



Nonnutritive Sweeteners: Are They Safe?

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Introduction

Cravings for a sweet treat come from time to time, and it can be frustrating to try to balance taste and calories. Luckily, science has made products that allow for the enjoyment of decadent foods with fewer calories.

One option is to substitute low-sugar products — such as fresh fruit, low-fat or fat-free milk, homemade snack mixes, and low-fat or fat-free yogurt or frozen yogurt — for high-sugar choices. Another is to use nonnutritive sweeteners (NNS; also known as sugar substitutes, low-calorie sweeteners, or artificial sweeteners). They taste similar to sugar, contain little to no calories, and do not provide many vital nutrients. Nonnutritive sweeteners are much sweeter than sugar — hundreds to thousands of times sweeter — so only a small amount is needed to sweeten foods and beverages. Typically, food producers combine more than one NNS to sweeten products.

Health Effects

Some NNS have gotten a bad name with claims that they cause cancer, but there is no clear evidence to suggest this.

Some nonnutritive sweeteners have gotten a bad name with claims that they cause cancer, behavioral and mood changes, and increased appetite. However, an examination of the science behind these claims has found no

clear evidence to support them. The U.S. Food and Drug Administration reviewed these studies and considers some NNS to be safe.

In addition, the Academy of Nutrition and Dietetics, American Diabetes Association, American Heart Association, and National Cancer Institute consider the use of NNS to be safe and not to pose an increased cancer risk (ADA 2008; Fitch and Keim 2012; NCI 2009) or negatively influence behavior, increase appetite, or affect the health of nursing or pregnant women when used as intended (Fitch and Keim 2012; American Dietetic Association 2004). Many of these organizations also agree that — when used in moderation and not in place of other wholesome, nutritious foods — NNS can be part of a healthy diet (ADA 2008; Fitch and Keim 2012; Gardner et al. 2012).

Acceptable Daily Intake

The acceptable daily intake is the amount of a substance found in a food or beverage that can be consumed every day over a lifetime without causing any ill effects.

Before going further, there is one piece of information that can help with understanding NNS: The FDA sets the acceptable daily intake for substances added to foods and beverages, such as NNS. The ADI is the amount of one of these substances that can be consumed

every day over a lifetime without having any ill effects (Fitch and Keim 2012; Gardner et al. 2012). Getting to the ADI level is fairly difficult considering that most products do not use only one NNS, but many.

Examples of NNS

[Acesulfame potassium is found in many products and is typically used in combination with other NNS because of its bitter taste when used alone.](#)

Acesulfame potassium or acesulfame K/ace K (Sweet One) – Approved by the FDA in 1988, acesulfame K is a sweetener found in many foods, beverages, and other products. It is about 200 times sweeter than sugar. It is typically used in combination with other NNS because alone, it is very bitter. The body gets rid of about 95 percent of acesulfame K. It can handle heat, so it is OK for cooking. Some time ago, this NNS was thought to cause tumors in rats when they ate a large amount of it; however, the FDA looked into these studies and found that the tumors were no different than would normally be expected in rats. In other words, the tumors were not caused by acesulfame K (FDA 2003). The Academy of Nutrition and Dietetics, American Diabetes Association, American Heart Association, and FDA all consider acesulfame K safe for humans — including those with diabetes and women who are nursing or pregnant — when consumed in reasonable amounts (American Dietetic Association 2004; Gardner et al. 2012; IFIC 2009). Drinking more than 25 cans of soda sweetened with pure acesulfame K or eating more than 20 packets of ace K a day for a lifetime would equal the ADI for a 150-pound person (see table; Gardner et al. 2012).

Acesulfame K can be found in pharmaceuticals, diet beverages, fruit juice, ice cream, chewing gum, toothpaste, yogurt, cereal, soup, vitamin supplements, salad dressing and other condiments, and mouthwash.

