed separately into pellets for livestock feed and other products.

SUGAR BEET MOLASSES is another co-product and can be used to remove or prevent icing of roads during the winter.

BAGASSE is a co-product of sugar cane refining and can be turned into paper, cardboard and cutlery among other uses. It can also be burned to provide heat and electricity to the factory.

CANE MOLASSES is what makes brown sugar brown. It is also used in the baking and brewing industries. (You can find a little more information on molasses on page 16.)

SUGAR CANE REFINING

After it's harvested, the sugar cane goes to a raw sugar factory located near the field, where the raw sugar is separated from the plant before it is shipped to the refinery. At the raw sugar factory, the sugar cane stalks are washed and cut into shreds by rotating knives. Next, huge rollers crush the juice out of the shredded **pulp**. The leftover pulp is called bagasse. The sugar juice is purified by carbonation and filtration. Carbonation removes non-sugar plant material like wax, fats and gums naturally present in all plant cells.

(Continued on back)

The juice is then boiled to remove the water through **evaporation**. This leaves behind a clear, golden syrup. As the water evaporates from the syrup, sugar crystals begin to form. These crystals are spun in a centrifuge, which leaves behind golden, raw sugar.

The raw sugar is transported to a sugar cane refinery where it is washed to remove the brown molasses that naturally surrounds the sugar. The washing **transforms** the crystals back into syrup. After the molasses is removed, the clear syrup is boiled to remove some of the water by evaporation. This thick syrup is then evaporated a second time and sugar crystals are formed. The sugar crystals are spun in a centrifuge again to remove the excess syrup. Then the sugar is dried and packaged. By the time the sugar leaves the refinery, it is ready for the table.



GLOSSARY

absorb – *v.* to take in or soak up

evaporation – *n.* the process of changing from a liquid into a vapor or gas

extract – *v.* to take or pull out

filter – *v.* to pass through a device that cleans unwanted matter from air or liquid

pulp – *n.* the soft, juicy part of fruits and certain vegetables

purify – *v.* to make pure; to clean out unwanted materials

transform – *v.* to change in form, nature, function or appearance

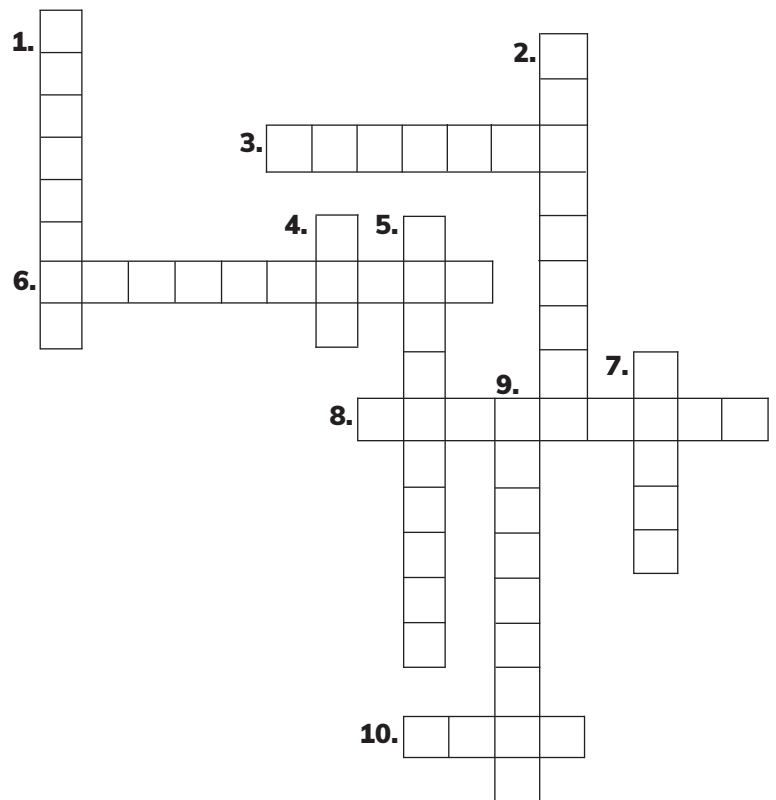
Complete this crossword puzzle, and you've processed a lot of sweet information.

DOWN

- 1) The sugar juice is _____ then boiled.
- 2) Thin strips of sugar beets
- 4) _____ sugar factories are located near sugar cane fields.
- 5) Works like the spin cycle in a washing machine
- 6) Sugar crystals are naturally _____-less.
- 9) Sugar is _____ occurring.

