

FOOD SAFETY Food Additives

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Shopping was easy when most food came from farms. Now, factory-made foods have made chemical additives a significant part of our diet. Most people may not be able to pronounce the names of many of these chemicals, but they still want to know what the chemicals do and which ones are safe and which are poorly tested or possibly dangerous.



A simple general rule about additives is to avoid sodium nitrite, saccharin, caffeine, olestra, acesulfame K, and artificial coloring. Not only are they among the most questionable additives, but they are used primarily in foods of low nutritional value.

Also, don't forget the two most familiar additives: sugar and salt. They may pose the greatest risk because we consume so much of them. Fortunately, most additives are safe and some even increase the nutritional value of the food.

Additives (Listed Alphabetically)

KEY



SAFE. The additive appears to be safe.



CUT BACK. Not toxic, but large amounts may be unsafe or promote bad nutrition.



CAUTION. May pose a risk and needs to be better tested. Try to avoid.



CERTAIN PEOPLE SHOULD AVOID.



AVOID. Unsafe in amounts consumed or is very poorly tested and *not worth any risk*.



ACESULFAME-K

Artificial sweetener: Baked goods, chewing gum, gelatin desserts, diet soda, Sunette.

This artificial sweetener, manufactured by Hoechst, a giant German chemical company, is widely used around the world. It is about 200 times sweeter than sugar. In the United States, for several years acesulfame-K (the K is the chemical symbol for potassium) was permitted only in such foods as sugar-free baked goods, chewing gum, and gelatin desserts. In July 1998, the FDA allowed this chemical to be used in soft drinks, thereby greatly increasing consumer exposure. It is often used together with sucralose (see SUCRALOSE).

The safety tests of acesulfame-K were conducted in the 1970s and were of mediocre quality. Key rat tests were afflicted by disease in the animal colonies; a mouse study was several months too brief and did not expose animals during gestation. Two rat studies suggest that the additive might cause cancer. It was for those reasons that in 1996 the Center for Science in the Public Interest urged the FDA to require better testing before permitting acesulfame-K in soft drinks. In addition, large doses of acetoacetamide, a breakdown product, have been shown to affect the thyroid in rats, rabbits, and dogs. Hopefully, the small amounts in food are not harmful.



ALGINATE, PROPYLENE GLYCOL ALGINATE

Thickening agents, foam stabilizer: Ice cream, cheese, candy, yogurt, beer.

Alginate, an apparently safe derivative of seaweed (kelp), maintains the desired texture in dairy products, canned frosting, and other factory-made foods. Propylene glycol alginate, a chemically-modified algin, thickens acidic foods (soda pop, salad dressing) and can stabilize the foam in beer.



ALPHA TOCOPHEROL (Vitamin E)

Antioxidant, nutrient: Vegetable oils, breakfast cereals, beverages.

Vitamin E is abundant in whole wheat, rice germ, and vegetable oils. It is destroyed by the refining and bleaching of flour. Vitamin E prevents oils from going rancid. Recent studies indicate that large amounts of vitamin E may help reduce the risk of heart disease and cancer.

ARTIFICIAL COLORINGS

Most artificial colorings are synthetic chemicals that do not occur in nature. Because colorings are used almost solely in foods of low nutritional value (candy, soda pop, gelatin desserts, etc.), you should simply avoid all artificially colored foods. In addition to problems mentioned below, [colorings cause hyperactivity](#) in some sensitive children. The use of coloring usually indicates that fruit or other natural ingredient has not been used.



ARTIFICIAL COLORINGS: BLUE 1

Beverages, candy, baked goods.

Inadequately tested; suggestions of a small cancer risk.



ARTIFICIAL COLORINGS: BLUE 2

Pet food, beverages, candy.

The largest study suggested, but did not prove, that this dye caused brain tumors in male mice. The FDA concluded that there is "reasonable certainty of no harm."



ARTIFICIAL COLORINGS: CITRUS RED 2

Skin of some Florida oranges only.

