

The Truth about Artificial Sweeteners or Sugar Substitutes

How Much Is Too Much?

Presented by the ADA Evidence Analysis Library®



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The Truth About Artificial Sweeteners or Sugar Substitutes: How Much Is Too Much? is presented by the ADA Evidence Analysis Library® (EAL).

The EAL® is an online library within the American Dietetic Association that provides information on many topics related to disease, nutrition and life cycle for health professionals, especially Registered Dietitians. This information is gathered from thousands of research articles, which are reviewed by experts in nutrition and health. Once reviewed, the experts make conclusions based on what was found in the research. These conclusions are used by health professionals and Registered Dietitians alike to teach their patients and clients how to live and maintain a better lifestyle, based on the latest research.

The Truth About Artificial Sweeteners or Sugar Substitutes

How Much Is Too Much?

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Introduction

Who doesn't at least occasionally crave a sweet treat? Maybe it's a morning macchiato, a mid-afternoon cola, or to wind things down, a bowl of Extreme Chocolate Fudge Brownie Overload with Caramel Swirl ice cream. Regardless of your favorite confectionary indulgences, we're actually born with a sweet tooth. This might explain Americans' excessive consumption of sugar —22 teaspoons a day equaling 355 calories. (NHANES Survey 2001-04). Recognizing our desire for sweet flavors, the food industry has developed and supplied sugar free alternatives designed to satisfy our cravings, referred to as sugar substitutes, artificial sweeteners or non-nutritive sweeteners. Do these really help with weight loss or managing blood sugar levels in conditions such as diabetes? Or do they actually increase appetite and weight, as some have claimed? Who's right? Let's take a look at the different types of sugar substitutes and their potential effectiveness in helping us manage weight and other medical conditions. Furthermore, artificial sweeteners or low/no calorie sugar substitutes have sparked much controversy and debate. Some have alleged that these sugar substitutes negatively affect behavior and mood, or could even be "toxic." But is there any scientific research that documents adverse effects, or is it only anecdotal? And how much sweetener is too much? Find out using our [interactive calculator](http://www.nafwa.org/sweetener.php) (available at: www.nafwa.org/sweetener.php)! Finally, we'll review some tips and resources regarding the use of sugar substitutes.

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Sugar Substitutes & Their Uses

Sugar substitutes refer to substances that have little to no calories or other nutrients. You may be familiar with various product names for example Equal® (which can contain aspartame), or Splenda® which contains sucralose, or Truvia™, which contains stevia. We are going to review the sugar substitute ingredients approved by the US Federal Drug Administration (FDA), the agency that regulates our food safety. More about the approval process, adverse effects, and recommended intake limits will be covered later. Right now, let's review some characteristics of the sweetener ingredients.



Saccharin, or where it all started

Once the leader of sugar substitutes, saccharin was discovered in the late 1800s at Johns Hopkins University by a scientist working on a coal-tar derivative. Recognizing the possibilities, the scientist-turned-entrepreneur patented and marketed saccharin as an "all-purpose curative." Initially sold in a New York City shop, saccharin was used by doctors to treat headaches, nausea, and overweight. The "miracle" product, 300 times sweeter than sugar, enjoyed high sales, and eventually entered the food industry and, eventually, consumers' homes. We've been using it ever since as a tabletop sweetener, in baked goods, jams, chewing gum, canned fruit, candy, dessert toppings and salad dressings.

Aspartame

One of the most debated sweeteners, Aspartame, was discovered in 1965 and was approved by the FDA as a dry ingredient in foods (table top sweeteners, gelatins, etc.) in 1981, and since then, has been used in a variety of foods. Aspartame is about 200 times sweeter than table sugar and is one of the most commonly used sweeteners today.

Acesulfame-K

Acesulfame-K is also 200 times sweeter than sugar with each table top packet containing the sweetness of two teaspoons of sugar. An advantage of this one is that it does not break down in heat so it can be used in cooking or baking. Some sugar substitutes tend to break down when subjected to heat, leaving an off-taste. Approved in 1998 by the FDA, the "K" in acesulfame-K refers to the mineral potassium, which is naturally found in our bodies. Studies show that 95% of the consumed sweetener basically ends up excreted in the urine because the body can't break it down.