ACROSS

- 3) Hot water _____ the sugar.
- 6) _____ water has changed from a liquid to a gas.
- 8) To change very much in form, nature, function or appearance
- 10) Soft, juicy part of a fruit or vegetable



It's Sweet to the Environment

Sugar is a gift from nature. The sugar industry, as a responsible **caretaker**, gives back to the environment as much as it can. Sugar farmers, processors, refiners and scientists are respectful of sugar's value and do all that is possible to **utilize** this gift in responsible ways.

Once they leave the field, sugar beet and sugar cane plants are headed for great things. Not only do they provide the sugar we eat, but the parts of the plants that are not used for sugar have important jobs, too. They're not just thrown away.

Would you believe some parts of these plants help power the factories that purify sugar? A fibrous substance called bagasse is one of the **co-products** of sugar cane refining. Bagasse is often burned as fuel to power the processing facilities and can be used to produce electricity for nearby towns! It has also been used to make compostable plates and take out containers.

Cows, horses and other livestock get their energy from sugar beet plants, too. The tops of the plants make nutritious animal **fodder**, and the **residue** from the beet pulp is used in livestock feed. When it's further processed, it can be used as fiber or in other products.



Speaking of other products, molasses (which comes



from the sugar purification process) is used in hundreds of goods. Many of them might be in your home right now! If you like gingerbread, you probably like too since it's one of the key ingredients. Bakers, pharmaceutical companies, distillers and other food processors use this flavorful syrup in many of their products. Some people even use it as syrup on their pancakes! Ask your favorite baker; they probably use it too!

The men and women working in the factories appreciate the value of these plants and help make sure that little is wasted in sugar processing and refining. Even professionals working outside of the factories and refineries "think green." Scientists have been experimenting with sugar for years. They have discovered many products that can be made better by using sugar. But, you may wonder, how does this help the environment? Good question.

The use of **renewable** materials is environmentally responsible. Researchers have discovered a **biodegradable** plastic made from sugar beet pulp that is an environmentally friendly product and helps reduce solid waste.

(Continued on back)

GLOSSARY

- biodegradable** – *adj.* capable of being broken down by bacteria or other living organisms
- caretaker** – *n.* one that takes care of the house or land for an owner
- compostable** – *adj.* can be broken down into nutrient-rich material at a rate similar to paper
- co-products** – *n.* something produced in addition to the main product
- fodder** – *n.* dry food used for animal food; feed
- renewable** – *adj.* capable of being replaced by natural ecological cycles
- residue** – *n.* the part left after something is removed; remainder
- utilize** – *v.* to make use of

For thousands of years, sugar has been an important ingredient for people all over the world.


Sugar:


More Than Just Sweet Taste!


Have you been surprised to find sugar in foods that don't necessarily taste sweet? There's a reason for that. You may not know it, but there's a lot of chemistry that takes place when ingredients in a recipe are put together. Sugar plays an **essential** functional role in the way foods look, last and, let's not forget, taste!


Sugar is made of carbon, hydrogen and oxygen atoms. Its molecular structure ($C_{12}H_{22}O_{11}$) makes it easy to **bond** with other molecules. It is also hygroscopic (absorbs moisture), which makes sugar an efficient natural preservative.


What Are Sugar's Amazing Powers in Cooking and Baking?


 Sugar grabs the available water in foods. This is important because bacteria grow in moist environments. By soaking up the water, sugar acts as a preservative, which prevents the growth of **microorganisms** that can spoil food. This is true for many products such as jams and jellies and even breakfast cereals, breads and other baked goods.


 Sugar reacts with the protein in foods causing the food to become brown when heated, like the crust of bread. The more sugar a food contains, the more brown it will become. The scientific name for this change is the Maillard reaction.


 Sugar can also brown foods through a process called caramelization. When the sugar is heated, it breaks down and caramelizes. If you heat white table sugar in a pan, it will turn into a beautiful caramel sauce.


 Bread is made with baker's yeast, which feeds on sugar. When the yeast **consumes** the sugar, it releases a gas called carbon dioxide. This gas is what makes the dough rise.


 Sugar absorbs water and inhibits flour gluten development, providing the proper texture in baked goods. A little sugar = dense texture like in a roll; a lot of sugar = fluffy texture like in a cake.

 Sugar contributes to **texture**. The air pockets formed when you beat together butter or shortening with sugar give cookies a crumbly structure. Sugar absorbs the moisture from other ingredients when baking making cookies crisp.

