

What's the story on alternative sweeteners?

LO 7 Compare and contrast a variety of alternative sweeteners.

Most of us love sweets but want to avoid the extra Calories and tooth decay that go along with them. Remember that all carbohydrates, whether simple or complex, contain 4 kcal of energy per gram. Because sweeteners such as sucrose, fructose, honey, and brown sugar contribute energy, they are called **nutritive sweeteners** ⓘ.

Other nutritive sweeteners include the *sugar alcohols* such as mannitol, sorbitol, isomalt, and xylitol. Popular in sugar-free gums, mints, and diabetic candies, sugar alcohols are less sweet than sucrose. Foods with sugar alcohols have health benefits that foods made with sugars do not have, such as a reduced glycemic response and decreased risk of dental caries. Also, because sugar alcohols are absorbed slowly and incompletely from the intestine, they provide less energy than sugar, usually 2 to 3 kcal of energy per gram. However, because they are not completely absorbed from the intestine, they can attract water into the large intestine and cause diarrhea.

A number of other products have been developed to sweeten foods without promoting tooth decay and weight gain. Because these products provide little or no energy, they are called **nonnutritive, or alternative, sweeteners** ⓘ.



Limited Use of Alternative Sweeteners Is Not Harmful

Research has shown alternative sweeteners to be safe for adults, children, and individuals with diabetes. Women who are pregnant should discuss the use of alternative sweeteners with their healthcare provider. In general, it appears safe for pregnant women to consume alternative sweeteners in amounts within the Food and Drug Administration (FDA) guidelines.¹⁶ These amounts, known as the Acceptable Daily Intake (ADI)[Ⓟ], are estimates of the amount of a sweetener that someone can consume each day over a lifetime without adverse effects. The estimates are based on studies conducted on laboratory animals, and they include a 100-fold safety factor. It is important to emphasize that actual intake by humans is typically well below the ADI.

Saccharin

Discovered in the late 1800s, *saccharin* is about 300 times sweeter than sucrose. Concerns arose in the 1970s that saccharin could cause cancer; however, more than 20 years of subsequent research failed to link saccharin to cancer in humans, and in 2000, the National Toxicology Program of the U.S. government removed saccharin from its list of products that may cause cancer. No ADI has been set for saccharin, and it is used in foods and beverages and as a tabletop sweetener. It is sold as Sweet n' Low (also known as "the pink packet") in the United States.

Acesulfame-K

Acesulfame-K (acesulfame potassium) is marketed under the names Sunette and Sweet One. It is a Calorie-free sweetener that is 200 times sweeter than sugar. It is used to sweeten gums, candies, beverages, instant tea, coffee, gelatins, and puddings. The taste of acesulfame-K does not change when it is heated, so it can be used in cooking. The body does not metabolize acesulfame-K, so it is excreted unchanged by the kidneys. The ADI for acesulfame-K is 15 mg per kg body weight per day. For example, the ADI in an adult weighing 150 pounds (or 68 kg) would be 1,020 mg.

Aspartame

Aspartame, also called Equal ("the blue packet") and NutraSweet, is one of the most popular alternative sweeteners currently in use. Aspartame is composed of two amino acids: phenylalanine and aspartic acid. When these amino acids are separate, one is bitter and the other has no flavor—but joined together, they make a substance that is 180 times sweeter than sucrose. Although

Aspartame

Aspartame, also called Equal (“the blue packet”) and NutraSweet, is one of the most popular alternative sweeteners currently in use. Aspartame is composed of two amino acids: phenylalanine and aspartic acid. When these amino acids are separate, one is bitter and the other has no flavor—but joined together, they make a substance that is 180 times sweeter than sucrose. Although aspartame contains 4 kcal of energy per gram, it is so sweet that only small amounts are used, thus it ends up contributing little or no energy. Heat destroys the bonds that bind the two amino acids in aspartame. Therefore, it cannot be used in cooking because it loses its sweetness.

Although there are numerous claims that aspartame causes headaches and dizziness, and can increase a person’s risk for cancer and nerve disorders, studies do not support these claims.¹⁷ A significant amount of research has been done to test the safety of aspartame.

The ADI for aspartame is 50 mg per kg body weight per day. For an adult weighing 150 pounds (or 68 kg), the ADI would be 3,400 mg. Table 4.4 shows how many servings of aspartame-sweetened foods would have to be consumed to exceed the ADI. Because the ADI is a very conservative estimate, it would be difficult for adults or children to exceed this amount of aspartame intake. However, drinks sweetened with aspartame, which are extremely popular among children and teenagers, are very low in nutritional value. They should not replace more healthful beverages such as milk, water, and 100% fruit juice.

Table 4.4 Foods and Beverages That a Child and an Adult Would Have to Consume Daily to Exceed the ADI for Aspartame

Foods and Beverages	50-lb Child	150-lb Adult
12 fl. oz carbonated diet soft drink or	5.6	17
8 fl. oz powdered soft drink or	11	34
4 fl. oz gelatin dessert or	14	42
Packets of tabletop sweetener	32	97

Data from: Academy of Nutrition and Dietetics. 2015. “Sugar Substitutes: How Much Is Too Much?” <http://www.eatright.org/resource/food/nutrition/dietary-guidelines-and-myplate/sugar-substitutes-how-much-is-too-much>.

