



Sugars and Sweeteners in Foods

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Our quality of life is highly dependent on our taste sensory system. Taste is the final check used to evaluate the quality of a food, and we select foods guided primarily by the emotions of pleasure or displeasure experienced upon tasting them. Research on taste indicates that “sweet” is an innately preferred sensation—infants favor sweetness when presented with the other basic tastes (salty, bitter, sour) or even umami, the so-called fifth basic taste, characterized as “savory.” This recognition of the importance of sweetness confirms why sweet foods are by far the most popular treats.

Sugars are forms of monosaccharide. Examples of monosaccharides are glucose (also called dextrose), fructose, and galactose. When two monosaccharides combine, a disaccharide is formed. For example, when glucose and fructose join together, the disaccharide sucrose, or table sugar, results. Maltose is composed of two glucose molecules, while lactose (milk sugar) is formed by one molecule of glucose and one molecule of galactose. All sugars are carbohydrates and contain four calories per gram.

To most people, “sweet” is synonymous with table sugar (sucrose), which is derived from sugarcane or sugar beets and contains 16 calories per teaspoon.

Fructose is commonly referred to as “fruit sugar” because of its presence in fruits. Fructose as a product is available in crystalline form (from cornstarch), as liquid honey, or as liquid high-fructose corn syrup (HFCS) when combined with glucose. HFCS is used in the preparation of many beverages.

Reduced-calorie and low-calorie sweeteners

Polyols

Also called “sugar alcohols” or sugar replacers, polyols may be classified as monosaccharide-derived (sorbitol, erythritol, xylitol, mannitol), disaccharide-derived (maltitol, isomalt, lactitol), and polysaccharide-derived (hydrogenated starch hydrolysates). They are carbohydrates imparting a sweet sensation but are neither sugars nor alcohols.

Polyols are mostly reduced-calorie sweeteners and may be used in the same amount as table sugar but are frequently used in conjunction with other sweeteners to achieve the desired sweetness level and taste. With fewer calories than sucrose, they provide sweetness to sugar-free cookies, candies, chewing gum, baked goods, ice cream, toothpastes, mouthwashes, breath mints, and pharmaceuticals.

The U.S. Food and Drug Administration allows the use of the following caloric values for polyol sugar replacers:

Polyol	(cal/g)	Sweetness relative to sucrose (%)
Hydrogenated starch hydrolysates	3.0	25–50
Sorbitol	2.6	50–70
Xylitol	2.4	100
Maltitol	2.1	75
Isomalt	2.0	45–65
Lactitol	2.0	30–40
Mannitol	1.6	50–70
Erythritol	0.2	60–80

Polyols also add bulk and texture to foods, provide a cooling effect or “cool” taste, help retain moisture in foods, do not lose sweetness, and do not cause browning when heated. Because molds do not grow well on polyols, they may contribute to longer shelf life of foods. They are naturally occurring in many fruits and beverages, but for commercial uses they are made from other carbohydrates, such as starch, sucrose, and glucose. The FDA considers the sugar alcohols listed above as either generally recognized as safe (GRAS) or approved food additives.

Polyols are incompletely absorbed from the small intestine into the bloodstream, producing a lower glyce-mic response (i.e., a lesser effect on blood glucose) than sucrose or glucose. When absorbed, they are metabolized to energy with little or no production of insulin. In theory, polyols may be useful to diabetics, but it is advised that diabetics first consult with their physician, dietitian, or other health professional before using polyols in meal plans. Physicians and other health professionals should also be consulted before the use of polyols in weight management. To date, there is no conclusive evidence that glycemic index is related to weight control.

Unabsorbed polyols continue to the large intestine, where they are fermented by bacteria. Some individuals who consume excessive amounts of polyols may experience gastrointestinal symptoms, such as gas and laxative effects, similar to reactions to high-fiber foods and beans. The American Dietetic Association advises that consuming more than 50 grams per day of sorbitol or 20 grams per day of mannitol may cause diarrhea. In such cases, the amount consumed on a single occasion should be reduced. Consequently, labels of polyol-containing products must bear the statement, “Excess consumption may have a laxative effect.”

Polyols are also non-cariogenic—they do not promote tooth decay because bacteria in the mouth do not metabolize and convert the sweetener into plaque or harmful acids that cause tooth decay. The U.S. Food and Drug Administration (FDA) authorizes the use of this claim on labels of products containing sugar alcohols. Xylitol is found even to inhibit oral bacteria. This is the reason for the use of polyols in many sugarless mints and chewing gums.