 Sugar helps to retain moisture to extend baked goods' **shelf life**.

 Sugar balances sour, bitter and spicy flavors in spaghetti and barbeque sauces and the dressing you put on your salad.















 Ice cream is creamy because sugar lowers its freezing point, slowing down the freezing process and preventing the formation of ice crystals. This creates a smooth, creamy **consistency** that's easy to scoop.

 Vegetables have that fresh-from-the-garden taste when a little sugar is added. Sugar naturally **enhances** flavors and helps strengthen fiber and cell structure in fruits and vegetables during cooking.

For more information on baking science, go to www.homebaking.org

Now you know that sweetening foods is only one of sugar's amazing powers! Its unique **versatility** makes sugar an essential functional ingredient in many of the foods we eat. They taste better, look more appealing and last longer. Below is a summary of all the different roles sugar plays in various food and beverage categories.

Sugar's Functional Roles in Food Beyond Sweetness

	FLAVOR ENHANCER/BALANCER, AROMA	BULK	TEXTURE/MOUTHFEEL	SHELF-LIFE/MICROBIAL STABILITY	FERMENTATION	FREEZING POINT DEPRESSION	COLOR	MOISTURE RETENTION
Dairy Products 	●	●	●		●			
Whole-Grain, Fiber-Rich Breads & Cereals 	●	●	●	●	●		●	●
Breads 	●	●	●	●	●		●	●
Bakery Products 	●	●	●	●			●	●
Salad Dressings, Rubs and Sauces 	●	●	●	●				
Preserves & Pickling 	●	●	●	●				
Jams & Jellies 	●	●	●	●			●	
Canned Fruits & Vegetables 	●	●	●	●			●	
Prepared Foods 	●	●	●	●			●	●
Beverages 	●	●	●	●				
Frozen Beverages 	●	●	●			●		
Fermented Beverages 	●	●	●		●			
Ice Cream 	●	●	●			●		
Confectionery 	●	●	●	●			●	●

GLOSSARY

- bond** – *v.* to stick together
- consistency** – *n.* the degree of how stiff, thick or firm something is
- consume** – *v.* to use up
- enhance** – *v.* to make greater; improve
- essential** – *adj.* very important, vital
- microorganisms** – *n.* an organism that can be seen only through a microscope
- shelf life** – *n.* the period of time a food stays fresh
- texture** – *n.* the look or feel of something
- versatility** – *n.* the ability to do many things well

QUIZ TIME!

1 Which category of foods or beverages uses the most functions of sugar?

(Hint: there may be a tie.)

We learned that sugar can contribute to the texture of foods, and different amounts of sugar can produce different textures. **Match the following amounts of sugar with the types of bakery product and the resulting texture.**

MORE SUGAR	CAKE	DENSE
LESS SUGAR	ROLL	FLUFFY

3 The sugar in a recipe contributes to browning of food. This reaction is called the reaction and is the result of sugar reacting with the in the food.



Types of Sugar

All sugar is made by first extracting sugar juice from sugar beet and sugar cane plants, and from there many types of sugar can be produced. Through slight adjustments in the process of cleaning, crystallizing, spinning and drying the sugar and varying the level of molasses, different sugar varieties are possible. Sugar of varying crystal sizes produces unique functional characteristics that make the sugar suitable for different foods and beverages. Sugar color is primarily determined by the amount of molasses remaining on or added to the crystals, giving pleasurable flavors and altering moisture. Heating sugar also changes the color and flavor (yum, caramell!).

Let's look at a few of the types of sugar we use most. They can be divided into two categories, white sugars and brown sugars.

WHITE SUGARS

(contain little or no molasses)

Granulated Sugar

- Granulated sugar, or table sugar, is the white sugar you typically find in your sugar bowl.
- It is the most common sugar called for in recipes with cooking and baking.
- These sugar crystals are formed during the purification process when the molasses surrounding the sugar crystals is removed.
- The “regular” sized granules are fine because they are ideal for bulk handling and not susceptible to caking or sticking together.

Powdered Sugar

- Powdered or confectioners sugar is simply granulated sugar ground to a smooth powder, mixed with a small amount of cornstarch to prevent caking and then sifted. The granule size is much smaller than table sugar.
- It is often used in icings, confections and whipped cream.

