

# Nutrition and Health Info Sheet

## Sugar

*For Health Professionals*

Produced by:  
Kevin Ha, BS  
Taylor Berggren, MS  
Sydney Cassel, BS  
Jennifer Tong, BS  
Akash Gurung, BS  
Anna M. Jones, PhD  
Rachel E. Scherr, PhD  
Department of Nutrition  
University of California, Davis  
2018

### What is sugar?

Sugars are short chain carbohydrates found in many different types of foods. While there are many forms of sugar, their chemical structures all include carbon, oxygen, and hydrogen. Sugars are classified by the number of monosaccharides, or single carbohydrate units, bound together by glycosidic bonds. Monosaccharides include galactose, glucose, fructose, ribose, and xylose. Disaccharides are combinations of two monosaccharides; the most common disaccharides are sucrose, lactose and maltose. Monosaccharides and disaccharides are known as simple sugars. Oligosaccharides and polysaccharides have more than 3-8 sugar units and more than 8 units, respectively.<sup>1</sup> Some examples of polysaccharides include starch and glycogen, both of which serve as means of storage for carbohydrates. Oligo- and polysaccharides are referred to as complex sugars.

Sugars in our food can be identified as natural or added. Natural sugars are those that are naturally-occurring in foods, such as lactose in dairy products, fructose in fruits, or starch in potatoes. Added sugars are those that are added during processing or preparation of foods for taste, color, or increased shelf life.<sup>2</sup> Some examples include table sugar, brown sugar, and high-fructose corn syrup.



### What are non-nutritive sweeteners?

Non-nutritive sweeteners are sugar replacements that provide sweetness to foods and beverages while contributing negligible calories. These include artificial/non-nutritive sweeteners and natural sweeteners such as sucralose (Splenda), Aspartame (Equal), and Stevia.<sup>1</sup>



## Why is sugar important?

Chains of carbohydrates are digested and absorbed as monosaccharides. Glucose is one of the body’s main sources of energy; it is the main compound used to fuel the brain. Carbohydrates are necessary to support daily activities and exercise.<sup>1</sup>

To protect the brain and other vital tissues, blood sugar levels are tightly controlled in the body.<sup>1</sup> Blood sugar concentrations are controlled through three pancreatic hormones: insulin, glucagon, and epinephrine.<sup>3</sup> After eating, insulin keeps blood sugar levels from rising too much by signaling glucose to enter cells. Glucagon works to do the reverse process and increase blood glucose levels when in the fasting state.<sup>3</sup> Epinephrine, often associated with “fight or flight” activities, also assists in the release of glucose from the cells in order to rapidly increase blood sugar to provide a fast energy source.<sup>4</sup>

## What are the recommendations for sugar?

The 2015-2020 Dietary Guidelines put specific focus on the intake of added sugar. Added sugars contribute to calorie count without adding much nutritional value. The recommendation is to reduce added sugar to less than 10% of one’s total daily caloric intake.<sup>5</sup> In 2015, it was estimated that added sugars composed at least 13% of caloric intake on a daily basis in the U.S. Figure 1 shows the percent of calories from added sugars for females and males compared to the new recommendation of less than 10% of total calories.

Beverages, like sugar-sweetened coffee drinks or soft drinks, contribute to 47% of the added sugars consumed in the U.S. Reducing intake of sugar-sweetened beverages has the potential to decrease overall added sugar intake. Figure 2 displays the contribution of some food groups on Americans’ intake of added sugar.<sup>5</sup>

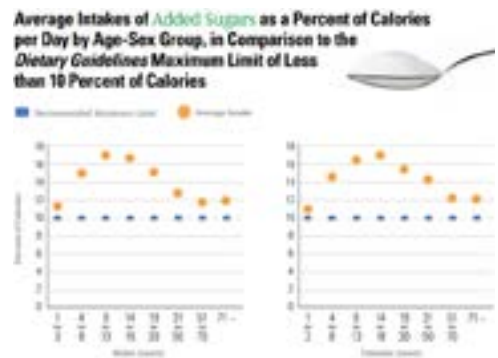


Figure 1<sup>5</sup>

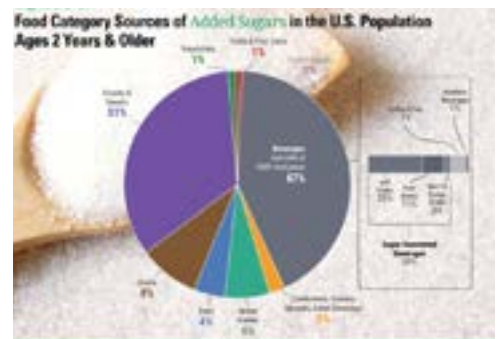


Figure 2<sup>5</sup>

## How much sugar and/or added sugar is in food?

On May 20, 2016, the FDA announced that there would be a change to the Nutrition Facts Label on packaged foods, shown in Figure 3. One of these changes includes the addition of added sugars in grams and in percent daily value on the label. Corresponding to the Dietary Guidelines, it recommends consuming no more than 10% of total calories from added sugars.<sup>5</sup> Because these values are based on a 2,000 calorie per day diet, they are not accurate for everyone, especially children. This change is important as it easily shows the difference between naturally-occurring sugars and added sugars.<sup>6</sup> The new Nutrition Facts panel will be required to be on foods by January 1, 2020 for large companies and January 1, 2021 for small companies.

