



Sugar Substitutes and

Artificial Sweeteners



sugar.

A sugar substitute refers to any sweetener that can be used to replace table sugar.

Caloric/Nutritive Sweeteners

The term sugar substitute includes sweeteners like honey, molasses, maple syrup, agave nectar, and others. Also called caloric- or nutritive sweeteners, it is important to remember that their calorie content is about the same as granulated or table

Depending on the type, these products may have antioxidants, vitamins, and minerals that are not found in plain sugar. They also have different and distinct flavors.

These sweeteners are often marketed as “more natural,” but some of these products are actually highly refined and processed. As of 2014, the term “natural” is not regulated by the FDA and is open to interpretation.

Novel Sweeteners and Sugar Alcohols

Novel sweeteners are hard to fit into one particular category because of what they're made from and how they're made. Stevia is the most common novel sweetener. Note that although the FDA has approved highly refined stevia preparations as a novel sweetener, it has not approved whole-leaf stevia or crude stevia extracts for this use.

- *Stevia* is also referred to as Rebaudioside A, Reb-A, or rebiana. Technically, Reb-A is a highly purified product that comes from the stevia plant and is several hundred times sweeter than sugar. According to the U.S. Food and Drug Administration (FDA), Reb-A is generally recognized as safe (GRAS) as a food additive and table top sweetener. When something is generally recognized as safe by the FDA, it means that experts have agreed that it is safe for use by the public in appropriate amounts.
- *Sugar alcohols* are carbohydrates found in certain fruits and vegetables, but they also can be manufactured. Compared to sugar, they aren't sweeter and some are actually less sweet. Sugar alcohols do have some calories but are lower in calories than regular sugar.

the FDA regulates the use of sugar alcohols. Despite their name, sugar alcohols are not “alcoholic.”

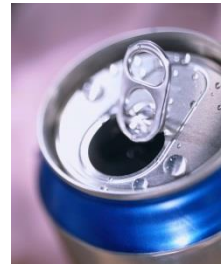
Artificial Sweeteners

Artificial sweeteners are also called low-calorie sweeteners or non-nutritive sweeteners. They are synthetic but can be created from naturally-occurring substances. They provide few calories because they can't be digested by our bodies (with the exception of aspartame).

These sweeteners are found in all sorts of products - diet drinks, baked goods, frozen desserts, candy, light yogurt, and chewing gum. You can buy them to use as tabletop sweeteners. Some are also available in "granular" versions for cooking and baking.

Artificial sweeteners can be used to sweeten food and drinks for less calories and carbohydrate when they replace sugar. The sweetening power of most artificial sweeteners is at least 100 times more intense than regular sugar, so only a small amount is needed.

Using artificial sweeteners is a personal choice. You may need to experiment with different sweeteners to find the right one for your needs.



Safety of Artificial Sweeteners

Artificial sweeteners are a hotly debated topic among consumers and researchers alike. Many people report negative health when they use artificial sweeteners (e.g., migraines, nausea, weight gain, mood swings, bitter aftertaste).

It is important to consider the weight of the evidence when deciding whether you want to use an artificial sweetener. Thus far, artificial sweeteners are not definitively linked to any major health problems in the general population.

The Academy of Nutrition and Dietetics conducted an in-depth review of the available studies and found that artificial sweeteners can help with weight management, prevent tooth decay and dental caries, and can help people with diabetes manage their blood sugar.

Before the government approves the use of any sweetener it carefully considers:

- How it is made
- Which foods it will be used in
- How much the average person will eat each day
- If it is potentially harmful to a person's health

The government then sets a limit for the amount that a person can safely consume based on their body weight. That limit is usually many times more than the average child will ever eat. For

example, a 40-pound child would need to eat 24 packets of aspartame or drink four 12-ounce cans of diet soda every day to reach this level.

This level is called the ADI (Acceptable Daily Intake). This is the maximum amount a person can consume everyday over their lifetime that is considered safe. Note that the ADI for artificial sweeteners is 100 times lower than the amount that might start to cause health problems. Most people consume less than 10% of the ADI for aspartame.

These are the four most commonly used artificial sweeteners that have been tested and approved by the U.S. Food and Drug Administration (FDA):

- ❖ acesulfame potassium (also called acesulfame K)
- ❖ aspartame
- ❖ saccharin
- ❖ sucralose

Acesulfame Potassium

Discovered in 1967, acesulfame potassium (also called acesulfame K or ace-K) is a no-calorie sweetener approximately 200 times sweeter than table sugar (sucrose). It has a clean, quickly perceptible sweet taste and excellent stability under high temperatures and good solubility.

Acesulfame K provides a synergistic sweetening effect when combined with other low- and no-calorie sweeteners such as sucralose and aspartame. Using blends of low- and no-calorie sweeteners not only helps give foods and beverages a more sugar-like taste, but also reduces the total amount of sweetener needed.