BROWN SUGARS

(contain varying levels of molasses)

Light and Dark Brown Sugar

- Brown sugars are made by mixing white sugar with various amounts of molasses. More molasses = darker color and stronger molasses flavor.
- Light brown sugar is commonly used in baking.
- Dark brown sugar is used in gingerbread, baked beans and other full-flavored foods.
- Brown sugars tend to clump because they contain more moisture than white sugars because of the molasses. This allows baked goods to retain moisture well and stay chewy.

Turbinado Sugar

- Turbinado sugar, sometimes known as Demerara sugar or raw cane sugar, is a partially processed sugar that retains more of the naturally present molasses.
- It has a light brown/tan color, mild brown sugar flavor and larger crystals than brown sugar used in baking.
- Turbinado sugar is the sugar in your packet of “raw cane sugar.” This type of sugar has been processed just enough to make it safe to eat.



What Is Molasses?

- Molasses is a co-product of sugar refining. During the refining process, it is separated from the raw sugar by spinning the sugar in a centrifuge. The first spin produces light molasses, while later spins produce darker molasses. Molasses is not as sweet as sugar but is used in many recipes for its rich flavor and it is what makes brown sugar brown!
- Molasses is naturally occurring in both sugar beets and sugar cane but they have different flavors and consistencies and are not used interchangeably. Sugar cane molasses is what we use in the food supply.

Here are some pretty cool activities you can do in the kitchen, whether as an experiment or if you are in a pinch when baking! Be sure to have an adult help you. Your friends and family will be impressed with all the things you know about sugar!



Make Your Own Brown Sugar

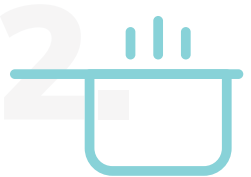
This would be a fun demonstration!

Brown Sugar Recipe:

1 cup white, granulated sugar
1 tablespoon molasses

Directions:

Pour the sugar into a food processor or blender. Add the molasses. Blend until the molasses coats the sugar. Ta da!



Create Your Own Caramelized Sugar

This is why our cooked foods turn that yummy, golden brown color. Mmmm...

Caramelized Sugar Recipe:

½ cup sugar
2 tablespoons water

Directions:

Cook in a small pan over medium heat, stirring constantly, until the mixture melts and begins to turn brown. It can turn into a dark brown color quickly, so be careful! Remove from heat and let cool.



Make Your Own Powdered Sugar

For when you just don't have enough for the frosting on that birthday cake!

Powdered Sugar Recipe:

1 cup sugar
1 tablespoon cornstarch

Directions:

Pour the sugar and cornstarch into a food processor or blender. Blend until very fine to get 1 cup of powdered sugar.

A Sweet Part of a Balanced Diet!

You've probably heard how important it is for you to eat a nutritious, balanced diet. Did you know that sugar can make a healthy diet more **palatable**?

Sugar Is a Carbohydrate

Carbohydrates, along with fat and protein, are **macronutrients** that provide your body with energy. Carbohydrates are found in all plant and dairy foods and beverages that provide your body with calories. Carbohydrates are the preferred source of energy for the body because the majority contain glucose. Glucose is the fuel your brain, organs and muscles need to function and engage in everyday activities.

According to the 2015-2020 Dietary Guidelines for Americans, a healthy diet includes up to 10% of calories from added sugars, allowing room for sugars in nutritious foods and occasional sweets and treats.

A calorie is a measure of energy in food. Carbohydrates and proteins supply your body with 4 calories per gram, while fats provide you with 9 calories per **gram**. A teaspoon of sugar has 15 calories.

All About Balance

If you eat more calories than you **expend**, no matter if the calories come from carbohydrates, proteins or fats, the excess energy is stored as added weight on your body. That's why it's important to balance the food you eat with regular physical activity. And, it's important to remember that foods and beverages that don't provide significant nutritional value (vitamins and minerals) should not be the centerpiece of your diet but consumed as treats.

Sugar, extracted from sugar beet or sugar cane or in fruits and vegetables you bite into, has been incorporated in the diets of people throughout all of time. Like many other foods and ingredients, sugars have been the subject of countless studies. And while new research will help us better understand how our food choices affect our health, the evidence consistently shows that a balanced lifestyle based on moderation, a variety of food choices and physical activity tends to lead to the best outcomes when compared to simply focusing on cutting out or adding one ingredient or another.

Simply put: by practicing **moderation** and portion control, there is room to include an appropriate amount of sugar in a healthful lifestyle.