Studies indicated that this additive might slightly increase the risk of cancer. The dye does not seep through the orange skin into the pulp. No risk except when eating peel.



ARTIFICIAL COLORINGS: GREEN 3

Candy, beverages.

A 1981 industry-sponsored study gave hints of bladder cancer, but FDA re-analyzed the data using other statistical tests and concluded that the dye was safe. Fortunately, this possibly carcinogenic dye is rarely used.



ARTIFICIAL COLORINGS: RED 3

Cherries in fruit cocktail, candy, baked goods.

The evidence that this dye caused thyroid tumors in rats is "convincing," according to a 1983 review committee report requested by FDA. FDA's recommendation that the dye be banned was overruled by pressure from elsewhere in the Reagan Administration.

**ARTIFICIAL COLORINGS: RED 40**

Soda pop, candy, gelatin desserts, pastries, pet food, sausage.

The most widely used food dye. While this is one of the most-tested food dyes, the key mouse tests were flawed and inconclusive. An FDA review committee acknowledged problems, but said evidence of harm was not "consistent" or "substantial." Like other dyes, Red 40 is used mainly in junk foods.

**ARTIFICIAL COLORINGS: YELLOW 5**

Gelatin dessert, candy, pet food, baked goods.

The second most widely used coloring causes mild allergic reactions, primarily in aspirin-sensitive persons.

**ARTIFICIAL COLORINGS: YELLOW 6**

Beverages, sausage, baked goods, candy, gelatin.

Industry-sponsored animal tests indicated that this dye, the third most widely used, causes tumors of the adrenal gland and kidney. In addition, small amounts of several carcinogens contaminate Yellow 6. However, the FDA reviewed those data and found reasons to conclude that Yellow 6 does not pose a significant cancer risk to humans. Yellow 6 may also cause occasional allergic reactions.

**ARTIFICIAL AND NATURAL FLAVORING**

Flavoring: Soda pop, candy, breakfast cereals, gelatin desserts, and many other foods.

Hundreds of chemicals are used to mimic natural flavors; many may be used in a single flavoring, such as for cherry soda pop. Most flavoring chemicals also occur in nature and are probably safe, but they are used almost exclusively in junk foods. Their use indicates that the real thing (often fruit) has been left out. Companies keep the identity of artificial (and natural) flavorings a deep secret. Flavorings may include substances to which some people are sensitive, such as MSG or HVP.

**ASCORBIC ACID (Vitamin C), SODIUM ASCORBATE**

Antioxidant, nutrient, color stabilizer: Cereals, fruit drinks, cured meats.

Ascorbic acid helps maintain the red color of cured meat and prevents the formation of nitrosamines, which promote cancer (see SODIUM NITRITE). Vitamin C is also used to pump up the vitamin content of foods like "fruit" drinks. It helps prevent loss of color and flavor by reacting with unwanted oxygen. It is used as a nutrient additive in drinks and breakfast cereals. Sodium ascorbate is a more soluble form of ascorbic acid. ERYTHORBIC ACID is very similar to ascorbic acid, but has no value as a vitamin. Large amounts of ascorbic acid may slightly reduce the severity of colds.

**ASPARTAME**

Artificial sweetener: "Diet" foods, including soft drinks, drink mixes, gelatin desserts, low-calorie frozen desserts, packets.

Aspartame (Equal, NutraSweet), a chemical combination of two amino acids and methanol, was initially thought to be the perfect artificial sweetener, but it might cause cancer or neurological problems such as dizziness or hallucinations.

A 1970s study suggested that aspartame caused brain tumors in rats. However, the Food and Drug Administration persuaded an independent review panel to reverse its conclusion that aspartame was unsafe. The California Environmental Protection Agency and others have urged that independent scientists conduct new animal studies to resolve the cancer question. In 2005, researchers at the Ramazzini Foundation in Bologna, Italy, conducted the first such study. It indicated that rats first exposed to aspartame at eight weeks of age caused lymphomas and leukemias in females. However, the European Food Safety Authority reviewed the study and concluded that the tumors probably occurred just by chance.