Sucralose

Ironically, sucralose starts out as cane sugar but ends up 600 times sweeter than table sugar. It came on the scene in 1976 and was approved by the FDA in 1999. After some laboratory wizardry which changes the sugar molecule, its structure now prevents it from being absorbed by the body so that it's eliminated through the urine and feces. The result? No calories! Like Acesulfame-K, sucralose is also heat stable making it a superb sweetener



for cooking and baking. Another advantage is its long shelf life. It retains its sweetness significantly longer than aspartame, for example, which can break down over time.

Neotame™

Manufactured by the NutraSweet Company and approved by the FDA in 2002, neotame is sweeter than aspartame and 7,000-13,000 times sweeter than sugar. This could be a super sweet deal for food and beverage manufacturers—all the sweetness of sugar without a metallic after-taste plus at a fraction of the amount of sweetener needed compared to other sugar substitutes. Neotame is approved for use across many food categories, including beverages, dairy products, frozen desserts, baked goods, and gums. Like sucralose, it can also be used in baked goods. It is **not** available for consumer purchase at this time.

Stevia

Stevie who? Stevia was first introduced outside the United States, and has become a popular sweetener in recent years. This “natural” sweetener (as it’s marketed) comes from the leaves of the Stevia Rebaudiana Bertoni bush native to Central and South America. (Note: there is no FDA definition or standard for the term “natural.”) Two forms can be extracted from the plant: Reb A and stevioside. Both are 200-300 times sweeter than sugar and are calorie-free but only highly purified Reb A has been generally recognized as safe [GRAS] by the FDA in 2008 for use as a tabletop sweetener and in prepared foods. This is because there have been no adverse effects reported.

Effect on Weight, Appetite and Food, and Nutrient Intake



What Works?

Adults

The majority of studies comparing effects of sugar substitutes on weight have shown that they may help you reduce calories and may even help you shed a few pounds. Using sugar substitutes in place of sugary foods and beverages may also help prevent unwanted weight gain.

In one 10-week study¹ of non-dieting, overweight adults, the subjects were split into two groups and told to eat what they normally would. However, one group was told to substitute their normally calorically-sweetened foods and beverages with artificially sweetened ones while the other sugared up with the real deal. At the end of the study, the sugar group downed three times more calories from sugar, (mostly from sweetened beverages), and 368 more calories per day than the group consuming artificially sweetened foods and beverages. Not surprisingly, the former group walked away a little heavier at the end of the study—with an average four pound weight gain. The others actually dropped a couple of pounds, leaving with less body fat and lower blood pressure. The study concluded that it might pay to consider beverages containing artificial sweeteners, rather than sugar, to prevent weight gain.

A longer study² found that people could still lose weight without using a sugar substitute but were able to keep it off more effectively using artificially sweetened products. During a 17-month weight loss program that included exercise, obese women were divided into two groups and given a 1500 calorie per day weight loss diet. In this study, one group received aspartame-sweetened product alternatives while the other group was told to avoid artificial sweeteners and drink water instead of sugary beverages. Both groups lost weight. During the maintenance phase of the program, both groups regained weight. In this study, however, the “sugar” group regained an average of 20 pounds while the aspartame group only regained an average of 10 pounds by the end of the program. That’s twice as much weight for the sugar users! Therefore, participation in a weight loss program using artificial sweeteners and exercise may help individuals manage their weight in the long-haul.

Children and Teens

There’s a pretty strong link between intake of sugary beverages and overweight in children. The more sugar sweetened sodas and sweets kids devour, the higher their weight tends to be. We don’t know if using sweeteners will prevent weight gain in children. However, one study in adolescents³ found that replacing their sugared beverages with non-calorie/sugar ones resulted in fewer calories taken in and a decrease in body mass index (a measure of obesity/obesity risk) compared to their counterparts who drank sugary beverages. The adolescents who were most overweight to begin with experienced the most improvement. Thus, it seems, replacing sugary beverages with an alternative low/no calorie beverage might make sense to prevent and treat overweight teens. However,

larger, long term studies are needed to examine the long term benefit of artificial sweeteners on calorie intake and weight loss in children and adolescents. See “[Fighting Childhood Obesity](http://science.eatright.org/Childhood-Obesity)” (<http://science.eatright.org/Childhood-Obesity>) for additional information on helping your child manage his or her weight.

Did you know?