Remember, making sure that fruits, vegetables, whole grains and other fiber and calcium-rich foods are the centerpiece of your diet is most important. Sugar makes many of these healthful foods more palatable, which helps contribute to intakes of important vitamins, minerals and fiber. Getting ready for breakfast? Go ahead, sprinkle a little brown sugar on that bowl of nutritious oatmeal. Sugar can make healthy foods taste better so you are more likely to eat them.

GLOSSARY

expend – *v.* to burn up or use up

gram – *n.* a unit of weight measurement. A gram weighs about as much as a small paper clip.

macronutrient – *n.* a nutrient (a carbohydrate, protein or fat) that is present in large quantities in foods

moderation – *n.* the avoidance of excess or extremes, especially in one's behavior

palatable – *adj.* pleasant to taste, acceptable or satisfactory



How Can I Tell How Much Sugar Is In My Food?

Using the Nutrition Facts Label

The goal of the Nutrition Facts Label is to provide you with access to the information you need to make informed decisions about the foods you eat. However, all that information can be confusing! Understanding and knowing how to use the numbers on the label is the only way the information can actually inform your food choices. It is important to look at how each food and beverage fits into an entire day's intake and not just focus on the Nutrition Facts Label of one product. It's also helpful to examine the entire nutrient package of a product and consider how it fits in your total daily diet instead of focusing on one nutrient.

When it comes to sugar, there are some definitions you need to know to be able to use the information on the label. See if you can answer the questions by using the Nutrition Facts Label for strawberry yogurt:

Nutrition Facts	
1 serving per container	
Serving size 1 container (150g)	
Amount Per Serving	
Calories	130
% Daily Value*	
Total Fat 2.5g	3%
Saturated Fat 1.5g	8%
Trans Fat 0g	
Cholesterol 15mg	5%
Sodium 45mg	2%
Total Carbohydrate 15g	5%
Dietary Fiber 0g	0%
Total Sugars 11g	
Includes 7g Added Sugars	14%
Protein 12g	24%
Vitamin D 0% · Calcium 15% · Iron 0% · Potassium 6%	

INGREDIENTS: CULTURED PASTEURIZED GRADE A LOW FAT MILK, WATER, SUGAR, STRAWBERRIES, CORN STARCH, LEMON JUICE CONCENTRATE, NATURAL FLAVOR, VEGETABLE JUICE COLOR, CAROB BEAN GUM
CONTAINS: MILK.

Total Sugars

This number includes the total of both naturally occurring sugars and sugars added for sweetening or other functional purposes. For example, in strawberry yogurt the naturally occurring sugars come from both the milk and the strawberries, and the added sugars come from the sugar added to balance and enhance flavors.



How many total sugars are in one serving of this yogurt?

Added Sugars

Added sugars are listed to help you know how much you are consuming. The 2015-2020 Dietary Guidelines for Americans recommend limiting added sugars to no more than 10% of calories per day from added sugars. That is because it may be difficult to get the nutrients you need for good health while staying within calorie limits if you consume more than 10% of your total daily calories from added sugars.



How many added sugars are in one serving of this yogurt?

Added sugars refers to a category that includes a variety of caloric sweeteners, including sugar and many other sweeteners that are classified as sugars. Added sugars do not include low- and non-caloric sweeteners; those are only found on the ingredient list.

Percent Daily Value

Shown as a general rule, the percent daily value tells you how much a nutrient in a serving of food contributes to a daily diet, based on a target of 2,000 calories per day.



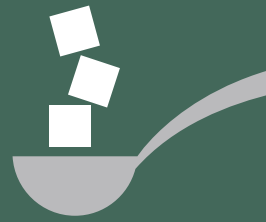
If 10 grams of added sugars = 20% daily value, how many grams of added sugars = 100% daily value?

Ingredient List

While not technically a part of the Nutrition Facts Label, ingredients are listed in descending order by weight on the back (or side) panel of packaged goods.

How Much Sugar Are We Consuming?

Since 2000, added sugars intake in the United States has decreased by nearly 25%, from 21 teaspoon equivalents per day to 16.1 teaspoon equivalents per day.



Intake data for total added sugars is a combination of the intakes of all caloric sweeteners, including sugar (sucrose from sugar beets and sugar cane), high-fructose corn syrup (HFCS), honey, maple syrup and others.

In 2016, added sugars was reported to be about 12.6% of total calories, just slightly above the 2015-2020 Dietary Guidelines for Americans recommendation of 10% of calories from added sugars per day.