In 2007, the same Italian researchers published a follow-up study that began exposing rats to aspartame in utero. This study found that aspartame caused leukemias/lymphomas and mammary (breast) cancer. It is likely that the new studies found problems that earlier company-sponsored studies did not because the Italian researchers monitored the rats for three years instead of two.

In a 2006 study, U.S. National Cancer Institute researchers studied a large number of adults 50 to 69 years of age over a five-year period. There was no evidence that aspartame posed any risk. However, the study was limited in three major regards: It did not involve truly elderly people (the rat studies monitored the rats until they died a natural death), the subjects had not consumed aspartame as children, and it was not a controlled study (the subjects provided only a rough estimate of their aspartame consumption, and people who consumed aspartame might have had other dietary or lifestyle differences that obscured the chemical's effects).

The bottom line is that lifelong consumption of aspartame probably increases the risk of cancer. People—especially young children—should not consume foods and beverages sweetened with aspartame, should switch to products sweetened with SUCRALOSE (Splenda), or should avoid all artificially sweetened foods. Two other artificial sweeteners, SACCHARIN and ACESULFAME-K, have also been linked to a risk of cancer.



BENZOIC ACID: See [SODIUM BENZOATE](#).



BETA-CAROTENE

Coloring; nutrient: Margarine, shortening, non-dairy whiteners, beverages, breakfast cereals, supplements.

Beta-carotene is used as an artificial coloring and a nutrient supplement. The body converts it to Vitamin A, which is part of the light-detection mechanism of the eye and which helps maintain the normal condition of mucous membranes. Large amounts of beta-carotene in the form of dietary supplements increased the risk of lung cancer in smokers and did not reduce the risk in non-smokers. Smokers should certainly not take beta-carotene supplements, but the small amounts used as food additives are safe.



BROMINATED VEGETABLE OIL (BVO)

Emulsifier, clouding agent: Soft drinks.

BVO keeps flavor oils in suspension and gives a cloudy appearance to citrus-flavored soft drinks. Eating BVO leaves small residues in body fat; it is unclear whether those residues pose any risk. Fortunately, BVO is rarely used.



BUTYLATED HYDROXYANISOLE (BHA)

Antioxidant: Cereals, chewing gum, potato chips, vegetable oil.

BHA retards rancidity in fats, oils, and oil-containing foods. While some studies indicate it is safe, other studies demonstrate that it causes cancer in rats, mice, and hamsters. Those cancers are controversial because they occur in the forestomach, an organ that humans do not have. However, a chemical that causes cancer in at least one organ in three different species indicates that it might be carcinogenic in humans. That is why the U.S. Department of Health and Human Services considers BHA to be "reasonably anticipated to be a human carcinogen." Nevertheless, the Food and Drug Administration still permits BHA to be used in foods. This synthetic chemical can be replaced by safer chemicals (e.g., vitamin E), safer processes (e.g., packing foods under nitrogen instead of air), or can simply be left out (many brands of oily foods, such as potato chips, don't use any antioxidant).



BUTYLATED HYDROXYTOLUENE (BHT)

Antioxidant: Cereals, chewing gum, potato chips, oils, etc.

BHT retards rancidity in oils. It either increased or decreased the risk of cancer in various animal studies. Residues of BHT occur in human fat. BHT is unnecessary or is easily replaced by safe substitutes (see discussion of BHA). Avoid it when possible.



CAFFEINE

Stimulant: Naturally occurring in coffee, tea, cocoa, coffee-flavored yogurt and frozen desserts. Additive in soft drinks, energy drinks, gum, and waters.

Caffeine is the only drug that is present naturally or added to widely consumed foods (quinine is the other drug used in foods). It is mildly addictive, one possible reason that makers of soft drinks add it to their products. Many coffee drinkers experience withdrawal symptoms, such as headaches, irritability, sleepiness, and lethargy, when they stop drinking coffee.

Because caffeine increases the risk of miscarriages (and possibly birth defects) and inhibits fetal growth, it should be avoided by women who are pregnant or considering becoming pregnant. It also may make it harder to get pregnant.

