



Sugar-Sweetened Beverages

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In the United States, 69% of adults and 32% of children age 2-19 are considered overweight or obese. Evidence suggests that consumption of sugar-sweetened beverages (SSB) is associated with an increase in weight among Americans. Adults consume approximately 14.6% of total daily calories from added sugars; sugar sweetened beverages contribute to approximately 33% of these calories.

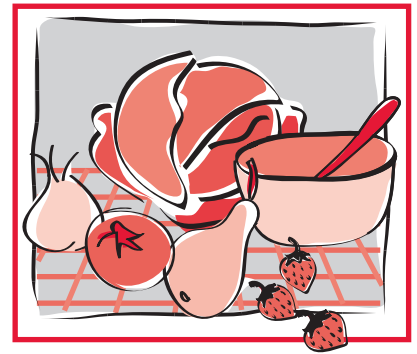
A sugar-sweetened beverage is any beverage with added sugar, including sodas, sweetened juices, energy drinks, sport drinks, sweetened teas, and coffee drinks. An individual sweetened beverage can be a major contributor of added sugars in a daily diet. A 20 oz. cola contains over 16 teaspoons of added sugar, about double the daily recommendation, constituting 240 calories. A common name brand iced tea contains 72 grams of sugar in its 23 oz. can, for a total of 270 calories and 18 teaspoons of added sugar.



Typically, when calories are consumed, they create a feeling of fullness. However, a growing body of evidence suggests that liquid carbohydrates, such as those found in SSBs, do not stimulate the feeling of fullness, or create satiety following consumption. This may lead to higher overall caloric intake. Additionally, the carbohydrates in SSBs are rapidly absorbed into the bloodstream, causing larger swings in blood glucose levels. Crashing after a large peak in blood sugar can cause an individual to seek more calories to restore glucose levels, further contributing to a pattern of high calorie intake and overeating.

Sugar Sweetened Beverages and High Fructose Corn Syrup

Many SSBs are made with large amounts of high fructose corn syrup, which may be a factor in some of the disease risk associated with high SSB consumption. Fructose is metabolized differently than glucose, and excessive consumption of fructose has been shown to increase risk for dyslipidemia, non-alcoholic fatty liver disease, increased abdominal fat and decreased insulin sensitivity. These factors can increase the risk for heart disease and diabetes. Yet, short term studies have also observed similar levels of triglycerides in the blood after consuming pure glucose. This evidence suggests that similar effects may be observed in cases of regular consumption of glucose-sweetened beverages as well, indicating the negative effects may not be limited to just high fructose corn syrup consumption.



Quick Facts

- An individual sugar sweetened beverage can be a major contributor to added sugars in a daily diet.
- Sugar sweetened beverages do not stimulate the feeling of fullness or create satiety following consumption.
- Excessive consumption of SSBs has been linked to several chronic diseases, including cardiovascular disease and type 2 diabetes mellitus.
- There is strong evidence to support that SSBs are associated with increased childhood overweight and obesity.
- While excessive intake of SSBs or other sources of added sugar is not advised, moderate consumption of added sugar can be part of a balanced diet.

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Sugar-Sweetened Beverages and Disease

Excessive SSB consumption has been linked to several chronic diseases, including cardiovascular disease and type 2 diabetes mellitus. In some instances, this relationship has been shown to exist independent of weight status or total caloric intake. Therefore, moderating SSB consumption can be important to overall health and wellbeing.

Obesity

High consumption of SSBs increases the risk for overweight and obesity. Some evidence suggests that this relationship exists independent of the caloric intake, signifying that SSB digestion and metabolism may be digested differently than other forms of sugar. In one study, researchers followed participants for an average of 4 years, and they found that daily consumption of SSBs was linked to a 37% increased risk for development of obesity.

Obesity has been linked to an increased risk of developing many chronic diseases, including heart disease, stroke, type 2 diabetes, cancer, osteoarthritis, sleep apnea, reproductive problems, and gallstones. Additionally, obesity-related healthcare costs are estimated to be \$147 billion per year, constituting 9.1% of total healthcare costs.

Metabolic Syndrome

Metabolic syndrome is a cluster of risk factors that increase the risk for cardiovascular disease, diabetes and stroke. These risk factors include:

- Abdominal adiposity
- High triglyceride levels
- Low HDL cholesterol levels
- High blood pressure
- High fasting blood sugar

According to the National Heart, Lung, and Blood Institute, metabolic syndrome may surpass smoking to become the leading

risk factor for heart disease in the United States. Studies have found that greater SSB consumption has been linked to higher risk for metabolic syndrome. The high sugar content of these beverages can cause increased fat production by the liver, increasing abdominal adiposity and triglyceride levels, and detrimentally impacting levels of HDL and LDL cholesterol. These beverages also have a high glycemic load, increasing insulin resistance and raising blood sugar levels.