[Individuals with Phenylketonuria must be cautious with aspartame, but it is considered safe for the general public.](#)

Aspartame (NutraSweet, Equal) – Aspartame is probably the most debated NNS on the market because, when consumed, aspartame is broken down into amino acids and an alcohol called methanol. When methanol

is in the body, it can change into formic acid, which can be toxic — but only at very high levels. Even if formic acid levels started rising, the body would rid itself of the excess through urine.

The legitimate concern with aspartame is for people with a rare genetic disease called phenylketonuria. When the human body breaks down aspartame, one of the amino acids formed is called phenylalanine. While this is fine for most people, it can be toxic for those with phenylketonuria. This is why the packaging of beverages and foods that contain aspartame have the statement “Phenylketonurics: Contains phenylalanine.”

Aspartame provides some good sweetening power, being 160 to 220 times sweeter than sugar. To equal the ADI, a 150-pound person would need to drink about 14 cans of soda sweetened only with aspartame each day or eat 68 packets of aspartame per day for their whole life (see table; Gardner et al. 2012).

Some common products with aspartame are yogurt, diet beverages, chewing gum, syrups, juice blends, jams and jellies, “low-carb” products, ice cream, dairy products, flavored water, and many others.

[Luo han guo is a newer NNS that comes from monk fruit, a vine found in Southern China.](#)

Luo han guo (Go-Luo, Fruit Sweetness, Nectresse) – Also known as monk fruit extract, this more recently approved sweetener comes from a vine in Southern China and is made up of sugar and nonsugar molecules. It is about 150 to 300 times sweeter than sugar and may be used in cooking and baking. Because it is so new, not much is known about it; however, that may change in the coming years.

Food manufacturers such as Kashi and Vitalicious use this sweetener.

[Neotame is chemically similar to aspartame but is a NNS powerhouse that is 7,000 to 13,000 times sweeter than sugar.](#)

Nonnutritive/artificial sweetener reference.

Scientific name	Brand name	No. of times sweeter than sugar	Safe in humans?	Use in cooking and baking?	Year FDA approved	Cans of soda per day to equal ADI ^{b,c}	Packets of sweetener per day to equal ADI ^{b,c}
Acesulfame potassium, ace K, acesulfame K	Sweet One	200	Yes	Yes	1988	25	20
Aspartame	NutraSweet, Equal	160-220	Yes	No	1981	14	68
Luo han guo	Go-Luo, Fruit Sweetness, and Nectresse	150-300	Yes ^a	Yes	2009, 2011, and 2012	Information not currently available	
Neotame	—	7,000-13,000	Yes	Yes	2002	Information not currently available	
Saccharin	Sweet'N Low	300	Yes	Yes	Before 1958	42	8.5
Stevia extract, stevia leaf extract, rebiana	Pure Via, Truvia, Sun Crystals, Stevia in the Raw, Enliten, SweetLeaf	250	Yes	Yes	2008	16	30
Sucralose	Splenda	600	Yes	Yes	1999	15	30

^a The FDA considers Go-Luo, Fruit Sweetness, and Nectresse to be “generally recognized as safe,” which means that when these products are used for their intended purposes, experts believe they will not cause harm or problems. For more information, see www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/.

^b ADI (acceptable daily intake): The amount of a substance found in either a food or beverage that a person can consume over a lifetime without having any ill effects.

^c Information adapted from Gardner et al (2012).

Neotame – Neotame is an NNS not often seen in foods and beverages, but it was approved in 2002 and is chemically similar to aspartame. It is about 7,000 to 13,000 times sweeter than sugar and is shelf-stable (Fitch and Keim 2012). Countries on other continents, such as Australia, Asia, South America, and Europe have tested neotame and found it to be safe.

Neotame can be used in chewing gum, baked goods, cereals, yogurt, beverages, and frozen desserts (American Dietetic Association 2004).

Saccharin was thought to cause cancer, but the FDA looked further into the claims and concluded that there was no evidence to support them.