Caffeine also keeps many people from sleeping, causes jitteriness, and affects calcium metabolism.

The caffeine in a standard cup or two of coffee is harmless to most people. But if you drink more than a couple of cups of coffee or cans of caffeine-containing soda per day, experience symptoms noted above, are at risk of osteoporosis, or are pregnant, you should rethink your habit. Note that some "energy" drinks contain far more caffeine than most soft drinks.



CALCIUM (or SODIUM) PROPIONATE

Preservative: Bread, rolls, pies, cakes.

Calcium propionate prevents mold growth on bread and rolls. The calcium is a beneficial mineral; the propionate is safe. Sodium propionate is used in pies and cakes, because calcium alters the action of chemical leavening agents.



CALCIUM (or SODIUM) STEAROYL LACTYLATE, CALCIUM (or SODIUM) STEAROYL FUMARATE

Dough conditioner, whipping agent: Bread dough, cake fillings, artificial whipped cream, processed egg whites.

These additives strengthen bread dough so it can be used in commercial bread-making machinery and help produce a more uniform grain and greater volume. They act as whipping agents in dried, liquid, or frozen egg whites and artificial whipped cream.



CARMINE; COCHINEAL EXTRACT

Artificial coloring.

Cochineal extract is a coloring extracted from the eggs of the cochineal beetle, which lives on cactus plants in Peru, the Canary Islands, and elsewhere. Carmine is a more purified coloring made from cochineal. In both cases, the actual substance that provides the color is carminic acid. These colorings, which are extremely stable, are used in some red, pink, or purple candy, yogurt, Campari, ice cream, beverages, and many other foods, as well as drugs and cosmetics. These colorings have caused allergic reactions that range from hives to life-threatening anaphylactic shock. It is not known how many people suffer from this allergy. The Food and Drug Administration should ban cochineal extract and carmine or, at the very least, require that they be identified clearly on food labels so that people could avoid them. Natural or synthetic substitutes are available. A label statement should also disclose that, Carmine is extracted from dried insects so that vegetarians and others who want to avoid animal products could do so.



CARRAGEENAN

Thickening, gelling, and stabilizing agent: Ice cream, jelly, chocolate milk, infant formula, cottage cheese.

Carrageenan is an indigestible family of large molecules obtained from seaweed. Large amounts of carrageenan have harmed test animals' colons; the small amounts in food are safe.



CASEIN, SODIUM CASEINATE

Thickening and whitening agent: Ice cream, ice milk, sherbet, coffee creamers.

Casein, the principal protein in milk, is a nutritious protein containing adequate amounts of all the essential amino acids. People who are allergic to casein should read food labels carefully, because the additive is used in some "non-dairy" and "vegetarian" foods.



CITRIC ACID, SODIUM CITRATE

Acid, flavoring, chelating agent: Ice cream, sherbet, fruit drink, candy, carbonated beverages, instant potatoes.

Citric acid is versatile, widely used, cheap, and safe. It is an important metabolite in virtually all living organisms and is especially abundant naturally in citrus fruits and berries. It is used as a strong acid, a tart flavoring, and an antioxidant. Sodium citrate, also safe, is a buffer that controls the acidity of gelatin desserts, jam, ice cream, candy, and other foods.



COCHINEAL EXTRACT: see [CARMINE](#).



CORN SYRUP

Sweetener, thickener: Candy, marshmallows, syrups, snack foods, imitation dairy foods.

Corn syrup, which consists mostly of dextrose, is a sweet, thick liquid made by treating cornstarch with acids or enzymes. It may be dried and used as corn syrup solids in coffee whiteners and other dry products. Corn syrup contains no nutritional value other than calories, promotes tooth decay, and is used mainly in foods with little intrinsic nutritional value.

**CYCLAMATE**

Artificial sweetener: Diet foods.

This controversial high-potency sweetener was used in the United States in diet foods until 1970, at which time it was banned. Animal studies indicated that it causes cancer. Now, based on animal studies, it (or a byproduct) is believed not to cause cancer directly, but to increase the potency of other carcinogens and to harm the testes.