- The average American ingests 22 teaspoons of added sugar a day according to the 2001–2004 National Health and Nutrition Examination Survey (NHANES) study. At 16 calories per teaspoon, that’s 352 added calories per day. Over a week, that translates to an additional 2464 calories.
- Of 2,157 teenagers (ages 12 to 18) NHANES 2001–2004 found the average daily consumption of added sugars was 119 grams (28.3 tsp or 476 calories), accounting for 21.4 percent of their total energy! Those who ate the most added sugar had higher levels of cholesterol and the worst lipid profiles.
- A 12-ounce can of sugar sweetened soda contains about 150 calories and 9 teaspoons of sugar. Substituting just one diet soft drink daily for regular soda can amount to savings of 4500 calories a month with a potential weight loss of about 1 pound per month.
- If you’re overweight, just losing 10% of your body weight (20 pounds in a 200 pound person, for example) can help improve cholesterol, blood sugar, blood fats, and blood pressure.

Bottom line

Adults may be able to better manage weight when sugary foods and beverages are replaced with a lower/no sugar counterpart. Although studies are limited, using sucralose or aspartame does not seem to result in weight gain among children or adults. In fact, when substituted for higher sugar foods, sugar substitutes have the potential to aid in a reduction of calories, which may lead to weight loss in children and adolescents who are overweight or at risk for overweight.

Healthy Weight Resources

Maintaining a healthy weight is important at every age and the following list of resources can help:

- Healthy Weight (includes healthy weight loss tips) www.eatright.org/Public/content.aspx?id=6843
- Childhood Obesity: www.eatright.org/childhoodobesity
- Back to Basics for Healthy Weight Loss: www.eatright.org/Public/content.aspx?id=6847

Sugar Substitutes and Diabetes

What works?

You might be surprised that “sugar-free” doesn’t automatically equal “carbohydrate- or calorie-free.” If you have diabetes, don’t expect sugar substitutes to save the day. Think of mile-high piles of mashed potatoes or unlimited restaurant bread and tortilla chip baskets and you’ve probably already exceeded your carbohydrate intake. Although limited in number, studies generally show that simply using sugar substitutes alone without reducing carbohydrate from sugary, starchy foods (such as bread, rice or pasta) or fat (oils, high fat meat and dairy products) will probably not help control your blood sugar or blood fat levels. If you have diabetes, [find a registered dietitian](#) who can help you fit your favorite sweet indulgences into your diet.



Did you know?

Sugar-Free Not Necessarily Carbohydrate- or Calorie-Free

See the nutrition information below comparing a “no sugar added” vs “reduced fat,” with a regular supermarket brand ice cream. The carbohydrate intake is similar for all three. This is because ice cream is made from milk which contains a naturally occurring sugar, lactose. Also note that the calorie reduction is not radically different.

Sugar Free versus Regular Ice Cream

Nutrition Information (per 1/2 cup Serving)	Breyers Smooth & Creamy No Sugar Added Ice Cream	Breyers Smooth & Creamy ½ the Fat Ice Cream	Breyers All Natural Vanilla Ice Cream
Calories	90	110	130
Total Fat (g)	4	3.5	7
Saturated Fat (g)	2.5	2	4
Trans Fat (g)	0		0
Total Carbohydrates (g)	15	16	16
Sugars (g)	4	16	14

Bottom line

Using sugar substitutes does not appear to affect blood sugar or blood fat and cholesterol levels in adults with diabetes. There were no studies found in children. People with diabetes must consider the total amount of carbohydrate they consume from all foods and beverages. See recommendations for use of sugar substitutes in **pregnancy** if you have gestational diabetes. And you can also consult with a registered dietitian.

Appetite, Food Intake, and Healthfulness of Diet



What works?

“Do sugar substitutes increase appetite and food intake?”

Some individuals believe that sugar substitutes increase appetite, which would make losing weight more difficult for the dieters using them. Although there were a few reports of increased hunger sensation, the majority of research in adults shows that sugar substitutes (such as sucralose and aspartame) do not increase their appetite, sensation of hunger, or food intake. In children, there are few studies related to appetite and food intake. In general, aspartame does not affect appetite or food intake in young people. There were no studies found for the remaining sweeteners.

“Do sugar substitutes help individuals meet dietary recommendations for nutrients?”

Some worry that heavy use of foods and beverages with sugar substitutes may replace more healthful food groups so that people don't get enough nutrients. No one knows for sure. Individuals can potentially replace more nutritious foods and beverages with less—nutritious—ones. Routinely drinking diet soda instead of milk, for example, may cause one to consume less calcium than recommended. See recommended nutrition tips for maintaining a well-balanced diet using artificial sweeteners.

Did you know?