Products with acesulfame K can be found in about 90 different countries. It is used in thousands of foods and beverages, including tabletop sweeteners (under the brand names Sunette®, Sweet One®), desserts, puddings, baked goods, soft drinks, candies and canned foods. It is also used in oral hygiene and pharmaceutical products.

Aspartame

Aspartame is one of the most thoroughly studied food ingredients in the world. Permitted for use in more than 100 countries worldwide, it is found in hundreds of products ranging from chewing gum to toothpaste and table top sweeteners like Equal®.

The safety of aspartame was reaffirmed in December 2013 by the European Food Safety Authority (EFSA) following a comprehensive assessment of aspartame safety undertaken to address consumer concerns. The National Cancer Institute (NCI) and an independent international expert review panel have also confirmed that aspartame does not cause cancer, seizures or other health problems. An evidence-based research review by the [Academy of Nutrition and Dietetics](#) confirms aspartame does not increase appetite or food intake.



Aspartame is unique among low-calorie sweeteners in that it is completely broken down by the body into its components – the amino acids aspartic acid and phenylalanine, and a small amount of methanol. These components are found in much greater amounts in common foods, such as meat, milk, fruits, and vegetables, and are used by the body in the same ways whether they come from aspartame or common foods.

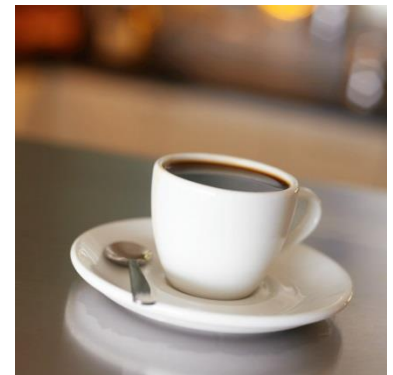
Since aspartame is made of amino acids which yield 4 calories per gram, it is technically a caloric sweetener. However, because it is nearly 200 times sweeter than sugar, a mere 190 milligrams (190 milligrams ~1 calorie) of aspartame has the same sweetening power as almost 40 grams (160 calories) of sugar.

Note that aspartame is not safe for use for a very small percentage of people. Some people have a genetic condition called PKU (phenylketonuria). Their bodies cannot metabolize the amino acid phenylalanine. All babies in the U.S. are tested for PKU at birth so you will already know if you have it or not.

Saccharin

Saccharin is a no-calorie sweetener 300 times sweeter than table sugar. It has been used as a no-calorie sweetener in foods and beverages for more than 100 years. Saccharin was used heavily during the sugar shortages of the two world wars, particularly in Europe.

Today saccharin is used in a wide range of low- and no-calorie and sugar-free foods and beverages, including tabletop sweeteners, baked goods, jams, chewing gum, canned fruit, candy, dessert toppings and salad dressings as well as cosmetic products, vitamins and pharmaceuticals. It is also used in tabletop sweeteners under the brand names Sweet n' Low®, Sugar Twin® and Necta Sweet®.



Saccharin has been the subject of extensive scientific research and is one of the most studied ingredients in the food supply. Extensive research on human populations confirms saccharin is safe for use by all populations, including children, and women who are pregnant or lactating. It is permitted for use in food and beverages in more than 100 countries around the world, including the United States. Saccharin has been reviewed and is regarded as safe by the Joint FAO/WHO Expert Committee on Food Additives (JECFA), the European Food Safety Authority (EFSA), and the U.S. Food and Drug Administration (FDA).

Today, health authorities around the world agree that saccharin is safe for human consumption. However, saccharin safety was questioned in the early 1970s after studies in male rats fed high doses of saccharin (equivalent to hundreds of cans of diet soft drinks a day for a lifetime) showed increased incidence of bladder cancer. Subsequent studies showed that the factors causing the

cancer in rats were specifically related to male rat urinary physiology and not applicable to humans. In addition, epidemiological studies also found no association between saccharin consumption and urinary bladder cancer in humans.

These factors, plus research conducted over the past 25 years that overwhelmingly demonstrates that saccharin does not cause cancer in humans, resulted in saccharin being “delisted” from the U.S. National Toxicology Program’s Report on Carcinogens in 2000.

Sucralose

Sucralose is a no-calorie sweetener 600 times sweeter than table sugar (sucrose). It was discovered in 1976 by researchers at Queen Elizabeth College, University of London, during a collaborative research program with the sugar producer Tate & Lyle, PLC. Sucralose is used as an ingredient in a broad range of foods and beverages and as a tabletop sweetener under the name Splenda®.

Sucralose is safe for the entire family, including children and women who are pregnant or breastfeeding. It is permitted for use in foods and beverages in nearly 80 countries including Canada, Australia and Mexico. Sucralose was approved for use in 15 food and beverage categories by the U.S. Food and Drug Administration (FDA) in April 1998 and as a “general purpose” sweetener in 1999. Like other low- and no-calorie sweeteners, sucralose is also suitable for individuals with diabetes.