**DEXTROSE**

Sweetener: Bread, caramel, soda pop, cookies, many other foods. [Learn more.](#)

Dextrose is an important chemical in every living organism. A sugar, it is a source of sweetness in fruits and honey. Added to foods as a sweetener, it represents empty calories and contributes to tooth decay. Dextrose turns brown when heated and contributes to the color of bread crust and toast. Americans consume about 25 pounds per year of dextrose -- and a total of about 150 pounds per year of all refined sugars.

**DIACETYL**

Butter flavoring.

Diacetyl is one of the many chemicals that gives butter its characteristic flavor. Low levels are present in butter (including unsalted butter, to which extra diacetyl is added to prolong its shelf life). Much higher levels have been used in butter-flavored popcorn, margarine, and butter-flavored cooking oils and sprays. The low levels are safe, but workers in factories that produce microwave popcorn learned the hard way that long-term exposure to diacetyl causes obstructive lung disease, which is potentially fatal. Following widespread publicity around 2005 to 2007 and several lawsuits persuaded most major American food manufacturers to protect their workers (and restaurant cooks) by switching to safer ingredients.

**DIACYLGLYCEROL**

Cooking oil.

This is the diglyceride part of the long-used emulsifier, mono- and diglycerides. The manufacturer claims that it can help people lose weight and reduce triglyceride levels.

**EDTA**

Chelating agent: Salad dressing, margarine, sandwich spreads, mayonnaise, processed fruits and vegetables, canned shellfish, soft drinks.

Modern food-manufacturing technology, which involves rollers, blenders, and containers made of metal, results in trace amounts of metal contamination in food. EDTA (ethylenediamine tetraacetic acid) traps metal impurities, which would otherwise promote rancidity and the breakdown of artificial colors. It is safe.



ERYTHORBIC ACID: see ASCORBIC ACID.

Antioxidant, color stabilizer: Cured meats.

**FERROUS GLUCONATE**

Coloring, nutrient: Black olives.

Used by the olive industry to generate a uniform jet-black color and in pills as a source of iron.



FOOD-STARCH, MODIFIED: see STARCH, MODIFIED.

**FRUCTOSE**

Sweetener: "Health" drinks and other products.

Fructose (also called levulose) is a sugar that is a little sweeter than table sugar. Modest amounts of fructose occur naturally in fruits and vegetables, which also contain other sugars. When table sugar is digested, it breaks down into equal amounts of fructose and glucose (dextrose). Another major source of fructose in the typical diet is high-fructose corn syrup (HFCS), which typically contains about half fructose and half glucose. Fructose itself is used as a sweetener in a small number of foods whose labels often imply, deceptively, that such foods are healthier than competing products that are sweetened with sugar or HFCS.

Modest amounts of fructose are safe and do not boost blood glucose levels, making the sweetener attractive to diabetics. However, large amounts increase triglyceride (fat) levels in blood and, thereby, increase the risk of heart disease. Large amounts consumed on a regular basis also may affect levels of such hormones as insulin, leptin, and ghrelin, that regulate appetite, thereby contributing to weight gain and obesity.

**FUMARIC ACID**

Tartness agent: Powdered drinks, pudding, pie fillings, gelatin desserts.

A solid at room temperature, inexpensive, highly acidic, fumaric acid is the ideal source of tartness and acidity in dry food products. However, it dissolves slowly in cold water, a drawback cured by adding DIOCTYL SODIUM SULFOSUCCINATE (DSS), a detergent-like additive that appears to be safe.

**GELATIN**

Thickening and gelling agent: Powdered dessert mixes, marshmallows, yogurt, ice cream, cheese spreads, beverages.

Gelatin is a protein obtained from animal hides and bones. It has little nutritional value, because it contains little or none of several essential amino acids.

**GLYCERIN (GLYCEROL)**

Maintains water content: Candy, fudge, baked goods.

In nature, glycerin forms the backbone of fat and oil molecules. The body uses it as a source of energy or as a starting material in making more-complex molecules.