Heart Disease

In the Nurses' Health Study, women who consumed two or more SSBs per day had a 35% increased risk of heart disease compared to those who rarely consumed sweetened beverages, even after accounting for lifestyle factors, such as smoking, physical activity, and body mass index (BMI). Low to moderate consumption of SSBs (1-2 per day) has been shown to negatively impact the markers of cardiovascular disease, increasing the expression of atherogenic LDL particles, which promote the formation of arterial plaques. Plaques are a buildup of cholesterol, fats, and other substances in vessel walls, which is often the precursor to cardiovascular disease. It also increases other markers of inflammation, such as C-reactive protein, which plays a role in the development of atherosclerosis and further increases the risk for cardiovascular disease. Researchers also observed that SSB consumption raised fasting glucose levels, which is associated with insulin resistance and increased risk for heart disease. The effects of SSB consumption on heart disease has been observed independent of factors such as BMI, total energy intake, and incidence of diabetes.

Diabetes

Consumption of SSBs increases the risk of developing type II diabetes mellitus. According to data gathered during the Nurses' Health Study II, women who consumed one or more SSBs per day had an

83% higher relative risk of developing diabetes when compared to those who rarely consumed sweetened drinks. Other studies have supported the findings that SSB consumption increases risk for this chronic disease. These studies have demonstrated that BMI is a mitigating factor for the effect of SSBs, though there is evidence that BMI only accounts for a portion of the increased risk for type II diabetes development.

Cancer

Thus far, a direct relationship between sugar-sweetened beverage intake and cancer has not been observed. However, overweight and obesity has been associated with several forms of cancer, including cancers of the breast, colon, rectum, endometrium, esophagus, kidneys, and pancreas. Therefore, the strong link between obesity and SSBs may indicate an indirect link between consumption and cancer risk.

Gout and Kidney Problems

SSB consumption has been linked to high levels of uric acid in the body. This may be due to the fact that SSBs are high in fructose, a compound known to raise uric acid levels. Heightened levels of uric acid has been known to cause gout and the formation of certain types of kidney stones. Therefore, individuals who are prone to either of these conditions should consider decreasing consumption of SSBs.

Additionally, SSB consumption has been linked to declining kidney function and higher incidence of chronic kidney disease. This may be due to the heightened levels of uric acid. SSBs have also been linked to an increase in urine albumin, known as microalbuminuria, another risk factor for kidney disease. Diabetes, hypertension, and kidney stones are additional known risk factors for kidney disease and may further contribute to the association between SSBs and declining kidney function.

Osteoporosis

There have been concerns about the relationship between SSBs and bone health. Consumption of soda has been linked to decreasing bone density and increased risk for osteoporosis and fractures. This is due to the high levels of phosphate found in some sodas, which can have a deleterious effect on bones.

Furthermore, SSBs can displace milk consumption, decreasing the intake of calcium and vitamin D, key nutrients in bone health. In the US, soda consumption is highest among adolescents and young adulthood, a time in life when calcium intake is crucial for bone deposition and when maximum bone density can be reached. A diminished level of maximum bone density can lead to higher risk for hip fracture and osteoporosis later in life. remember that excessive consumption of artificial sweeteners can cause undesirable side effects, such as diarrhea and headaches.

Sugar-Sweetened Beverages and Children

There is strong evidence to support that SSBs are associated with increased childhood overweight and obesity. This link has been observed in both child and adolescent populations. One study found that children between ages 2.5-4.5 who regularly consume SSBs were 2.4 times more likely to be overweight or obese than children who did not consume SSBs. Daily consumption of SSBs was shown to increase the risk of overweight or obesity by 4.8 times among adolescents. Overweight in childhood has been linked to an increased likelihood for overweight and obesity in adulthood. Additionally, increasing weight status in children has been associated with increased childhood incidence of type 2 diabetes (previously considered “adult-onset” diabetes).