The name of the polyol used in a product is listed in the ingredient statement. The term “sugar alcohol” must be used if more than one polyol is used. Polyols are also

included in the total carbohydrate content in the Nutrition Facts panel of the product label. If the terms “sugar-free” or “no added sugar” are used, the sugar alcohol content must be declared separately under carbohydrates in the Nutrition Facts panel. Some food manufacturers are using the new descriptions “net carb,” “low carb,” or “impact carb,” where net carbohydrate is calculated by subtracting carbohydrates from fiber and sugar alcohols from the total carbohydrate. FDA has not defined these new terms, and this calculation is still being debated in the scientific community.

Tagatose

Tagatose is a low-carbohydrate sweetener contributing 1.5 calories per gram, and it is especially suitable as a flavor enhancer at low doses. Technically known as D-tagatose, it is a white, crystalline powder that is prepared from lactose. It was first launched in the United States in May 2003 with FDA notification as a GRAS ingredient. It was approved for use as a general-purpose sweetener in Korea in 2003 and in Australia and New Zealand in April 2004. Its safety was confirmed by the Joint FAO/WHO Committee on Food Additives (JECFA) in June 2004 with no limited acceptable daily intake (ADI), JECFA’s safest category for a food ingredient. Other regulatory approvals are currently under way in major markets worldwide.

Tagatose is ideal for use in diet soft drinks because of its synergistic flavor-enhancing effect when used in combination with other high-intensity sweeteners such as acesulfame-K, sucralose, and aspartame. Sweetness onset occurs rapidly, and bitterness is reduced. Tagatose is found to enhance mint and lemon flavors in chewing gums and mints, toffee flavor, and creaminess in some dairy product applications. It is pH-stable in acidic products, such as carbonated beverages and yogurts. It performs well in frostings because of its easy crystallization properties. Tagatose may be used in small amounts in baking applications to increase moistness and flavor while maintaining sweetness, but it caramelizes or browns more readily than sucrose.

Tagatose behaves like fructose in the body, but only 15–20 percent of tagatose is absorbed in the small intestine. Due to this incomplete absorption, tagatose has minimal effect on blood glucose and insulin levels. The rest of the ingested tagatose proceeds to the large intestine where it acts as a *prebiotic*, promoting the produc-

tion of butyrate and lactic acid bacteria (considered “good” bacteria), which are essential in maintaining a healthy digestive system. Like other low-digestibility carbohydrates and dietary fibers, tagatose is fermented in the colon to short-chain fatty acids that decrease acidity and may contribute to a healthy epithelium in the large intestine. These short-chain fatty acids are then almost completely absorbed and metabolized. This fermentation, however, may result in mild gastrointestinal discomfort (e.g., flatulence and laxation) in some sensitive individuals, just as high-fiber carbohydrates do.

Tagatose is also non-cariogenic. The FDA has approved the use of dental claims on products containing tagatose provided that the products satisfy all the requirements for a tooth-friendly product. The approved claims may state “Tagatose sugar does not promote tooth decay” and “Tagatose sugar may reduce the risk of tooth decay.” Products containing up to 0.5 gram per serving of tagatose may be labeled “sugar free,” while products with less than 3.33 grams per serving may be labeled “zero calorie.”

Trehalose

Trehalose is a disaccharide consisting of two glucose molecules. It is found in common foods such as honey, mushrooms, and shrimp and is naturally produced by the body. It is half as sweet as sucrose, provides sustained energy, and elicits a very low insulin response. Trehalose may be used in foods and beverages such as fruit juices, white chocolate chips, nutrition bars, and dehydrated fruits and vegetables.

It is heat stable, and in addition to being a sugar, it also stabilizes proteins, or prevents protein aggregation, making it useful as a biological preservative. Trehalose protects and preserves cell structure in foods and may be useful in freezing and thawing processes by maintaining a desired texture.

The FDA has given trehalose a GRAS designation. It is approved for use in Japan, Taiwan, and Korea, and it may be used in the preservation of freeze-dried products in the United Kingdom. Trehalose is commercially prepared from starch and is available as Ascend™.