**GUMS**

Arabic, Furcelleran, Ghatti, Guar, Karaya, Locust Bean, Tragacanth, Xanthan

Thickening agents, stabilizers: Beverages, ice cream, frozen pudding, salad dressing, dough, cottage cheese, candy, drink mixes.



Gums are derived from natural sources (bushes, trees, seaweed, bacteria) and are poorly tested, though probably safe. They are not absorbed by the body. They are used to thicken foods, prevent sugar crystals from forming in candy, stabilize beer foam (arabic), form a gel in pudding (furcelleran), encapsulate flavor oils in powdered drink mixes, or keep oil and water mixed together in salad dressings. Gums are often used to replace fat in low-fat ice cream, baked goods, and salad dressings. Tragacanth has caused occasional severe allergic reactions.

**HEPTYL PARABEN**

Preservative: Beer, non-carbonated soft drinks.

Heptyl paraben -- short for the heptyl ester of para-hydroxybenzoic acid -- is a preservative. Studies suggest that this rarely used additive chemical is safe, but it, like other additives in alcoholic beverages, has never been tested in the presence of alcohol (such as in animals weakened by long-term consumption of alcohol).

**HIGH-FRUCTOSE CORN SYRUP**

Sweetener: Soft drinks, other processed foods.

Our consumption of high-fructose corn syrup (HFCS) has soared since around 1980. That's because this sweet syrupy liquid is cheaper and easier for some companies to use than sugar. HFCS has been blamed by a few people for the obesity epidemic, because rates of obesity have climbed right along with HFCS consumption. But that's an urban myth. There isn't a shred of evidence that HFCS is any more harmful (or healthier) than sugar. We're consuming way too much of both.

Some people think that HFCS is mostly fructose, and fructose probably does play a role in obesity. However, HFCS, on average, is about half fructose and half glucose—exactly the same as ordinary table sugar, sucrose, when sucrose is metabolized by the body. When sugar is (or, as is generally the case, was) used in soft drinks, much of it was broken down to glucose and fructose right in the bottle. If the big soda companies weren't using HFCS, they'd be using regular sugar, and the extra cost would only be a couple of cents per can, a difference that likely would have little effect on consumption.

HFCS starts out as cornstarch. Companies use enzymes or acids to break down the starch into its glucose subunits. Then other enzymes convert different proportions of the glucose to fructose. The resulting syrups contain as much as 90 percent fructose, but most HFCS is 42 percent or 55 percent fructose. In 2005, about 77 pounds of corn sweeteners, mostly HFCS, and 63 pounds cane and beet sugar were produced per capita (U.S.). A total of 142 pounds of all caloric sweeteners, down from the 1999 high of 151 pounds, was produced per person. (Production does not equal actual consumption, because some sugars, or the products in which they are used, are lost or discarded in the distribution chain.)

See also [MALTODEXTRIN](#) and [HIGH MALTOSE CORN SYRUP](#) .

**HIGH MALTOSE CORN SYRUP**

Improves shelf life, inhibits bacterial growth, fermentation, other purposes: Candy, baked goods, beer.

Acids or enzymes are used to break down cornstarch into a syrup rich in maltose (35 percent or more), a disaccharide. High maltose corn syrup, corn syrup solids, and maltodextrin are similar, and each are produced in a wide variety of formulations for different applications.

See also [MALTODEXTRIN](#) and [HIGH FRUCTOSE CORN SYRUP](#).

**HYDROGENATED STARCH HYDROLYSATE (HSH)**

Sweetener: Dietetic and reduced-calorie foods.

HSH, like sorbitol, is slightly sweet and poorly absorbed by the body. Like sorbitol, and other sugar alcohols, eating significant amounts of HSH may cause intestinal gas and diarrhea.

**HYDROLYZED VEGETABLE PROTEIN (HVP)**

Flavor enhancer: Instant soups, frankfurters, sauce mixes, beef stew.