There are some people who should not consume aspartame at all: those with the disease *phenylketonuria* (PKU). This is a genetic disorder that prevents the breakdown of the amino acid phenylalanine. Because the person with PKU cannot metabolize phenylalanine, it builds up to toxic levels in the tissues of the body and causes irreversible brain damage. In the United States,

There are some people who should not consume aspartame at all: those with the disease *phenylketonuria* (PKU). This is a genetic disorder that prevents the breakdown of the amino acid phenylalanine. Because the person with PKU cannot metabolize phenylalanine, it builds up to toxic levels in the tissues of the body and causes irreversible brain damage. In the United States, all newborn babies are tested for PKU; those who have it are placed on a phenylalanine-limited diet. Some foods that are common sources of protein and other nutrients for many growing children, such as meats and milk, contain phenylalanine. Thus, it is critical that children with PKU not waste what little phenylalanine they can consume on nutrient-poor products sweetened with aspartame.

Sucralose

Sucralose is marketed under the brand name Splenda and is known as “the yellow packet.” It is made from sucrose, but chlorine atoms are substituted for the hydrogen and oxygen normally found in sucrose, and it passes through the gastrointestinal tract unchanged, without contributing any energy. It is 600 times sweeter than sucrose and is stable when heated, so it can be used in cooking. It has been approved for use in many foods, including chewing gum, salad dressings, beverages, gelatin and pudding products, canned fruits, frozen dairy desserts, and baked goods. Studies have shown sucralose to be safe. The ADI for sucralose is 5 mg per kg body weight per day. For example, the ADI of sucralose in an adult weighing 150 pounds (or 68 kg) would be 340 mg.

Neotame, Stevia, and Advantame

Neotame is an alternative sweetener that is 7,000 times sweeter than sugar. Manufacturers use it to sweeten a variety of products, such as beverages, dairy products, frozen desserts, and chewing gums.

Stevia was approved as an alternative sweetener by the FDA in 2008. It is produced from a purified extract of the stevia plant, native to South America. Stevia is 200 times sweeter than sugar. It is currently used commercially to sweeten beverages and is available in powder and liquid for tabletop use. Stevia is also called Rebiana, Reb-A, Truvia, and Purevia.





A purified extract of the stevia plant, native to South America, is the source of the alternative sweetener stevia.

Advantame was approved as an alternative sweetener in 2014. It is Calorie-free and 20,000 times sweeter than sugar. Although derived from aspartame, it is so much sweeter that very little is used; therefore, it is considered safe for people with phenylketonuria to consume. Advantame is used to sweeten foods such as frozen desserts, beverages, and chewing gum.

The Effect of Alternative Sweeteners on Body Weight Is Unclear

Although alternative sweeteners are used to reduce the energy content of various foods, their role in weight loss and weight maintenance is unclear. Although the popular media have recently linked drinking diet soft drinks with weight gain, a recent review concluded that there is no evidence that alternative sweeteners cause weight gain, and they may help people to lose weight.¹⁸ In addition, a recent randomized controlled trial found that participants in a behavioral weight loss program who consumed at least 24 fluid ounces per day of an artificially sweetened beverage lost more weight after 12 weeks than participants who drank only water, suggesting that alternative sweeteners can be an effective part of a weight loss program.¹⁹

However, this doesn't mean that consuming alternative sweeteners will necessarily help you maintain a healthful body weight. To prevent weight gain, you need to balance the total number of kcal you consume against the number you expend. If you're expending an average of 2,000 kcal a day and you consume about 2,000 kcal per day, then you'll neither gain nor lose weight. But if, in addition to your normal diet, you regularly indulge in "treats," you're bound to gain weight, whether they are sugar free or not. Consider the Calorie count of these artificially sweetened foods:

foods:

- One cup of nonfat chocolate frozen yogurt with artificial sweetener = 199 Calories
- One sugar-free chocolate cookie = 100 Calories
- One serving of no-sugar-added hot cocoa = 55 Calories

Does the number of Calories in these foods surprise you? *Remember, sugar free doesn't mean Calorie free.* Make it a habit to check the Nutrition Facts panel to find out how much energy is really in your food!

Recap

Alternative sweeteners can be used in place of sugar to sweeten foods. Most of these products do not promote tooth decay and contribute little or no energy. The alternative sweeteners approved for use in the United States are considered safe when consumed in amounts less than the Acceptable Daily Intake, an estimate of the amount of a sweetener that someone can consume each day over a lifetime without adverse effects. People with phenylketonuria should avoid foods and beverages sweetened with aspartame. Other approved sweeteners commonly used are saccharin, acesulfame-K, sucralose, neotame, stevia, and advantame. Products that are sugar free are not necessarily low in Calories; thus, consuming foods and beverages made with alternative sweeteners will not necessarily help you maintain a healthful body weight.

Nutri-case

HANNAH

HANNAH



"Last night, my mom called and said she'd be late getting home from work, so I made dinner. I made vegetarian quesadillas with flour tortillas, canned green chilies, cheese, and sour cream, plus a few baby carrots on the side. Later on while I was studying, I got really hungry, so I had some sugar-free cookies. They're sweetened with sorbitol and taste just like regular cookies! I ate maybe three or four, but I didn't think it was a big deal because they're sugar free. When I checked the package label this morning, I found out that each cookie has 90 Calories! I'm so mad at myself for blowing my diet!"

Without knowing the exact ingredients in Hannah's dinner and snack, would you agree that, prior to the cookies, she'd been making healthy choices? Why or why not? How might she have changed the ingredients in her quesadillas to increase their fiber content? And, if the cookies were sugar free, how can you explain the fact that each cookie still contained 90 Calories?