Acesulfame potassium

Also known as acesulfame-K or “Ace-K,” acesulfame potassium is a high-intensity, non-nutritive sweetener that is 200 times sweeter than sucrose. It imparts a clean,

sweet taste with no lingering aftertaste. It is non-cariogenic, is stable under high temperatures, and has an excellent shelf life. It is used as a sweetener in many foods, including chewing gums, baked goods, dessert and dairy products, alcoholic beverages, canned foods, and candies—all told, in more than 4,000 products in about 90 countries including Australia, the UK, Canada, and Germany. Acesulfame potassium is often used as a blend with other sweeteners to achieve a more sugar-like taste with the finished product containing about 40 percent less total sweetener added. It is not metabolized or stored in the body, being quickly absorbed and then excreted unchanged.

The FDA first granted the use of acesulfame potassium in soft drinks in July 1988 and has since reaffirmed its safety on several occasions until granting its general-use approval in December 2003 with no restrictions for any segment of the population, including pregnant women and diabetics. Use of acesulfame potassium does not require a warning label or information statement. It has been used in Europe since 1983, and the European Union’s Scientific Committee for Food (SCF) has accepted its use in foods and beverages. JECFA has also found it safe.

Like the FDA, JECFA set an acceptable daily intake (ADI) of 15 mg/kg body weight as the amount of this ingredient a person can safely consume each day for an entire lifetime. This means that a 70-kg (154-lb) person would have to consume about 1.05 grams of acesulfame potassium per day, or about 210 grams sugar (about ½ pound), or the equivalent of about two gallons beverage per day. Because acesulfame potassium is a high-intensity sweetener that is used in very small amounts, even if it were the only low-calorie sweetener used today, the daily intake by a heavy food and beverage consumer would be only 3.8 mg/kg body weight, which is much lower than the ADI of 15 mg/kg body weight.

The results of several long-term animal studies using much higher amounts of acesulfame potassium than are normally consumed by humans indicated no evidence of cancers or tumors. There is also no evidence of potential health concern from the 10 mg of potassium in a packet of acesulfame potassium table-top sweetener. For comparison, a banana may contain 400 mg potassium and a sweet potato 390 mg. In addition, there have been no documented cases of allergic reactions to acesulfame potassium.

Acesulfame potassium is sold under the brand name Sunett™.

Aspartame

Aspartame is a nutritive sweetener containing 4 calories per gram. Because it is 200 times sweeter than sucrose, however, very little aspartame is needed to impart the same sweetness as sugar, resulting in minimal calories added to foods. Aspartame completely breaks down upon digestion into small amounts of methanol and the amino acids aspartic acid and phenylalanine. These components are then absorbed into the blood and used by the body in exactly the same ways as when they come from other foods and beverages. No accumulation of aspartame or its components occurs in the body over time.

Aspartame has a clean, sugar-like taste, enhances fruit and citrus flavors, can be safely used under heat with some loss of sweetness at higher temperatures, and is non-cariogenic. It is primarily responsible for the growth of the low-calorie and reduced-calorie product market in the past two decades and is today an important component of thousands of foods and beverages. Because aspartame helps impart a good, sweet-tasting flavor to low-calorie and reduced-calorie foods and beverages, it is helpful to diabetics and beneficial in weight control by managing caloric intake while still maintaining a healthful diet.

The FDA approved aspartame first in 1981 for use in table-top low-calorie sweeteners and powdered mixes and later in 1983 for carbonated beverages. It was given approval for use in all foods and beverages in 1996. Aspartame is considered one of the most thoroughly researched food additives in the world. The FDA continues to confirm its safe use by the general public, including diabetics, pregnant and nursing women, and children. People with a rare hereditary disease known as phenylketonuria (PKU) must control their phenylalanine intake from all sources, including aspartame. Products sweetened with aspartame must carry a statement on the label that they contain phenylalanine.

