



What products are low-calorie sweeteners used in?

Diet soft drinks and tabletop sweeteners are the most popular of the thousands of low-calorie foods and beverages. Low-calorie sweeteners may be used in many foods or beverages, including: instant coffees and teas, ready-to-drink teas, powdered soft drink mixes, refrigerated and non-refrigerated fruit juice beverages, chewable multi-vitamins, cold cereals, chewing gum, breath mints, gelatins, puddings and fillings, dry mixes for dessert toppings, frozen desserts and novelties, yogurt-type products, baked goods, wine coolers, candies and pharmaceuticals.

Will the search for the ideal low-calorie sweetener continue?

None of the known sweeteners (both approved and yet-to-be-approved) is perfect for all uses. As long as the strong demand for low-calorie foods and beverages continues, the search for the perfect low-calorie sweetener will persist. And, until the ideal sweetener is discovered, consumers will depend on a variety of low-calorie sweeteners to satisfy their desire for something sweet but low in calories.

For more information on low-calorie sweeteners, visit www.caloriecontrol.org.



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SWEET *Choices*

Questions & Answers about Sweeteners
in Low-Calorie Foods and Beverages

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Why do people crave sweetness?

Research shows that people have an inborn desire for sweet taste, one of the four fundamental taste sensations. Newborn infants have been observed to react positively to sweetness. Also, studies with adults, as well as infants, have demonstrated that the pleasant response to sweet solutions is a reflex, innate reaction, rather than a learned response. Historical evidence, such as a 20,000-year-old cave painting of a neolithic man robbing a wild bees' nest, indicates that humans may always have had a preference for sweets. It also is likely that sweetness was used in early times as an indicator of safety in selecting foods. This phenomenon may have led to the search for sources of additional sweetness (sweeteners) to make foods more palatable.

How is the desire for sweetness satisfied?

Honey and fruits have long been sought out for their sweet taste; however, since it was first refined some 600 years ago, table sugar (sucrose) has been the standard for sweetness. Until recent decades, sucrose was virtually the only sweetener in general use. Currently, in the U.S., low-calorie sweeteners such as acesulfame potassium, aspartame, neotame, saccharin, and sucralose provide alternatives to sucrose. These sweeteners contribute few or no calories to the diet and are sweetening agents for low-calorie and sugar-free foods and beverages. In addition, polyols, or "sugar alcohols," are appropriate for use in sugar-free and reduced-calorie products since they are not sugars and have caloric values lower than sucrose. Tagatose is also suitable for sugar-free foods and beverages. It is a low carbohydrate functional sweetener, similar to fructose in structure and has only 1.5 calories per gram.

What is the ideal sweetener?

The ideal sweetener is as sweet or sweeter than sucrose and has a pleasant taste with no aftertaste. Consumer acceptance of a sweetener is closely linked to how similar its taste is to sugar. The ideal sweetener also is colorless, odorless, readily soluble, stable, functional, economically feasible and does not promote dental cavities. It is nontoxic and is either metabolized normally or excreted from the body unchanged without contributing to any metabolic abnormalities, such as diabetes. Currently, the availability of a variety of low-calorie sweeteners allows the use of sweeteners either alone or in combination to achieve the requirements of the ideal sweetener.



What is a "low-calorie" sweetener?

A low-calorie sweetener provides consumers with a sweet taste without the calories or carbohydrates that come with sugar and other caloric sweeteners. Some low-calorie sweeteners, such as aspartame, are "nutritive," but are low in calories because of their intense sweetness. For example, because aspartame is 200 times sweeter than sucrose, the amounts needed to achieve the desired sweetness are so small that aspartame is considered virtually non-caloric. Many non-nutritive sweeteners, such as saccharin, are non-caloric because they are not metabolized and pass through the body unchanged. Currently, acesulfame potassium, aspartame, neotame, saccharin and sucralose are the approved low-calorie sweeteners in the United States.

Is there a need for low-calorie sweeteners?