## What are common sources of added sugars?

Added sugars contain little or no nutritive value but do contribute to overall calories. These may include:<sup>7</sup>

- Sugary beverages (soda, sweet coffee, energy drinks)
- Sugary cereal
- Candy and chocolates
- Flavored yogurt
- Baked goods
- Frozen foods
- Pasta sauce
- Barbecue sauce, ketchup, salad dressing and other condiments

Nutrition Facts	
8 servings per container	
Serving size 2/3 cup (55g)	
Amount per serving	
<b>Calories</b>	<b>230</b>
% Daily Value*	
<b>Total Fat</b> 6g	<b>10%</b>
Saturated Fat 1g	5%
Trans Fat 0g	
<b>Cholesterol</b> 0mg	<b>0%</b>
<b>Sodium</b> 160mg	<b>7%</b>
<b>Total Carbohydrate</b> 37g	<b>13%</b>
Dietary Fiber 4g	14%
Total Sugars 12g	
Includes 10g Added Sugars	<b>20%</b>
<b>Protein</b> 3g	
Vitamin D 2mcg	10%
Calcium 200mg	20%
Iron 8mg	45%
Potassium 250mg	4%

Figure 3



## How can you decrease sugar intake?

The Dietary Guidelines for American's 2015-2020 advises a variety of ways to decrease sugar intake:<sup>2</sup>

- Drink water, unsweetened tea or coffee, or other calorie-free beverages instead of soda or sweetened beverages
- Choose beverages like low fat or fat-free milk and 100% fruit juice to meet recommendations for dairy and fruit groups
- Choose fruit as a dessert or snack instead of foods with added sugars
- Choose packaged foods that have little or no added sugars such as plain yogurt

## What health conditions are related to sugar?

*Diabetes:* Diabetes is a chronic, non-communicable disease in which the body cannot use blood glucose for energy properly. This results in increased levels of glucose in the bloodstream. To bring blood glucose into the cells and lower blood glucose levels, the body uses the hormone insulin. While diabetes is not caused by excess sugar intake, it is a disease related to sugar homeostasis. Type 1 diabetes is an autoimmune disease in which the body attacks the beta cells in the pancreas that produce insulin. Type 2 diabetes occurs when the pancreas is not able to make enough insulin or the body's cells do not use insulin properly. Type 2 diabetes is caused by genetic and lifestyle factors, including a diet high in calories.<sup>8</sup>

Approximately 30 million Americans have been diagnosed with diabetes; only about 5% of these cases are Type 1 diabetes.<sup>8</sup> Type 2 diabetes can be managed through lifestyle. Staying at a healthy weight, managing high blood pressure, and decreasing unhealthy cholesterol can help prevent and manage problems caused by type 2 diabetes. Increasing physical activity

can also help to manage type 2 diabetes. To lower your risk for developing type 2 diabetes, closely manage your blood sugar levels, keep cholesterol and blood pressure at healthy levels, increase physical activity, and quit smoking.<sup>9</sup>

*Heart Disease:* Heart or cardiovascular disease (CVD) is any disease of the heart or blood vessels, and includes plaque buildup, heart attack, and stroke.<sup>10</sup> Recent epidemiological studies have shown an association between higher intake of added sugar with CVD risk. One study found that the risk for mortality from CVD had a significant positive relationship with added sugar consumption. Participants who consumed more than 25% of calories from added sugars were twice as likely to die from CVD than those who consumed the recommended 10%.<sup>11</sup>

People with diabetes are at a higher risk for heart disease, may develop heart disease at a younger age, and may have more severe heart disease. The higher a person's blood sugar levels, the higher their risk for a CVD event.<sup>12</sup>

*Tooth Decay (Dental Caries):* It is well thought that sugar has an impact in increasing dental caries or cavities. Much of this has to do with a diet of highly processed carbohydrates and starches, sweetened beverages, and other sweetened products. The consumption of sugars leads to metabolism of these sugars by bacteria in the mouth, which in turn form plaques that create acids that deteriorate the teeth. The longer the exposure of sugars to the teeth, the more time for harmful plaques to build up on the teeth. However, it is important to note that it is not sugars alone that contribute to dental caries but a wide host of factors such as form of sugar, frequency of consumption of sugar, dietary patterns, and oral hygiene.<sup>13</sup>



## Are the things in the media about sugar true?

*Sugar and ADHD:* A commonly made claim in the media is that added sugar causes Attention Deficit Hyperactivity Disorder (ADHD). These claims, however, have not been substantiated by research. Research has been unable to show any causal relationship between sugar and ADHD. Additionally, a review of 12 studies failed to show any evidence that candy or chocolate lead to negative behavior in children with and without ADHD.<sup>14</sup> Another study examined the diets of 192 children and found no proof of causation between sugar consumption and ADHD.<sup>15</sup>