- According to the Centers for Disease Control and Prevention (CDC), an estimated 32.5% of adults consumed fruit two or more times per day and 26.3% consumed vegetables three or more times per day falling far short of national targets.⁴
- Estimated calcium intakes are also less than desired with women, girls aged 9-24 and 14-18 years, women aged 51-70 years, and both men and women older than 70 years according to the NHANES 2003-2006 study. Overall, females are less likely than males to get recommended intakes of calcium from foods.^{5,6}

Bottom line

Non-nutritive sweeteners do not increase appetite or food intake in adults, adolescents or children. Nor do they necessarily result in a less healthful diet. Choose your foods wisely. For information on general dietary guidelines, go to www.choosemyplate.gov.

How Much Is Too Much?



Are there Adverse Effects?

In the US, all food additives must be approved by the US Food and Drug Administration (FDA). Testing involves determining whether a substance is toxic, causes or increases risk for cancer, and whether it would affect a developing fetus. After passing these tests and being approved by the FDA, why—is there still controversy? Questions regarding the effects of non-nutritive sweeteners have been posed for the past 200 years beginning with the discovery and use of the first artificial sweetener, saccharin. Even despite decades of scientific research demonstrating the safety of artificial sweeteners, some still remained unconvinced.

These six sweeteners—acesulfame-K, aspartame, neotame, saccharin, stevia and sucralose—have been approved by the FDA for use in foods and/or drinks. Although the majority of research has been conducted on aspartame and saccharin, studies have not documented adverse effects related to the intake of these or other non-nutritive sweeteners, even when human subjects have consumed relatively large amounts. The American Dietetic Association (ADA), through its Evidence Analysis Library, examined the research on the effects of nonnutritive sweeteners on human subjects. There is strong evidence that aspartame, in particular, after testing for a wide range of possible effects over decades, is not associated with adverse effects in the general population. However, pregnant women should avoid aspartame because the fetus cannot break down the amino acid. Additionally, consistent with the findings of the FDA, the available research from peer-reviewed journals supports the safety of all these ingredients for the general adult population; however, the ADA suggests that continued post-market surveillance is needed; and that only limited research currently exists regarding possible adverse effects in children.

The FDA states that these six sugar substitutes are safe to eat in the amounts that consumers typically consume them. The next section discusses what amount is acceptable and safe.

Acceptable Daily Intake (ADI)

The FDA has set Acceptable Daily Intake (ADI) levels for each artificial sweetener. The ADI is the maximum amount of a food additive that can be safely consumed on a daily basis over a person's lifetime without any adverse effects and includes a 100-fold safety factor. You might think, "just look at the number of diet soft drinks and other "sugar free" products we devour!" However, US intake of sugar substitutes is well below the ADI...even for the heaviest users, namely, dieters, adults and children with diabetes, and women of child-bearing age. One study showed that the average daily aspartame intake of those described above plus pregnant women was minimal, only 5-10% of the ADI. In general, children and adults with diabetes are the top users of sugar substitutes and they still do not exceed the ADI.

Two of the most highly debated sugar substitutes are saccharin and aspartame. Since these sweeteners have been highly researched compared to newer sugar substitutes, safety concerns regarding these sweeteners will be addressed below. Much less is known about potential adverse effects or benefits regarding the remaining sugar substitutes.

Saccharin

The question of saccharin's safety arose early and was tested as early as 1882—shortly after its debut. Since then, heated debates by both the public and scientists threatened to ban it from the market. In 1997, the FDA proposed a ban on saccharin because it was found to cause cancer in rats. However, in 2000, this research was declared invalid both because of the high dosage given to rats and the knowledge that rats are a poor model for human research. Ultimately, saccharin was officially declared safe and the ban was removed. With the growing use of other sugar substitutes, saccharin's once prominent market status has dropped.