Without low-calorie sweeteners, many of the reduced-calorie and light products that are in such great demand today would not be possible. A recent national consumer survey shows that approximately 180 million Americans age 18 and over consume low-calorie/sugar-free foods and beverages — nearly double the number a decade ago. Manufacturers currently are providing consumers with an increasing variety of low-calorie food and beverage choices.

What are the benefits acesulfame potassium?

Acesulfame potassium (also known as acesulfame K) was approved by the U.S. Food & Drug Administration (FDA) in 1988. It is a non-caloric sweetener and has a clean sweet taste that is 200 times sweeter than sugar. Acesulfame potassium's high degree of stability when exposed to heat and in liquids makes it a versatile sweetener with potential use in a wide range of foods and beverages. Acesulfame potassium may be combined with other low-calorie sweeteners resulting in a synergistic effect (the combination of the sweeteners is sweeter than the sum of the individual sweeteners) that provide improved taste profiles.

Is acesulfame potassium safe?

Acesulfame potassium's safety is supported by more than 90 studies conducted over 15 years. In addition to the U.S., it has been reviewed and determined safe by regulatory authorities in about 90 countries — including Canada, the United Kingdom, France, Switzerland, Italy and Belgium — by the Joint Expert Committee on Food Additives of the World Health Organization, and by the Scientific Committee for Food of the European Union. Acesulfame k received a general use approval from the FDA in 2003.



What are the benefits of aspartame?

In addition to being low in calories, aspartame tastes very similar to sugar. It is 200 times sweeter than sugar and is appropriate for many food applications. Aspartame also enhances some flavors, especially fruit flavors, and when combined with other sweeteners, it has a synergistic sweetening effect. Aspartame loses sweetness with prolonged exposure to high temperatures of oven or range heat and over an extended period of time in liquids — but this is not a safety issue. It can be added successfully to recipes available from the manufacturers of these sweeteners. Aspartame tabletop sweeteners may also be added to some recipes at the end of heating to maintain sweetness.

Is aspartame safe?

Aspartame has been extensively studied in animals and humans for more than two decades in more than 200 studies. When FDA approved aspartame, it noted: “Few compounds have withstood such detailed testing and repeated, close scrutiny, and the process through which aspartame has gone should provide the public with additional confidence of its safety.” Persons born with a rare genetic disease called phenylketonuria (PKU), numbering about 15,000 in the total U.S. population, know to restrict their intake of phenylalanine from all dietary sources. Because aspartame-containing products are a source of phenylalanine in the diet, they carry the labeling, “Phenylketonurics: Contains Phenylalanine.” It should be noted, however, that phenylalanine is found in much greater quantities in meats, milk and other protein foods. In addition to the FDA, the Joint Expert Committee on Food Additives of the World Health Organization, the Scientific Committee for Food of the European Union, and regulatory agencies in more than 100 countries have reviewed aspartame and found it safe for use. Additionally, a number of health groups, including the American Medical Association, the American Diabetes Association and the American Academy of Pediatrics Committee on Nutrition, have issued statements in support of aspartame.

What are the benefits of neotame?

Neotame is a non-caloric sweetener and is approximately 30-40 times sweeter than aspartame; 7,000-13,000 times sweeter than sugar. Neotame has a clean, sweet taste like sucrose and unique flavor enhancement properties. At projected trace levels of use, neotame will provide a full, sweet taste in foods and beverages. Neotame received a general use approval from the FDA in 2002.

What are the benefits of saccharin?

Saccharin, the oldest of the approved low-calorie sweeteners, continues to be important for a wide range of food and beverage applications. It is a very stable sweetener allowing for good product shelf life and, like aspartame, has a synergistic sweetening effect when combined with other sweeteners. Saccharin is 300 times sweeter than sucrose.

Is saccharin safe?

Nearly a century of use in the food supply has allowed studies to determine if saccharin poses a risk to humans. More than 30 human studies have been completed and overwhelmingly support saccharin's safety. Additionally, the extensive research on saccharin has been reviewed by many in the scientific community and by national health groups. These reviews have led to significant statements in support of saccharin. In May 2000, the National Toxicology Program (NTP) released its 9th Report on Carcinogens and announced that saccharin had been delisted from its list of potential carcinogens. And, on December 21, 2000, President Clinton signed federal legislation to remove the saccharin warning label that had been required on saccharin-sweetened foods and beverages in the U.S. since 1977 — ending any remaining controversy on the safety of saccharin.