*Sugar and Addiction:* The topic of sugar addiction continues to remain controversial in the media and scientific research. Studies in rats have shown that there is a response in the brain when rats are given sugar intermittently. Further investigation has shown that the desire for sugar was for the sweet taste, rather than for the calories.<sup>16</sup> Similar results have been shown with use of artificial sweeteners such as sucralose.<sup>17</sup> Research has shown that the pathways activated by certain foods, including sugar, are separate from those that are activated in drug use. The complexity of brain imaging and pathways, however, makes it hard to determine which pathways are shared.<sup>16</sup>

## References:

1. Background on Carbohydrates & Sugars. [https://www.foodinsight.org/Background\\_on\\_Carbohydrates\\_Sugars](https://www.foodinsight.org/Background_on_Carbohydrates_Sugars). International Food Information Council Foundation. Accessed March 6, 2017.
2. Added Sugars. <https://www.choosemyplate.gov/added-sugars>. U.S. Department of Agriculture. Updated July 12, 2017. Accessed August 6, 2017.
3. Carbohydrates and Blood Sugar. <https://www.hsph.harvard.edu/nutritionsource/carbohydrates/carbohydrates-and-blood-sugar/>. Harvard T.H. Chan School of Public Health. Accessed March 7, 2017.
4. Sherwin RS, Sacca L. Effect of Epinephrine on Glucose Metabolism in Humans: Contribution of the Liver. *Am J Physiol*. 1984; 247: E157-65.
5. Dietary Guidelines for Americans 2015-2020. <https://health.gov/dietaryguidelines/2015/guidelines/>. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 8th edition. Updated December 2015. Accessed March 7, 2017.
6. Changes to the Nutrition Facts Label. <https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm>. U.S. Food and Drug Administration. Updated June 28, 2018. Accessed August 6, 2018.
7. Cording J. Looking to Reduce Your Family's Intake of Added Sugars? Here's How. <https://www.eatright.org/food/nutrition/dietary-guidelines-and-myplate/looking-to-reduce-your-familys-added-sugar-intake-heres-how>. Academy of Nutrition and Dietetics. Published July 31, 2018. Accessed August 20, 2018.
8. Diabetes Basics. <http://www.diabetes.org/diabetes-basics/>. American Diabetes Association. Accessed August 15, 2018.
9. Lower Your Risk. <http://www.diabetes.org/are-you-at-risk/lower-your-risk/?loc=atrisk-slabnav>. American Diabetes Association. Accessed March 17, 2017.
10. What Is Cardiovascular Disease?. <http://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease>. American Heart Association. Updated May 31, 2017. Accessed August 20, 2017.
11. Yang Q, Zhang Z, Gregg EW, et al. Added Sugar Intake and Cardiovascular Diseases Mortality Among US Adults. *JAMA Internal Medicine*. 2014;174(4):516.
12. Diabetec Heart Disease. <https://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0063004/>. PubMed Health. Updated June 11, 2014. Accessed March 6, 2017.
13. Gupta P, Gupta N, Pawar AP, et al. Role of Sugar and Sugar Substitutes in Dental Caries: A Review. *ISRN Dent* 2013: 519421.
14. Krummel DA, Seligson FH, Guthrie HA. Hyperactivity: is candy causal? *Crit Rev Food Sci Nutr*. 1996; 36(1-2): 31-47.
15. Woo HD, Kim DW, Hong YS, et al. Dietary patterns in children with attention deficit/hyperactivity disorder (ADHD).” *Nutrients*. 2014; 6(4):1539-53.
16. Rippe JM, Marcos A. Controversies about sugars consumption: state of the science. *Eur J Nutr*. 2016; 55(Suppl 2):11-16.
17. Domingos AI, Sordillo A, Deitrich MO, et al. Hypothalamic melanin concentrating hormone neurons communicate the nutrient value of sugar. *Elife*. 2013; 2:e01462.

The University of California prohibits discrimination or harassment of any person on the basis of race, color, national origin, religion, sex, gender identity, pregnancy (including childbirth, and medical conditions related to pregnancy or childbirth), physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or service in the uniformed services (as defined by the Uniformed Services Employment and Reemployment Rights Act of 1994: service in the uniformed services includes membership, application for membership, performance of service, application for service, or obligation for service in the uniformed services) in any of its programs or activities.

University policy also prohibits reprisal or retaliation against any person in any of its programs or activities for making a complaint of discrimination or sexual harassment or for using or participating in the investigation or resolution process of any such complaint.

University policy is intended to be consistent with the provisions of applicable State and Federal laws.

Copyright © The Regents of the University of California, Davis campus, 2018. All rights reserved. Inquiries regarding this publication may be directed to [cns@ucdavis.edu](mailto:cns@ucdavis.edu). The information provided in this publication is intended for general consumer understanding, and is not intended to be used for medical diagnosis or treatment, or to substitute for professional medical advice.