PERCENT OF CALORIES FROM ADDED SUGARS

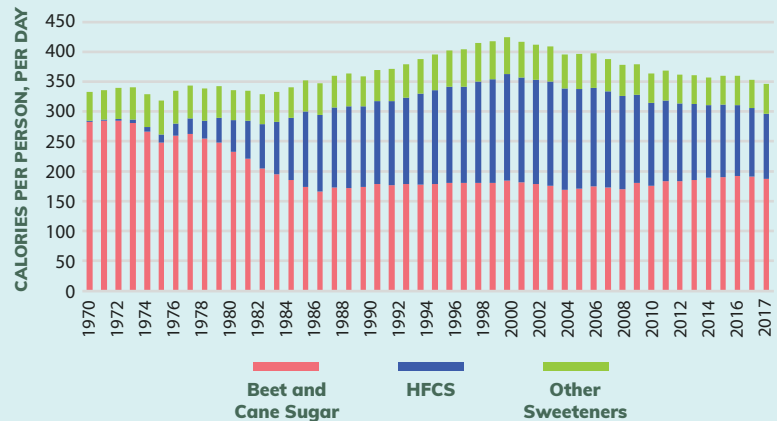
YEAR	% OF CALORIES FROM ADDED SUGAR
1999-2000	18.1
2001-2002	17.1
2003-2004	15.9
2005-2006	14.5
2007-2008	14.6
2009-2010	13.9
2011-2012	14.1
2013-2014	13.4
2015-2016	12.6

A LITTLE HISTORY

In the 1990s, added sugars consumption increased sharply as soda consumption increased and manufacturers raced to change their recipes and develop new products during the “low-fat era.” Removing fat from a product requires replacing it with something. The same is true of removing sugar. Data has shown that the seesaw effect of focusing on removing or decreasing one nutrient only leads to **overcompensation** with another, whether sugar for fat or **vice versa**.

As long as dietary data have been collected, added sugars intake has never been below 10%.

CONSUMPTION OF CALORIC SWEETENERS IN THE UNITED STATES, 1970-2017



GLOSSARY

estimating – *v.* roughly calculate or judge the value, number or quantity

overcompensation – *n.* try too hard to correct a real or imagined problem, and therefore produce a new difficulty or lack of balance

proxy – *n.* a figure that can be used to represent the value of something

survey – *v.* investigate the behaviors or opinions of a group of people by asking them questions

vice versa – *adv.* the other way around

WHERE DO THESE NUMBERS COME FROM?

What We Eat in America (WWEIA) captures U.S. dietary intake as a part of the National Health and Nutrition Examination Survey (NHANES). This **survey** is conducted every 2 years in partnership with the United States Department of Agriculture (USDA) and Health and Human Services (HHS) to assess the health and nutritional status of Americans.

Loss-Adjusted Food Availability is another **proxy** for **estimating** intake. This number is calculated using food and nutrition availability for consumption and considers estimated loss or waste. The downward trend in availability of caloric sweeteners mirrors the NHANES consumption estimates.

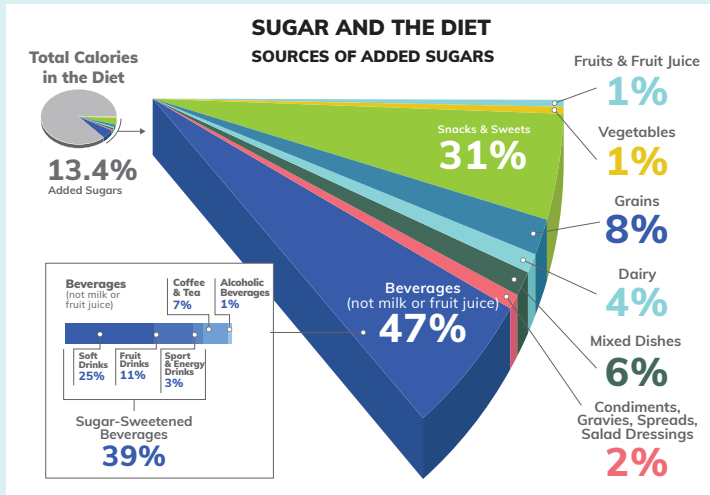


Where Do We Get Our Added Sugars?

Added sugars are found in a variety of foods and beverages for different reasons. Real sugar from sugar beets and sugar cane is often added for functions beyond sweetness.

Calorically sweetened beverages such as soft drinks, tea and fruit drinks are the main source of added sugars in the diet for all age groups in the U.S. (older than 2 years), making up almost half of the calories from added sugars. These beverages are often sweetened with high-fructose corn syrup. While these beverages continue to be the largest contributor to added sugars intakes, there has been a significant decline in calorically sweetened beverage consumption since 1999.