Saccharin (Sweet’N Low) – This NNS has been around the longest and is about 300 times sweeter than sugar. A study in the 1970s said saccharin caused cancer in rats, which led to its reputation for being unsafe. The FDA banned it and labeling requirements were made to inform the public that using saccharin had been linked with cancer in animals. In 2000, after reviewing the research linking cancer to saccharin and considering that humans and animals are different biologically, saccharin was declared safe and warning labels are no longer needed on products containing this sweetener.

A 150-pound person would have to drink about 42 cans of soda sweetened with pure saccharin each day for the rest of their life to equate the ADI (see table; Gardner et al. 2012).

Saccharin can be found in toothpaste, diet beverages, mouth rinse, jams, chewing gum, and salad dressing and other condiments.

Stevia is also known as rebiana, rebaudioside A/reb A, stevioside, or steviol glycosides and is considered “natural” because it comes from the *stevia rebaudiana* plant.

Stevia (Truvia, Sweet Crystals, Stevia in the Raw, Enlighten, PureVia, SweetLeaf) – Also known as or seen in ingredient lists as rebiana, rebaudioside A/reb A, stevioside, or steviol glycosides, stevia is one of the newer NNS on the market. It comes from leaves of a plant called the *Stevia rebaudiana*, and the FDA has

approved its refined form (what is typically sold). It is about 250 times sweeter than sugar and is calorie-free. Because it is fairly new, a limited amount of research is available on stevia and its role in weight management, diabetes, and appetite. It is shelf-stable, so it may stay sweeter longer than some other NNS.

Drinking 16 cans of soda sweetened only with stevia or eating 30 packets of stevia daily for a lifetime would equal the ADI for a 150-pound person (see table; Gardner et al. 2012).

Stevia is found in some flavored water, juices, and diet beverages.

Sucralose itself does not have calories, but the other ingredients used as fillers with the sweetener provide four calories per packet.

Sucralose (Splenda) – Approved by the FDA in 1998, this sweetener is known as the “no-calorie sweetener;” however, it does contain approximately four calories per packet. The calories come from two other ingredients used as fillers in the product (i.e., dextrose and maltodextrin), but sucralose — the sweetening ingredient in Splenda — does not have any calories and is not completely absorbed by humans. It is eliminated through urine and feces.

Sucralose actually starts as cane sugar with modest sweetness, but through some clever scientific techniques, it ends up being 600 times sweeter than sugar. It is heat-stable, meaning it can be used in cooking and baking, and it also has a long shelf life.

In order to equal the ADI, a 150-pound person would have to eat about 30 packets of pure sucralose or drink about 15 cans of soda sweetened only with sucralose each day for the rest of their life (see table; Gardner et al. 2012).

Some foods and beverages with sucralose are diet sodas, ice cream, sugar-free drinks, pudding, syrups, juices, salad dressing, and some nutrition bars (e.g., PowerBar).

Summary

When used as intended, nonnutritive sweeteners can be part of a balanced, healthy diet for adults. They are also considered safe for children and pregnant and nursing women, although some people feel uncomfortable about consuming “artificial” additives rather than “natural” ingredients during these times. It’s important that products with nonnutritive sweeteners are not replacing more wholesome foods in the diet, assuring adequate nutrients needed to promote health and longevity.

Additional Resources and Information

Cut Back on Your Kid’s Sweet Treats: 10 Tips to Decrease Added Sugars, 2011. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. 10 Tips Nutrition Education Series, DG TipSheet No. 13. www.choosemyplate.gov/food-groups/downloads/TenTips/DGTipsheet13CutBackOnSweetTreats.pdf

Make Better Beverage Choices: 10 Tips to Get Started, 2012. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. 10 Tips Nutrition Education Series, DG TipSheet No. 19. 2012. www.choosemyplate.gov/food-groups/downloads/TenTips/DGTipsheet19MakeBetterBeverageChoices.pdf

Make Celebrations Fun, Healthy & Active: 10 Tips to Creating Healthy, Active Events, 2012. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. 10 Tips Nutrition Education Series, DG TipSheet No. 20. www.choosemyplate.gov/food-groups/downloads/TenTips/DGTipsheet20MakeCelebrations.pdf

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