Artificial Sweeteners: No Calories ... Sweet!

Artificial sweeteners can help consumers cut down on calories and control weight, help to manage chronic conditions such as diabetes, and potentially prevent cavities, according to the American Dietetic Association (ADA).

To date, five artificial sweeteners are approved by the Food and Drug Administration: aspartame, saccharin, acesulfame-K, neotame, and sucralose. The agency regulates artificial sweeteners as food additives, which must be approved as safe before they can be marketed.

"The FDA evaluates a sweetener's composition and properties, how much of the substance is likely to be consumed, and various types of safety studies," says Laura Tarantino, Ph.D., director of the Office of Food Additive Safety in the FDA's Center for Food Safety and Applied Nutrition.

For each of the approved sweeteners, the typical amount used by U.S. consumers is well within designated "acceptable daily intake levels (ADI)," or levels that can be consumed safely every day over a lifetime. Here's a detailed look at each of the sweeteners.

Aspartame

Aspartame is 200 times sweeter than sugar. It has a caloric value similar to sugar (4 kcal/g), but the amounts used are small enough to consider aspartame essentially free of calories. Brand names include NutraSweet and Equal. Aspartame was first approved by the FDA in 1981 as a tabletop sweetener, and for use in gum, breakfast cereal, and other dry products. The use of aspartame was expanded to sodas in 1983, and then to use as a general-purpose sweetener in all foods and drinks in 1996.

Before approval, the FDA reviewed numerous studies showing that aspartame did not cause cancer or other adverse effects in laboratory animals. "This included three studies in which rats were fed aspartame in proportions more than 100 times higher than humans would likely consume," Tarantino says.

In the mid-1990s, a researcher raised concerns that a rise in brain cancer incidence in the United States was linked to aspartame use. According to FDA experts, there is no scientific evidence supporting a link between aspartame and any type of cancer. The National Toxicology Program, part of the U.S. Department of Health and Human Services, also conducted aspartame studies in mice and found no cancer link.

In 2005, the European Ramazzini Foundation (ERF) published new findings of a long-term feeding study on aspartame in rats. ERF scientists concluded that aspartame causes leukemia and lymphoma and that current uses of aspartame should be reevaluated. After reviewing the study data, however, the European Food Safety Authority (EFSA) released a statement in May 2006 that said the ERF's conclusion was not supported by the data. After learning of the ERF study results, the FDA requested the study data and received a portion of the data in February 2006. The FDA will announce its conclusions after completing its review.

"At this time, our position that aspartame is safe is based on the large body of information previously reviewed," Tarantino says. "Our conclusions are based on a detailed review of more than 100 toxicological and clinical studies on safety."

When ingested, aspartame is converted in the body to methanol and two amino acids--aspartic acid and phenylalanine. Tarantino says, "These substances are produced in much greater amounts in other common foods."

Because of the phenylalanine component, aspartame does carry a risk for people with the rare genetic disorder phenylketonuria. People who have this disorder should avoid or restrict aspartame use because of their body's difficulty in metabolizing phenylalanine. Its use can cause phenylalanine to build up in the blood at higher levels than normal. The aspartame regulation requires that a statement be placed on the label of all products containing aspartame specifically to alert phenylketonurics of the presence of phenylalanine.

Saccharin

Saccharin is 200 to 700 times sweeter than sugar and has no calories. Brand names include Sweet'N Low, Sweet Twin, and Necta Sweet. Saccharin is used in tabletop sweeteners, baked goods, soft drinks, jams, and chewing gum.

Saccharin was discovered in 1879 and had been considered generally recognized as safe (GRAS) until 1972, when it was removed from the GRAS list by the FDA. By definition in the law, a GRAS substance has a long history of safe use in foods, or is determined to be safe based on proven science. But if new evidence suggests that a GRAS substance may no longer be safe, the FDA can prohibit its use or require further safety studies.

In 1977, the FDA proposed a ban on saccharin because of concerns about rats that developed bladder cancer after receiving high doses of saccharin. In response, Congress passed the Saccharin Study and Labeling Act. This legislation put a moratorium on the ban while more safety studies were under way. Also, foods containing saccharin were required to carry a label warning that the sweetener could be a health hazard and that it was found to cause cancer in laboratory animals. Saccharin has been the subject of more than 30 studies in humans.

According to the National Cancer Institute, further studies showed that saccharin did not cause cancer in humans, and that the bladder tumors in rats were related to a mechanism that isn't relevant for humans.

In 2000, the National Toxicology Program determined that saccharin should no longer be listed as a potential cancer-causing agent. Federal legislation followed in 2001, removing the requirement for the saccharin warning label.

Acesulfame-K (potassium)

Acesulfame-K is 200 times sweeter than sugar, with zero calories. Brand names include Sunett and Sweet One. Acesulfame-K was first approved by the FDA in 1988 for specific uses, including as a tabletop sweetener. The FDA approved the sweetener in 1998 for use in beverages. In December 2003, it was approved for general use in foods, but not in meat or poultry. Acesulfame-K can be found in baked goods, frozen desserts, candies, beverages, cough drops, and breath mints.

The FDA and the Food and Agriculture Organization/World Health Organization (FAO/WHO) Joint Expert Committee on Food Additives have evaluated the sweetener's safety. "More than 90 studies support the safety of acesulfame-K," Tarantino says.

Neotame

Neotame is 7,000 to 13,000 times sweeter than sugar, depending on how it's used in food, and has no calories. The FDA approved neotame in 2002 as a general-purpose sweetener in a wide variety of food products other than meat or poultry. It has been approved for use in baked goods, soft drinks, chewing gum, frosting, frozen desserts, jams, jellies, gelatins, puddings, processed fruit and fruit juices, toppings, and syrups.

Tarantino says that neotame is structurally similar to aspartame. "The potential release of phenylalanine from neotame is so limited that a warning for phenylketonuric-type individuals isn't warranted," she says.

The FDA reviewed data from more than 100 animal and human studies on neotame. These studies evaluated cancer-causing, reproductive, and neurological effects. "Based on a thorough evaluation of the data, there are no adverse effects anticipated when neotame is ingested at levels that are used in foods," Tarantino says.

Sucralose

Sucralose is 600 times sweeter than sugar on average and has no calories. Although sucralose is made from table sugar, it adds no calories because it isn't digested in the body. The brand name is Splenda. After reviewing more than 110 animal and human studies, the FDA approved sucralose in 1998 for use in 15 food categories, including as a tabletop sweetener and for use in products such as beverages, chewing gum, frozen desserts, fruit juices, and gelatins. In 1999, the FDA allowed sucralose as a general-purpose sweetener in all foods.