Aspartame is used in more than 100 countries including Canada, Japan, the UK, and Germany. It is found in more than 6,000 products and is estimated to be consumed by more than 200 million people worldwide. JEFCA and the EU's SCF have also found aspartame safe for food use. In the United States, health organiza-

tions such as the American Medical Association, the American Dietetic Association, and the American Diabetes Association have reviewed research on aspartame and also concluded that it is safe. The FDA has established an ADI for aspartame of 50 mg/kg body weight. This ADI is equivalent to a daily dietary intake for a 150-lb adult of about 20 cans of soft drink, 42 servings of sugar-free gelatin, or 97 packets of low-calorie table-top sweetener—all much higher than normal levels of consumption. For a 50-lb child, the ADI is equivalent to a daily consumption of 6 cans of soft drink, 11 servings of sugar-free gelatin, and 32 packets of low-calorie table-top sweetener over a lifetime. In terms of sweetness, this ADI is equivalent to consuming about 1½ pounds of sugar daily for an entire lifetime, which is obviously too high a level of sweetness consumption for any adult. Occasional consumption of aspartame greater than the ADI has been shown to have no adverse health effects. Results of extensive market research studies indicate that 9 out of 10 people consume less than 10 percent of the ADI. It must also be remembered, however, that children, especially those under 2 years of age, need adequate calories for growth and development.

Aspartame is available under the brand names Nutrasweet®, Equal®, Spoonful®, and Equal-Measure®.

Aspartame has had its share of allegations and unfounded claims, including being linked to tumors, cancer, epilepsy, headaches, multiple sclerosis, and weight increase. For additional information about these claims, see the CTAHR publication *Falsifications and Facts about Aspartame* (<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/FST-3.pdf>).

Neotame

This is a non caloric sweetener consisting of two amino acids, aspartic acid and phenylalanine. It has a clean, sugar-like taste and is non-cariogenic. It is 30–40 times sweeter than aspartame, or about 8,000 times sweeter than sucrose. Through normal biological processes, neotame is quickly metabolized, fully eliminated, and does not accumulate in the body. No special labeling for PKU is required.

Neotame is used in many cooking and baking applications. It is found in chewing gums, carbonated soft drinks, frozen desserts and novelties, yogurt-type products, refrigerated and non-refrigerated ready-to-drink beverages, and puddings and fillings.

Neotame also has unique flavor-enhancement properties. It prolongs flavor and sweetness in chewing gum and masks flavors unique to soy-based, nutritionally-fortified products, vitamins, and minerals, even at non-sweetening levels. Possible benefits of these properties are cost reduction and better sensory acceptance qualities.

In July 2002 the FDA allowed its use as a general-purpose sweetener for the general population, including pregnant and nursing women, diabetics, and children. Neotame is also approved for use in Australia and New Zealand.

Saccharin

Saccharin has been in use for over a century to sweeten foods and beverages without adding calories or carbohydrates. It was especially useful in Europe during the two world wars, when sugar was in short supply. It has been an integral component of the lifestyle of many people for weight control and caloric or carbohydrate intake restriction. Like most other low-caloric sweeteners, saccharin helps prevent the formation of dental cavities, compared to sugar.

In 1977, FDA proposed a ban on saccharin based on studies that linked its use to bladder cancer. Research methodologies involved the use of a sensitive strain of laboratory rats fed with extremely high doses of saccharin. Although the United States Congress overrode the ban because of the need at that time for a low-calorie alternative to sucrose, a warning label was required on products containing saccharin. In May 2000, due to a preponderance of scientific results obtained from nearly 20 years of studies, the government removed saccharin from its list of substances reasonably anticipated to be human carcinogens. The federal requirement for a warning label on products containing saccharin has also been removed. Saccharin is not metabolized by the body and does not react with DNA, lacking two of the major characteristics of a classical carcinogen.

Saccharin continues to be used in a wide range of low-calorie and sugar-free foods and beverages. It is found in soft drinks, baked goods, chewing gum, canned fruit, salad dressings, and also in cosmetic products and pharmaceuticals. It is approved for use in more than 100 countries. Its safety has been affirmed by JEFCA and EU-SCF. Its use is also supported by many health organizations including the American Diabetes Association,

the American Medical Association, and the American Cancer Society.

Sucralose

The only non-caloric sweetener prepared from sucrose, sucralose is manufactured through a patented multi-step process that replaces three hydroxyl groups of the sucrose molecule with three chloride groups. These tightly bound chloride groups make sucralose exceptionally stable and indigestible, which makes sucralose free of dietary calories. Sucralose is a sweetener that is 600 times sweeter than sugar with a clean, sugar-like taste and no lingering objectionable aftertaste. It can be used anywhere sugar is used without losing its sugar-taste properties even when heated and stored for a long time. Thus it is now used as a spoonful-for-spoonful replacement for sugar in eating, baking, cooking, and other sugar applications.