To get a better idea of the types of foods and beverages those who eat very little sugar are choosing compared to those who eat a lot of sugar, researchers divided the study population into 10 groups, ranging from those who don't consume much added sugars to those who consume a lot, and looked at the top sources of added sugars in each group. You can read more about the research on this topic at <https://www.sugar.org/blog/where-do-kids-get-their-added-sugars/>



Here is a snapshot of the top sources of added sugars in adolescents and how much they each contribute to the total amount of added sugars consumed.

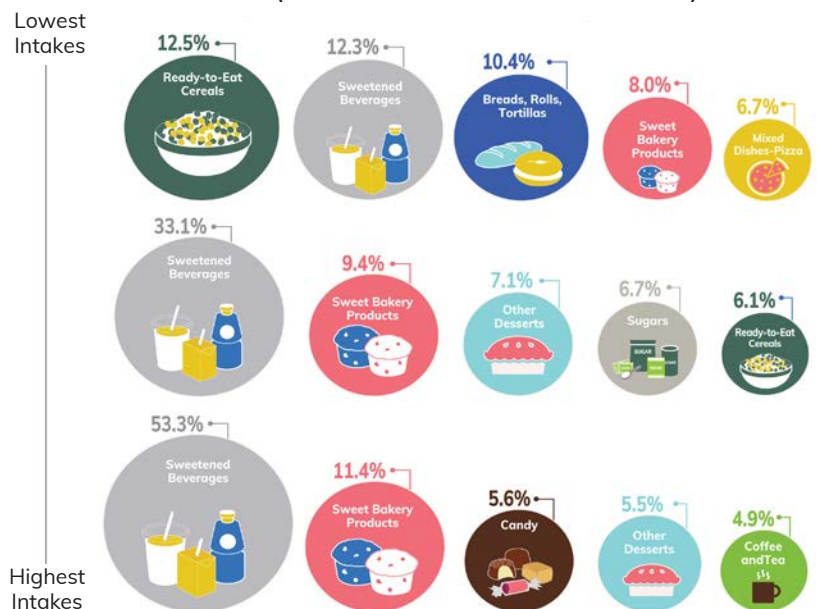
The percent of total calories contributed by added sugars for adolescents and teens (ages 9-18) ranged from <11.9 to ≥19.6%, with an average of 16.2%.

The findings show that for adolescents and teens, **sweetened beverages are the primary source of added sugars except for the lowest added sugars consumers.**

The second largest source was sweet bakery products. Candy was also among the top 10, ranking increasingly higher with increasing added sugars intake.

It is worth noting that **the list of top 10 sources of added sugars also includes foods that contribute important nutrients** such as fiber, vitamins and minerals, like ready-to-eat cereals and flavored dairy. Both were in the top 10 sources of added sugars for adolescents and teens.

Top 5 Food Sources of Added Sugars for Adolescents and Teens 9-18 Years from Low to High Intake
(% TOTAL ADDED SUGARS FROM FOOD CATEGORY)



ACTIVITY

Keep a food journal for a week and see if you can identify what your top sources of added sugars are. Which of these sources contribute important nutrients? Which of these sources are considered treats?

Let's Bake!

Try these recipes that use various types of sugar (with appropriate supervision).

On-the-Fence Brownies

Recipe courtesy of Whole Grains Council
(via HomeBaking.org)

Prep Time: 15 minutes
Cook Time: 28 minutes
Serves: 24

INGREDIENTS

1 cup unsalted butter
2 ¼ cups **granulated sugar**
1 ¼ cups Dutch process cocoa
1 teaspoon salt
1 teaspoon baking powder
1 tablespoon vanilla extract
4 large eggs
1 ½ cups white whole wheat flour
1 cup chopped walnuts or pecans (optional)
1 cup chocolate chips (optional)

INSTRUCTIONS

1. Preheat the oven to 350°F.
2. Lightly grease a 9 x 13-inch pan.
3. In a medium-sized microwave-safe bowl, or in a medium saucepan set over low heat, melt the butter.
4. Add the sugar and stir to combine.
5. Return the mixture to the heat (or microwave) briefly, just until it's hot (110°F to 120°F — about 40°C), but not bubbling; it will become shiny looking as you stir it. Heating this mixture a second time will dissolve more of the sugar, which will yield a shiny top crust on your brownies.
6. Stir in the cocoa, salt, baking powder and vanilla.
7. Whisk in the eggs, stirring until smooth.
8. Add the flour, nuts and chips, again stirring until smooth. Spoon the batter into the prepared pan.
9. Bake the brownies for 28 to 30 minutes, until a cake tester inserted into the center comes out clean. The brownies should feel set on the edges and in the center. Remove them from the oven and cool on a rack before cutting and serving.