Research demonstrates that it has no effect on carbohydrate metabolism, short- or long- term blood glucose control, or insulin secretion. Following its discovery, sucralose underwent extensive safety testing. More than 100 safety studies have been conducted over a 20-year period, with no safety concerns found. These studies include assessments for cancer, genetic damage, reproduction and fertility, birth defect, immunology, central nervous system, and metabolic assessments.

The safety of sucralose has been confirmed by leading medical, scientific and regulatory authorities around the world including, the U.S. Food and Drug Administration (FDA), the Joint FAO/WHO Expert Committee on Food Additives (JECFA), European Commission’s Scientific Committee on Food, Health Canada and Food Standards Australia/New Zealand.

Using Artificial Sweeteners in Cooking and Baking

For those with diabetes and anyone else looking to cut down on sugar, artificial sweeteners can be used in baking applications. There are scores of recipes available online or in cookbooks that have been developed for specific sweeteners. Be careful, though. Sweeteners are not always interchangeable because their levels of sweetness are different. Plus, they can't always simply replace sugar. This is because they differ in their sweetness and baking properties. Sugar can add volume, browning, moisture, and tenderness. Artificial sweeteners only add sweet taste.



To save time, money, and effort, it's best to use recipes that have been developed for the specific product you want to use. If you do want to experiment, make sure to keep records of your results for future reference. Note any changes in volume, browning, moisture, sweetness, and so on. In baked goods, try replacing half the sugar in the recipe with artificial sweetener. In cold or unbaked dishes, try replacing all the sugar in the recipe with artificial sweetener.

Some artificial sweeteners may leave an aftertaste, so try experimenting with different brands to see which you like best.

Artificial Sweeteners and Sugar-Free Products

Does sugar-free mean calorie-free? Not always. Sugar-free products may sound healthier, but they can still lead to weight gain if eaten in excess quantities. Just like everything else, sugar-free products and artificial sweeteners are perfectly fine in moderation and when enjoyed as such, unlikely to cause health problems. Always check the Nutrition Facts panel to know what you're getting.

References

- ❖ Academy of Nutrition and Dietetics
- ❖ American Diabetes Association
- ❖ American Heart Association
- ❖ The Beverage Institute for Health and Wellness
- ❖ Kansas State University Extension
- ❖ National Cancer Institute
- ❖ World Health Organization

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Non-Nutritive Sweeteners in Summary

Sweetener Name	Brand Names Found in Stores	Sweetness Compared to Sugar	Heat Stable?	ADI (acceptable daily intake)
Acesulfame Potassium	Sunette	200x	Yes – can be used for cooking/baking	15 mg/kg of body weight
	Sweet One			
Aspartame	Nutrasweet	220x	No – loses sweetness	50 mg/kg of body weight
	Equal			
Saccharin	Sweet 'N Low	200-700x	No – not used for cooking/baking	5 mg/kg of body weight
	Sweet Twin			
	Sugar Twin			
	Necta Sweet			
Sucralose	Splenda	600x	Yes – can be used for cooking/baking	5 mg/kg of body weight
Stevia/Rebaudioside A	A Sweet Leaf			5 mg/kg of body weight
	Sun Crystals			
	Steviva			
	Truvia			
	PureVia			

General Guidelines for Replacing Sugar with Non-Nutritive Sweeteners

Replace Sugar	Saccharin types ¹				Aspartame types ²			Acesulfame Potassium Packets	Sucralose Gran.	Truvia Pure Via Packets
	Packets	Gran.	Brown	Liquid	Packets	Gran.	Equal for Recipes			
1-2 tsp	1	1 tsp	1 tsp	1 drop	1	1-2 tsp	¼ tsp	1	1-2 tsp	½ - 1
¼cup	6	¼ cup	¼ cup	1½ tsp	6	¼ cup	1 ¾ tsp	3	¼ cup	6
⅓ cup	8	⅓ cup	⅓ cup	2 tsp	8	⅓ cup	2½ tsp	4	⅓ cup	8
½ cup	12	½ cup	½ cup	1 Tbsp	12	½ cup	3½ tsp	6	½ cup	12
1 cup	24	1 cup	1 cup	2 Tbsp	24	1 cup	7¼ tsp	12	1 cup	24
Heat stable	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Aftertaste	Yes	Yes	Yes	Yes	No	No	No	Some	No	Yes

1 Manufacturer does not recommend replacing more than ½ cup sugar with saccharin sweetener in baked recipes.

2 Contains phenylalanine. People with phenylketonuria must avoid this sweetener.

Check measurements on product packages for most accurate information. Remember that those products are not calorie-free at the amounts used in baking.