In 1998, sucralose was given the broadest initial approval by the FDA for a food ingredient for use in 15 foods and beverages. The FDA expanded its use in 1999 as a general-purpose sweetener without excluding any population subgroup, such as pregnant or breastfeeding women, children, and diabetics. It is now used in more than 3,500 products in over 60 countries, including Canada, Australia, and Mexico.

Like the other low-calorie sweeteners, sucralose passes quickly through the body relatively unchanged and is not converted to energy. It is not recognized by the body as either a sugar or a carbohydrate. Sucralose is also non-cariogenic because it is an inert ingredient that cannot be acted upon by bacteria in the mouth. It is also stable over a wide range of temperatures over time, and it is used in many applications such as canned fruit, low-calorie beverages, apple sauce, baked goods, nutritional supplements, and medical foods.

Sucralose joins the other food ingredients that have been extensively studied. More than 100 scientific studies over a 20-year period were conducted to assess its safety regarding cancer, reproduction and fertility, genetic effects, birth defects, immunology, the central nervous system, and metabolism. Scrutiny using the highest scientific standards has indicated that sucralose does not cause cancer, genetic defects, birth defects, or tooth decay. In addition, sucralose has no effect on the immune system, female or male reproduction, blood glucose levels, insulin production, and carbohydrate me-

tabolism. The added chloride is a natural component of many everyday foods and beverages, such as natural waters, lettuce, and tomatoes, and is safe. The safety of sucralose is confirmed by JECFA, EU-SCF, Food Standards Australia/New Zealand, the Health Protection Branch of Health and Welfare Canada, and other regulatory bodies in Asia and South America. Sucralose may be consumed safely every day without concern of exceeding a maximum safety level. Products containing sucralose are not required to carry a warning label. Sucralose is currently marketed under the name Splenda®.

Other low-calorie sweeteners of the future

Alitame

Sold under the name Aclame™, alitame is a sweetener formed from the amino acids L-aspartic acid and D-alanine and a new amine. It is 2,000 times sweeter than sucrose, with a clean, sweet taste, and has synergistic sweetening properties when combined with other low-calorie sweeteners. Because it is a high intensity sweetener, its caloric contribution to the diet is insignificant. The aspartic acid component of alitame is completely metabolized in the body. The alanine amide component passes through the body with minimal metabolic changes.

Alitame is highly soluble in water and is also pH- and heat-stable. It has an excellent shelf life but may produce off-flavors under prolonged storage in some standard acidic conditions. It may be used in products where sweeteners are currently used, such as baked goods, hot and cold beverages, fruit preparations, chewing gum, and pharmaceuticals.

Pfizer, Inc., the company that discovered alitame, has completed extensive animal and human studies to support its claim of alitame's safety for human consumption and has petitioned the FDA for approval for its use in a broad range of foods and beverages. Alitame is approved for use in a variety of foods and beverages in Australia, New Zealand, Mexico, and the People's Republic of China. Approval for its use is being sought from regulatory bodies of major countries worldwide.

Cyclamate

Cyclamate is a non-caloric sweetener that is 30 times sweeter than sucrose and is widely used in foods and

beverages. It is the least intense of all the commercially acceptable high-intensity sweeteners. It is stable under a wide range of temperatures and has a long shelf life. Because of its solubility in liquids, it is attractive for use in beverages and a variety of other foods including some baked goods. When used with other low-calorie sweeteners, particularly saccharin, a product sweeter than the combination of the individual sweeteners results. Most people do not metabolize cyclamate.

Cyclamate is approved for use in Canada and in more than 50 countries in Asia, South America, Europe, and Africa. Because of a study suggesting cyclamate may be related to the development of tumors in rats, cyclamate was banned for use in the United States in 1970. In 1984, the FDA's Cancer Assessment Committee reviewed scientific evidence and concluded that cyclamate is not a carcinogen. The National Academy of Sciences reaffirmed this conclusion in 1985. There is currently a petition to the FDA to have cyclamate approved again for use in the United States.

Dihydrochalcones

Also known as DHCs, dihydrochalcones are non-caloric sweeteners derived from the bioflavonoids of citrus fruits that are 300 to 2,000 times sweeter than sucrose. DHCs give a delayed sweet taste with a licorice aftertaste. Neo-DHC from Seville oranges is 1,500 times sweeter than sucrose and currently has the greatest potential for use in foods such as chewing gum and candies and other applications such as toothpaste, mouthwash, and some pharmaceuticals.