Oatmeal Bread

Recipe courtesy of FCCLA (via HomeBaking.org)



Serves: 12

INGREDIENTS

1 cup rolled oats
1 teaspoon salt
1 ½ cups boiling water
1 packet dry yeast (active)
¼ cup warm water (105°F to 115°F)
¼ cup **molasses**
1 ½ tablespoons vegetable oil
2 cups whole wheat flour
2 ½ cups flour (all-purpose)

INSTRUCTIONS

1. Combine rolled oats and salt in a large mixing bowl. Stir in boiling water; cool to lukewarm (105°F - 115°F).
2. Dissolve yeast in ¼ cup warm water in a small bowl.
3. Add yeast water, molasses and oil to cooled oatmeal mixture.
4. Stir in whole wheat flour and 1 cup all-purpose flour. Add additional all-purpose flour to make a dough stiff enough to knead.
5. Knead dough on a lightly floured surface until smooth and elastic, about 5 minutes.
6. Place dough in a lightly oiled bowl, turning to oil top. Cover with a clean towel; let the dough rise in a warm place until double, about 1 hour.
7. Punch dough down; turn onto a clean surface. Shape dough and place in a greased 9 x 5-inch pan. Cover with a clean towel; let rise in a warm place until almost double, about 1 hour.
8. Preheat the oven to 375°F.
9. Bake for 50 minutes or until bread sounds hollow when tapped. Cover with aluminum foil during baking if bread is browning too quickly.
10. Remove bread from pan and cool on a wire rack.

Easy Apple “Doughnuts”

Recipe courtesy of The Family Dinner Project
(via HomeBaking.org)

Prep Time: 7 minutes
Cook Time: 2 minutes
Serves: 14-16

INGREDIENTS

2 medium-sized apples, peeled, cored and cut crosswise into rings (about ¼-inch thick)
½ cup all-purpose or whole wheat flour
½ teaspoon baking powder
¼ teaspoon baking soda
¼ teaspoon nutmeg
½ teaspoon vanilla extract
1 large egg
6 tablespoons apple cider
2 tablespoons unsalted butter

Topping:

½ cup **granulated sugar**
1 teaspoon cinnamon



INSTRUCTIONS

1. In a medium bowl, whisk together the flour, baking powder, baking soda and nutmeg.
2. Add the egg and vanilla and mix.
3. Add the apple cider and whisk slowly until a smooth batter forms.
4. Melt the butter in a skillet over medium-high heat.
5. Dip the apple slices into the batter to coat them. Let excess batter drip off.
6. When the butter in the skillet starts to bubble, add the apple slices in a single layer. You may have to work in batches.
7. Let the apple slices cook for about 2 minutes on the first side, just until golden brown and set. Flip and cook for another 1 to 2 minutes on the second side, until golden brown.
8. Remove the apple “doughnuts” from the pan and set on paper towels.
9. In a shallow dish, mix together the cinnamon and granulated sugar. Toss the apple “doughnuts” in the cinnamon sugar, sprinkle with **powdered sugar** and serve.



INGREDIENTS

½ cup packed **brown sugar**
¾ cup to 1 cup whole wheat flour
¼ teaspoon baking soda
⅛ teaspoon salt
1 cup rolled oats
½ cup butter, softened
Use scant ⅔ cup seedless raspberry jam,
or other jam of choice

Whole Wheat Jam Bars

Recipe courtesy of Texas Wheat (via HomeBaking.org)

Prep Time: 15 minutes
Cook Time: 35 minutes
Serves: 12

INSTRUCTIONS

1. Preheat the oven to 350°F.
2. Grease one 8-inch square pan.
3. Combine brown sugar, flour, baking soda, salt and rolled oats.
4. Add butter using your hands or a pastry blender to form a crumbly mixture.
5. Press 2 cups of the mixture into the bottom of the prepared pan.
6. Spread jam over the mixture to within ¼ inch of the pan edge.
7. Sprinkle the remaining crumb mixture over the top, and lightly press it into the jam.
8. Bake for 35 to 40 minutes or until lightly browned. Allow to cool before cutting into bars.