Aspartame

Aspartame has been the target of a variety of claims alleging it to cause a number of ill effects. Many worry about the effects of ingesting “chemicals.” Aspartame is made by joining an amino acid called phenylalanine with aspartic acid. However, what many people don't know is that the amounts of amino acids, phenylalanine and aspartic acid found in aspartame are far less than that found commonly in foods. The human body can also easily use small amounts of aspartame. Toxicity fears are very common among consumers and even some health care professionals. However, many claims contain just enough science to make them sound believable. What is their reason for concern? When consumed, aspartame is broken down into amino acids and a type of alcohol called methanol. Methanol is a non-drinking alcohol used in industry products—antifreeze, paint thinner, and varnish are examples. Ingesting methanol can lead to toxicity and death within a few hours. Furthermore, the body also breaks down this methanol into formaldehyde which turns into formic acid in the liver. Formaldehyde and formic acid are both toxic. Given this information, who wouldn't pitch their diet sodas and packets of sugar substitute? The problem, however, is bad logic resulting in faulty conclusions. The fact is that our bodies produce formaldehyde in amounts thousands of times greater than you would get from the sweetener aspartame. In fact, formaldehyde is used by the body to make important substances. Furthermore, formic acid rarely builds up because the body uses formaldehyde so quickly and if there were an excess, it would be eliminated through urine or broken down into carbon dioxide and water. Finally, the aspartame in diet sodas or foods produces so little methanol that there is no chance that it could cause a toxic build-up or ill effects.

Other aspartame-related concerns include headaches or other reactions. However, the evidence from scientific studies is strong that aspartame is not associated with a wide range of adverse effects including hypersensitivity reactions, brain cancer, headaches, memory, mood, seizures, learning or thought disorders. The limited number of studies in children make it difficult to reach a strong conclusion related to side effects. However, they suggest that aspartame is not associated with eye problems, acne, blood pressure, seizure disorder or attention deficit disorder in children. This is not to say that some people



don't experience reactions from aspartame, or any other food or ingredient for that matter; just like you may have met someone who is allergic or sensitive to a food such as strawberries or chocolate. If you or someone you know believes they are sensitive to aspartame, you may want to avoid it. This does not however mean that the entire population would need to avoid aspartame.

Who should avoid sugar substitutes?

In general, the FDA has approved the above sweeteners for use in the general population. However, there are a few considerations where individuals should avoid sugar substitutes or at least exercise caution.

PKU (Phenylketonuria)

People with a rare genetic disorder called PKU (Phenylketonuria) should avoid phenylalanine, the substance found in the sweetener aspartame (i.e., Equal® or foods and beverages containing aspartame). These individuals are unable to break down the amino acid phenylalanine, found in aspartame. Pregnant women who carry this gene should also avoid aspartame because the fetus cannot break down the amino acid phenylalanine. However, neotame can be used by those with this genetic predisposition. Although related to aspartame, neotame is chemically different enough to allow its use. However, you should check with a registered dietitian or your health care provider.

Pregnancy

Based on limited human research data, experts believe that using FDA approved artificial sweeteners is generally safe for women during pregnancy. However, moderation is prudent. The American Medical Association advises women to avoid saccharin during pregnancy because the fetus may not be able to clear the substance quickly enough, leading to build-up and it is not known what the resulting long-term effects, if any, would be.

Did you know?

- What is the FDA's Acceptable Daily Intake for Various Sugar Substitutes?

FDA Acceptable Daily Intake of Common Sugar Substitutes

Artificial Sweetener	ADI (mg/kg body weight)	Avg mg amount in 12 oz can of diet soda	Avg mg amount in 1 packet of sweetener
Acesulfame K	15	40*	50
Aspartame	50	200	35
Saccharin	5	140	40
Sucralose	5	70	5
Stevia	0-4 mg stevia glycoside or 12 mg/kg rebiana	Product info not available...sodas containing stevia are not widely available	27

* Average amount as Acesulfame-K is usually mixed with 90 mg aspartame

Sources: *Guide to Medical Nutrition Therapy for Diabetes*. American Diabetes Association. Chicago, IL; 2005.

Rebiana. Recommended Intakes (ADI) and Metabolism. Coca-Cola Beverage Institute for Health and Wellness. Available at: www.thebeverageinstitute.org/articles/article-rebiana.htm. Accessed 29 Mar 2011.

- How much of sugar substitutes can be consumed without adverse effects? Find out below:
(Formula: Pounds/2.2 X ADI sweetener (mg) divided by amount sweetener (mg) in can beverage or pkg of sweetener)

Acceptable Daily Intake (ADI) of Common Sugar Substitutes

(Based on an 150 Pound Adult)

Sweetener	Number of 12 oz cans diet soda to reach the ADI	Number of artificial sweetener packets to reach the ADI
Acesulfame-K	25.6	20.4
Aspartame	17	97.4
Saccharin	2.4	8.6
Sucralose	4.8	68.2
Stevia/Reb A	Product info not available...sodas containing stevia are not widely available.	30

These amounts of sweetener would need to be consumed over a person's lifetime! The ADI also includes a 100 fold safety factor, which means the FDA takes the minimum amount considered to be without adverse effects and then takes one one-hundredth of that amount to establish the ADI.