DHCs are approved for use in the United States as a flavoring in baked goods, beverages, chewing gum, frozen dairy products, candies, and sauces. These sweeteners are approved for use in the European Union and Zimbabwe.

Stevioside

Stevioside is a low-calorie sweetener derived from *Stevia rebaudiana*, a South American plant, and is 300 times sweeter than sucrose. The plant leaves have been used for centuries in Paraguay to sweeten bitter beverages and to make tea. Stevioside is highly soluble in water, very sweet in taste, and synergistic with other sweeteners. It exhibits a menthol-like, bitter aftertaste that diminishes with increasing purity of the extract.

The metabolism of stevioside in humans has not yet

been investigated, but results from limited studies in laboratory rats indicate that some is excreted unchanged. Most ingested stevioside is degraded by intestinal bacteria.

Since the 1970s, stevioside has been used as a sweetener in Japan, by itself or with other sweeteners in beverages, pickles, dried seafoods, flavorings, confections, chewing gum, and table-top sweeteners. It is also approved for use as a sweetener in South Korea and Brazil. In 1999, JECFA and EU-SCF reviewed available studies and concluded that current scientific information is not acceptable to support its use as a sweetener. A subsequent review by JECFA in 2004 resulted in the granting of a temporary designation for stevioside of an acceptable daily intake of 2 mg/kg body weight. To remove its temporary designation, JECFA is requiring, by 2007, additional information on the pharmacological effects of stevioside on humans, as well as analytical data. Citing insufficient testing, the FDA has not allowed the use of stevioside in the United States as a sweetener food additive, but it may be sold as a dietary supplement without any reference to sweetness.

Glycyrrhizin

Glycyrrhizin is a non-caloric sweetener that is extracted from licorice root and is 50 to 100 times sweeter than sucrose. Because of its pronounced licorice flavor, its uses are limited. It is used as a flavoring in tobacco, pharmaceuticals, and some confectionary products. It is also used as a foaming agent in some non-alcoholic beverages.

Glycyrrhizin is approved for use in the United States as a flavor and flavor enhancer.

Thaumatim

Thaumatococcus is a mixture of intensely sweet proteins extracted with water from the katemfe fruit (*Thaumatococcus daniellii*) of West Africa. The fruit contains from one to three black seeds surrounded by a gel and capped by a membranous sac containing the sweet material. Thaumatococcus is 2,000 times sweeter than sucrose, with a slow-onset but lingering sweet taste and a licorice-like

aftertaste. It has synergistic sweetening effects with saccharin, acesulfame-K, and stevioside. Although it cannot be used in baked or boiled goods, it may be used as a flavor extender for some cosmetic and pharmaceutical products.

Thaumatococcus is approved for use in foods and beverages in Israel, Japan, and the European Union. It is approved for use in the United States as a flavor enhancer in beverages, jams and jellies, condiments, milk products, yogurt, cheese, instant coffee and tea, and chewing gum. Thaumatococcus is available under the brand name *Thalin*TM

Be prudent

More than 180 million adult Americans now consume low-calorie or sugar-free foods and beverages. This number has doubled within the past decade. Calorie-consciousness is part of today's lifestyle, and reduced-calorie, low-calorie, and non-caloric sweeteners are a major component of this lifestyle. The growing consumer demand challenges food manufacturers to provide a wider selection of good tasting, more stable, more economically available, and safe foods and beverages.

Health professionals continue to assert that excessive caloric intake leads to weight gain. People should avoid over-consumption of *any* food, including those with reduced or low-calorie sweeteners. As a helpful step in achieving a lower caloric intake, one recommendation from the U.S. government's *Dietary Guidelines for Americans* is to "choose the foods and beverages to moderate your intake of sugars." Thus, reduced-calorie and low-calorie sweeteners are part of a healthy lifestyle that includes a variety of nutritious foods in moderate portions combined with a program of appropriate physical activity.

Resources

American Diabetes Association: www.diabetes.org
American Dietetic Association: www.eatright.org
Calorie Control Council: www.caloriecontrol.org
Institute of Food Technologists: www.ift.org
International Food Information Council: www.ific.org