Not only have SSBs been associated with obesity in children, but they have also been linked to overall decreased health status. In a multi-ethnic study with children age 8-15, SSB consumption was linked to higher triglyceride levels and decreased HDL levels. In addition, high fructose consumption in children has been linked to increased markers of inflammation and decreased LDL particle size. Small LDL particles are known to be the more atherosclerotic. Atherosclerosis is a narrowing and hardening of blood vessels, and causes an increased risk for heart attack, stroke, and vascular disease. Additionally, SSB consumption has been linked to higher risk of metabolic syndrome among adolescents.

What about 100% Fruit Juice?

Fruit juices are often similar in sugar content, similar to SSBs. Therefore, similar concerns exist regarding excessive juice consumption and chronic disease risk. However, it is important to note that 100% fruit juice will also be a source of some vitamins and minerals, which are typically absent from SSBs. While 100% fruit juice counts as a serving of fruit, eating whole fruit is the preferred method of consuming these nutrients, because juice is a more concentrated source of sugar and does not contain the fiber typically found in fruit. It should also be noted that fruit drinks are not the same as 100% fruit juice. Fruit drink products often contain added sugar, and contain a smaller percentage of fruit juice, therefore offering less of the benefits that can be attributed to a 100% juice product.

Similar to SSBs, fruit juice should be consumed in moderation. Consider diluting juice with water, forming a 50:50 ratio, in order to decrease the sugar content while still enjoying the flavor. According to the Dietary Guidelines for Americans, adults should consume less than half of their recommended servings of fruit from juice. This means that intake of 100% juice (without added sugars) should not exceed one cup per day for a 2000 calorie diet.

Artificially Sweetened Beverages

Some observational studies have observed a relationship between the consumption of beverages made with artificial sweeteners and lower overweight/obesity. However, this relationship may be due to the fact that

that consumption of these beverages is more common among people who are concerned about their weight. There is some evidence that artificially sweetened beverages may decrease weight gain, but only when used as a substitution for existing SSB consumption. Additionally, higher rates of type II diabetes have been associated with higher consumption of artificial sweeteners, though this association is largely explained by other variables, such as health status, diet, and BMI. Nonetheless, it is also important to remember that excessive consumption of artificial sweeteners can cause undesirable side effects, such as diarrhea and headaches.



What are the recommendations for juice consumption for children?

According to the American Academy of Pediatrics, the amount of juice that can be healthfully consumed depends on age. Daily fruit juice consumption should be limited to:

Birth to 6 months of age	No fruit juice (unless to alleviate constipation)
6 to 12 months	4 to 6 ounces (served in a cup to avoid tooth decay)
1 to 6 years	Up to 6 ounces
7 years and older	No more than 8-12 ounces

Added Sugar Consumption as part of a Balanced Diet

While excessive intake of SSBs or other sources of added sugar is ill-advised, moderate consumption of added sugar can be part of a balanced diet. According to the 2015 Dietary Guidelines for Americans, as well as recommendations by the World Health Organization, added sugars should be limited to a maximum of 10% of total daily calories.

Alternatives to Sugar-Sweetened Beverages

Reducing consumption of sugar sweetened beverages is a good way to improve health and decrease caloric intake. Below are alternatives to drinking a sugar-sweetened beverage:

- Water infused with fresh fruit, mint, or cucumber instead of a sugary fruit drink
- Unsweetened herbal iced tea instead of sweetened iced tea
- Soda water with a squeeze of citrus instead of soda
- A low-fat plain latte instead of a sugary coffee drink or energy drink
- Chocolate flavored tea instead of hot chocolate with added sugar
- A fruit smoothie with low-fat yogurt instead of a milkshake
- If substitutes won't do, try a diet variety or decrease the size and frequency of SSB consumption

What does 10% of total daily calories mean?

To determine what 10% of daily calories looks like, begin by figuring out the daily caloric needs of an individual based on weight, age, gender, and activity level. For help determining energy needs, the Mayo Clinic has an online tool to calculate an estimate of caloric needs.

Once total caloric need has been determined, calculate 10% of this value ($.10 \times$ total calories). Next, divide this number by 4 (there are 4 calories per 1 gram of sugar). This converts calories of added sugar to grams, making it easier to compare the grams of sugar listed on a label to the total suggested amount of added sugar.

For example, a moderately active, middle-aged woman who is 5'5" and weighs 135 lbs needs about 1800 calories a day. This means that she should consume no more than 180 calories, or 45 grams, per day from added sugars. This is the amount of added sugar found in a single 12oz. can of root beer.

$(1800 \times .10 = 180 \text{ calories from sugar} \rightarrow 180/4 = 45 \text{ grams of sugar})$



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