* Average amount as Acesulfame-K is usually mixed with 90 mg aspartame

Sources: *Guide to Medical Nutrition Therapy for Diabetes*. American Diabetes Association. Chicago, IL; 2005.

Rebiana. Recommended Intakes (ADI) and Metabolism. Coca-Cola Beverage Institute for Health and Wellness. Available at: www.thebeverageinstitute.org/articles/article-rebiana.htm. Accessed 29 Mar 2011.

Acceptable Daily Intake (ADI) of Common Sugar Substitutes

(Based on a 50 Pound Child)

Sweetener	Number of 12 oz cans diet soda to reach the ADI	Number of artificial sweetener packets to reach the ADI
Acesulfame-K	8.6	6.8
Aspartame	5.6	32.4
Saccharin	.8	2.8
Sucralose	1.6	22.8
Stevia/Reb A	Product info not available...sodas containing stevia are not widely available.	10

These amounts of sweetener would need to be consumed over a person's lifetime! The ADI also includes a 100 fold safety factor, which means the FDA takes the minimum amount considered to be without adverse effects and then takes one one-hundredth of that amount to establish the ADI.

* Average amount as Acesulfame-K is usually mixed with 90 mg aspartame

Sources: *Guide to Medical Nutrition Therapy for Diabetes*. American Diabetes Association. Chicago, IL; 2005.

Rebiana. Recommended Intakes (ADI) and Metabolism. Coca-Cola Beverage Institute for Health and Wellness. Available at: www.thebeverageinstitute.org/articles/article-rebiana.htm. Accessed 29 Mar 2011.

Interpreting these charts: If you are a 150 pound adult, it is acceptable/safe for you to consume 97 packets of aspartame, or 17 twelve ounce cans of diet soda containing aspartame daily. If you are a 50 pound child, it is acceptable/safe for you to consume 22 packets of sucralose or 1 twelve ounce can of diet soda containing sucralose daily.

- Foods may naturally contain the same “chemicals” as a sugar substitute...and sometimes in greater quantities than the artificial sweetener itself. For example:
 - A serving of non-fat milk provides almost six to nine times more phenylalanine and 13 times more aspartic acid than the same amount of beverage sweetened with aspartame.
 - A serving of tomato juice provides almost four to six times more methanol than the same amount of beverage sweetened with aspartame.
- How much do Americans consume? Unfortunately, the intake of sugar substitutes in the United States has only been measured for aspartame and only from 1984-1992. More recent studies in various other countries though 2003 estimated intake values for aspartame, acesulfame-K, saccharin, and sucralose generally below their country’s established ADIs. The American Dietetic Association concludes that there is a fair amount of evidence to confirm the safety of sweeteners at levels consumed within the Acceptable Daily Intake levels.

Bottom line

Limited research using humans show that artificial sweeteners are safe for use in the general population including pregnant women and children based on studies reviewed by the American Dietetic Association. The FDA has approved a variety of sugar substitutes according to its rigorous testing and evaluation of sweeteners. The majority of studies did not document harmful effects related to the intake of artificial sweeteners, even when people consumed large amounts. Special populations, such as pregnant women, should limit use to FDA approved sugar substitutes, use them in moderation, and avoid saccharin. Individuals with PKU should avoid aspartame but can use neotame.