What are the benefits of sucralose?

Sucralose is a non-caloric sweetener created from sugar. Sucralose is made by a patented, multi-step process that starts with sugar (sucrose) and replaces three hydrogen-oxygen groups on the sugar molecule with three chlorine atoms. This results in a stable sweetener that tastes like sugar, but is calorie-free. Its unique combination of sugar-like taste and excellent stability allows sucralose to be used as a sugar replacement in virtually every type of food and beverage. It is 600 times sweeter than sugar, so very little is needed to obtain the same sweetness intensity. On April 1, 1998, the FDA approved sucralose for use in 15 different food and beverage categories. Sucralose received a general use approval from the FDA in 1999.



Is sucralose safe?

The safety of sucralose is documented by an extensive and thorough safety testing program. More than 100 studies conducted and evaluated over a 20-year period clearly demonstrate the safety of sucralose. Studies were conducted in a broad range of areas to assess whether there were any safety risks regarding cancer, genetic effects, reproduc-

tion and fertility, birth defects, immunology, the central nervous system, and metabolism. Conclusions from the studies showed no known side effects.

Why is there a need for more than one low-calorie sweetener?

The availability of a variety of sweeteners greatly increases low-calorie product choices. With several low-calorie sweeteners available, each can be used in the applications for which it is best suited. Also, by having a variety of sweeteners from which to choose, manufacturers can overcome sweetener limitations by using them in combination. Using the most appropriate sweetener, or combination of sweeteners, for a given product is known as the “multiple sweetener approach.”



How does the “multiple sweetener approach” benefit consumers?

The multiple sweetener approach allows the low-calorie food and beverage industry to meet the growing consumer demand for additional good-tasting, reduced-calorie products. A limited choice of sweeteners results in limited options for the consumer. Research has shown that certain low-calorie sweeteners perform better in some products than in others. A wide variety of low-calorie sweeteners provides products with improved taste, increased stability, lower manufacturing costs, and ultimately more choices for the consumer.

Is there an advantage to using more than one sweetener in a product?

Low-calorie sweeteners are synergistic, meaning that when one sweetener is combined with another, the resulting sweetness is greater than the sum of the individual sweeteners. In certain products, blending sweeteners can provide improved taste as well as economic and stability advantages.

What additional low-calorie sweeteners might be available in the future?

Low-calorie sweeteners that may be available in the U.S. in the future include alitame and cyclamate. A petition has been filed with the FDA for approval of a promising new low-calorie sweetener, alitame. Alitame is a highly intense sweetener (2000 times sweeter than sucrose). It has a sugar-like taste and offers good heat stability. Alitame is well suited for use in a broad array of food products, including beverages, frozen desserts and baked goods. Alitame is approved for use in a variety of food and beverage products in Australia, New Zealand, Mexico and the People's Republic of China. Approval also is being sought worldwide. A petition for cyclamate's reapproval also is under review by FDA. If cyclamate is reapproved, it will be used in combination with other sweeteners for most uses due to its relatively low sweetness intensity (30 times sweeter than sucrose). Cyclamate is approved for use in more than 50 countries worldwide.

What quantities of low-calorie sweeteners are consumed each year?

The amounts of low-calorie sweeteners consumed per capita are relatively very small, mainly because of their intense sweetness. Statistics from the U.S. Department of Agriculture show that the average combined consumption of low-calorie sweeteners is less than two ounces per person per year.

How do low-calorie sweeteners receive regulatory approval?

Before a low-calorie sweetener is approved for commercial use, it must undergo extensive testing (which can cost millions of dollars) and years of regulatory scrutiny. U.S. food safety laws prohibit FDA from approving a low-calorie sweetener (or any food ingredient) that has not been shown to be "safe," which the agency defines as "a reasonable certainty in the minds of competent scientists that the substance is not harmful under the intended conditions of use."