HVP consists of vegetable (usually soybean) protein that has been chemically broken down to the amino acids of which it is composed. HVP is used to bring out the natural flavor of food (and, perhaps, to enable companies to use less real food). It contains MSG and may cause adverse reactions in sensitive individuals.

**INULIN**

Fat substitute: Margarine, baked goods, fillings, dairy foods, frozen desserts, salad dressing.

It's a naturally occurring soluble fiber. Inulin doesn't raise blood sugar levels, so it may help people with diabetes. It also stimulates the growth of friendly bacteria in the large intestine.

**INVERT SUGAR**

Sweetener: Candy, soft drinks, many other foods.

Invert sugar, a 50-50 mixture of two sugars, dextrose and fructose, is sweeter and more soluble than sucrose (table sugar). Invert sugar forms when sucrose is split in two by an enzyme or acid. It provides "empty calories," contributes to tooth decay, and should be avoided.

**LACTIC ACID**

Controls acidity: Spanish olives, cheese, frozen desserts, carbonated beverages.

This safe acid occurs in almost all living organisms. It inhibits spoilage in Spanish-type olives, balances the acidity in cheese-making, and adds tartness to frozen desserts, carbonated fruit-flavored drinks, and other foods.

**LACTITOL**

Sweetener: Candy, chocolates, baked goods, ice cream, and other sugar-free foods.

Lactitol, like sorbitol, mannitol, and xylitol, is a sugar alcohol, also called a polyol. It is made from lactose, or milk sugar. Like other sugar alcohols, lactitol is not absorbed well by the body (which means it has fewer calories per gram than table sugar) and does not promote tooth decay. However, large amounts (above 20 to 30 grams) may cause loose stools or diarrhea.

**LACTOSE**

Sweetener: Whipped topping mix, breakfast pastry.

Lactose, a carbohydrate found only in milk, is one of Nature's ways of delivering calories to infant mammals. One-sixth as sweet as table sugar, lactose is added to food as a slightly sweet source of carbohydrate. Milk turns sour when bacteria convert lactose to lactic acid. Many people, especially non-Caucasians, have trouble digesting lactose. Bacteria in their guts may produce gas.

**LECITHIN**

Emulsifier, antioxidant: Baked goods, margarine, chocolate, ice cream.

A common constituent of animal and plant tissues, lecithin is a source of the nutrient choline. It keeps oil and water from separating out, retards rancidity, reduces spattering in a frying pan, and leads to fluffier cakes. Major natural sources are egg yolk and soybeans.

**MALTITOL**

Sweetener: Candy, chocolates, jams, and other sugar-free foods.

Maltitol, like sorbitol, mannitol, and xylitol, is a sugar alcohol, also called a polyol. It is made by hydrogenating maltose, which is obtained from corn syrup. Like other sugar alcohols, mannitol is not absorbed well by the body (which means it has fewer calories per gram than table sugar) and does not promote tooth decay. However, large amounts (above 20 to 30 grams) may have a laxative effect.



MALTODEXTRIN

It's made from starch and consists of short chains of glucose molecules. Normal maltodextrins are easily digested and absorbed by the body. But companies also use "resistant maltodextrin" to simulate dietary fiber. That form of maltodextrin is made by treating starch with enzymes, heat, or acids and cannot be broken down by digestive enzymes. That makes the additive an "isolated fiber." Resistant maltodextrins may help lower blood sugar levels, but don't help prevent constipation.

See also [HIGH FRUCTOSE CORN SYRUP](#) and [HIGH MALTOSE CORN SYRUP](#).



MANNITOL

Sweetener, other uses: "Dust" on chewing gum, low-calorie foods.

Mannitol, like sorbitol and xylitol, is a sugar alcohol, also called a polyol. Like other sugar alcohols, mannitol is not as sweet as sugar, not absorbed well by the body (which means it provides only half as many calories per gram as table sugar), and does not promote tooth decay. However, large amounts may have a laxative effect and even cause diarrhea. The FDA requires foods "whose reasonably foreseeable consumption may result in a daily ingestion of 20 grams of mannitol" to bear this mild warning: "Excess consumption may have a laxative effect."