Nutrition Tips

- For accurate information about nutrition, go to reliable Web sites sponsored by reputable organizations, such as the International Food Information Council Foundation, American Diabetes Association, National Cancer Institute, American Heart Association, Food and Drug Administration, United States Department of Agriculture, or the American Dietetic Association's www.eatright.org
- No one says you need to use sugar substitutes, not even if you have diabetes. If you would prefer to use sugar rather than a sugar substitute, try cutting back either by amount or portion size of sugary foods and beverages.
- The American Heart Association recommends no more than half of your daily discretionary calories from sugar. That equates to about 100 calories for women (6 tsp) and 150 (9 tsp) for men. They also recommend limiting sugar-sweetened beverages to no more than 450 calories (36 ounces) a week.
- If you're watching your weight or blood sugar, limit fruit juice intake as it contains the same amount of calories and carbohydrate as sugar sweetened beverages.
- Check the package of the sweetener you choose for an 800 number or website (See Resources) for uses and recipes specifically designed for that particular sweetener.
- If you want to bake or cook with a sugar substitute, use acesulfame-K, sucralose/sugar blends for the best result. Recipes for most baked goods need sugar to create proper texture and volume. If completely left out, a cake would have a lousy texture and be as flat as a pancake.
- Because sugar substitutes are much sweeter than sugar, use them in small amounts at first and increase gradually to avoid an overly sweet taste or unpleasant aftertaste.
- To boost your nutrient intake for health, be sure to eat across the "food rainbow." In other words, include a variety of colorful foods each day:
 - Green (broccoli, spinach, etc.),
 - Red (tomatoes, strawberries, etc.),
 - Orange (carrot, oranges, etc.)
 - Yellow (corn, bananas, etc.),
 - Blue (blueberries, cherries).
- Most people get enough protein but many lack adequate dietary calcium. On average, dairy foods give you the most, so bone-up by replacing milk for sodas. In addition, pudding, regular or frozen yogurt make great desserts or snacks. See www.choosemyplate.gov for additional information for following a healthier diet.



Resources

NutraSweet Company. Product information: www.nutrasweet.com/consumers/index.asp

NutraSweet Products and free recipe book offer: www.nutrasweetswirl.com

SweetOne Company. Product information and recipes: www.sweetone.com

Splenda recipes, conversion chart, cooking and baking tips: www.splenda.com

Sweet'NLow. Product information, recipes, and coupons: www.sweetnlow.com

NectaSweet. Product information, recipes: www.flavourcreations.com/NectaSweet.html

Stevia Extracts in the Raw. Product information, recipes and coupons: www.steviaextractintheraw.com

PurVia. Product information, promotions and recipes: www.purevia.com

Truvia. Product information and recipes: www.truvia.com

International Food Information Council Foundation Food Insight. Nutrition and food safety resources: www.foodinsight.org

National Cancer Institute Fact Sheet: "Artificial Sweeteners and Cancer"
www.cancer.gov/cancertopics/factsheet/Risk/artificial-sweeteners

US Food and Drug Administration. Information related to food safety, including artificial sweeteners: www.fda.gov

United States Department of Agriculture (USDA). Food and nutrition information, including Dietary Guidelines for Americans: www.usda.gov

My Plate. A "must visit" website featuring many interactive tools to help adults and children follow healthy diet recommendations-- Includes an individualized calculation of estimated needs for what to eat and how much then allows you to track your intake compared to recommendations. Tons of neat materials for kids including an interactive computer game and recommendations for families.
www.choosemyplate.gov

American Diabetes Association, Information about diabetes to include food and nutrition, and recipes www.diabetes.org
American Heart Association. A variety of information about nutrition, exercise, and lifestyle to avoid cardiovascular disease and stroke:
www.americanheart.org



References

1. Raben A, Vasilaras TH, Moller AC, Astrup A. Sucrose compared with artificial sweeteners: different effects on ad libitum food intake and body weight after 10 wk of supplementation in overweight subjects. *Am J Clin Nutr*. 2002;76:721-9.
2. Blackburn GL et al, The effect of aspartame as part of a multidisciplinary weight-control program on short- and long-term control of body weight. *Am J Clin Nutr*. 1997;65:409-18.
3. Ebbeling CB, Feldman HA, Osganian S, Chomitz VR, Ellenbogen SJ, Ludwig DS. Effects of decreasing sugar sweetened beverage consumption on body weight in adolescents: a randomized controlled pilot study. *Pediatrics*. 2006 Mar;117(3):673-680.
4. Centers for Disease Control and Prevention. State-Specific Trends in Fruit and Vegetable Consumption Among Adults—United States, 2000–2009. *Morbidity and Mortality Weekly Report*. 2010;59(35):1125-1130. Available at: www.cdc.gov/mmwr/preview/mmwrhtml/mm5935a1.htm.
5. Committee to Review Dietary Reference Intakes for Vitamin D and Calcium, Food and Nutrition Board, Institute of Medicine. *Dietary Reference Intakes for Calcium and Vitamin D*. Washington, DC: National Academy Press, 2010.
6. Bailey RL, Dodd KW, Goldman JA, Gahche JJ, Dwyer JT, Moshfegh AJ, Sempos CT, Picciano MF. Estimation of total usual calcium and vitamin D intakes in the United States. *J Nutr*. 2010 Apr;140(4):817-22.