The burden of demonstrating safety is on the petitioner requesting approval. The petitioner is required to provide FDA with extensive data, including the name, chemical identity and composition of the sweetener, the physical or other technical effects the sweetener is intended to produce, and comprehensive reports of research concerning safety. In addition to scientific evidence, FDA also considers projected consumption levels, as well as specific use levels requested in the petition.

Do consumers want reduced-calorie foods and beverages?

There has been a steady and significant increase in consumer demand for reduced-calorie products. Interestingly, a national consumer survey revealed that, despite the wide variety of reduced-calorie products available, nearly half the consumers of these products would like to see additional low-calorie foods and beverages in the marketplace. More than thirty-three percent of Americans are on a diet and more than half are trying to control their weight. For most dieters, the use of low-calorie food and beverage options is an important element of their weight-control strategy.



Why do people consume low-calorie products?

Low-calorie products provide consumers with many benefits. Whether by choice or necessity, millions of Americans restrict their intake of calories, carbohydrates and fats. According to opinion research, most people consume low-calorie products to stay in better overall health, eat or drink healthier foods and beverages, maintain weight, reduce weight or maintain an attractive physical appearance. Research also shows that health professionals believe low-calorie sweeteners are especially beneficial to overweight individuals and those with diabetes. Low-calorie sweeteners also do not promote dental cavities.

Are low-calorie foods and beverages useful in controlling weight?

As part of an overall sensible weight-control program, low-calorie foods and beverages can help consumers control calories and therefore control weight. Health professionals agree that the key to losing weight is to burn more calories than are consumed, either by increasing physical activity or consuming fewer calories — or, preferably, both. Low-calorie foods and beverages provide consumers an alternative to higher-calorie products. Recent studies support the effectiveness of low-calorie sweeteners in controlling caloric intake. In one study, researchers at Harvard Medical School concluded that aspartame “is a valuable adjunct to a comprehensive program of balanced diet, exercise and behavior modifications for losing weight.” Health professionals are increasingly reminding Americans that “calories still count” — foods and beverages containing low-calorie sweeteners can increase the variety of reduced-calorie choices in the diet.



Do low-calorie sweeteners perpetuate and increase the appetite?

No. In 1987, Dr. Barbara Rolls investigated the effect of aspartame versus sucrose on hunger and satiety and found that hunger was suppressed equally by both desserts over the past hour, but there was no compensation for the caloric difference when additional food was offered an hour later. In a subsequent study, Rolls et al., covertly substituted aspartame for sugar in gelatin or pudding preloads served to normal-weight adults two hours before a self-selection meal. Half of the 32 subjects were aware of the caloric manipulation, half were not. Both informed and uninformed subjects consumed significantly fewer calories from the aspartame preloads compared with the sucrose preloads. Awareness of the low caloric content of the aspartame-containing preloads did not cause these subjects to eat more at the subsequent meal. The researchers concluded: “Aspartame-sweetened foods can be of benefit in reducing hunger and increasing satiety.” In addition, a study conducted by Dr. Madeleine Sigman-Grant, Ph.D., R. D., found that people who use low-calorie, sugar-free foods and beverages have better quality diets. Researchers stud-

ied more than 1,000 adults and found that those who incorporated reduced-calorie products consumed more vitamins and minerals such as calcium, fiber, iron and more in their diets. Thus, the researchers found while participants were eating fewer calories overall, they were also eating more healthfully.

How many calories can be saved by using low-calorie, sugar-free products?

The following chart provides some examples.

Product	Calories with *Sugar	Calories with Low-Calorie Sweetener*	Calories Saved
Soft drink (12 oz.)	150	0	150
Lemonade (8 oz.)	102	4	98
Coffee (1 cup)	35	5	30
Strawberry yogurt (1 cup)	230	100	130
Vanilla ice cream (1/2 cup)	170	90	80
Gelatin dessert (1/2 cup)	70	10	60
Chocolate pudding (1/2 cup)	160	80	80

**Estimate*