MONO- and DIGLYCERIDES

Emulsifier: Baked goods, margarine, candy, peanut butter.

Makes bread softer and prevents staling, improves the stability of margarine, makes caramels less sticky, and prevents the oil in peanut butter from separating out. Mono- and diglycerides are safe, though most foods they are used in are high in refined flour, sugar, or fat.



MONOSODIUM GLUTAMATE (MSG)

Flavor enhancer: Soup, salad dressing, chips, frozen entrees, restaurant foods.

This amino acid brings out the flavor in many foods. While that may sound like a treat for taste buds, the use of MSG allows companies to reduce the amount of real ingredients in their foods, such as chicken in chicken soup. In the 1960s, it was discovered that large amounts of MSG fed to infant mice destroyed nerve cells in the brain. After that research was publicized, public pressure forced baby-food companies to stop adding MSG to their products (it was used to make the foods taste better to parents).

Careful studies have shown that some people are sensitive to MSG. Reactions include headache, nausea, weakness, and burning sensation in the back of neck and forearms. Some people complain of wheezing, changes in heart rate, and difficulty breathing. Some people claim to be sensitive to very small amounts of MSG, but no good studies have been done to determine just how little MSG can cause a reaction in the most-sensitive people. To protect the public's health, manufacturers and restaurateurs should use less or no MSG and the amounts of MSG should be listed on labels of foods that contain significant amounts. People who believe they are sensitive to MSG should be aware that other ingredients, such as natural flavoring and hydrolyzed vegetable protein, also contain glutamate. Also, foods such as Parmesan cheese and tomatoes contain glutamate that occurs naturally, but no reactions have been reported to those foods.



MYCOPROTEIN

Meat substitute: Quorn brand foods.

Mycoprotein, the novel ingredient in Quorn-brand frozen meat substitutes, is made from processed mold (*Fusarium venenatum*). Though the manufacturer's (Marlow Foods) advertising and labeling implied that the product is "mushroom protein" or "mushroom in origin," the mold (or fungus) from which it is made does not produce mushrooms. Rather, the mold is grown in liquid solution in large tanks. It has been used in the United Kingdom since the 1990s and has also been sold in continental Europe. Quorn foods have been marketed in the United States since 2002. The chunks of imitation meat are nutritious, but the prepared foods in which they are used may be high in fat or salt.

Several percent of consumers are sensitive to Quorn products, resulting in vomiting, nausea, diarrhea, and, less often, hives and potentially fatal anaphylactic reactions. Many people have gone to emergency rooms for treatment of Quorn-related reactions. A survey in the United Kingdom sponsored by the Center for Science in the Public Interest (CSPI) found that the percentage of consumers sensitive to Quorn is probably as great as, or

greater than, the percentage sensitive to soy, milk, peanuts, and other common food allergens. The British and American governments acknowledge that Quorn foods cause allergic reactions, but rejected CSPI's recommendations to bar the use of mycoprotein or require Quorn foods to bear a warning label. (In fact, when Quorn-containing "vegetarian" products are served at restaurants, cafeterias, and other foodservice locations, there is no label to inform consumers that they are eating Quorn foods.)



NEOTAME

Artificial sweetener: Diet soft drinks and other diet foods.

Neotame, produced by NutraSweet Co. (maker of aspartame), is about 8,000 times sweeter than table sugar and 40 times sweeter than aspartame. Neotame is chemically related to aspartame, but the difference confers greater chemical stability, enabling the new sweetener to be used in baked foods. It likely will be used mostly in low-calorie foods, but may also be used to adjust the flavor of other foods. It was approved by the U.S. FDA in 2002, but is still rarely used.



OAT FIBER, WHEAT FIBER

Isolated fiber: Cereal, crackers, bread, muffins.

When a food ingredient contains the word "fiber," it's code for an isolated fiber. "Wheat fiber" and "oat *hull* fiber" are insoluble fibers, which may help prevent constipation but don't lower blood cholesterol or blood sugar. "Oat fiber" can be either insoluble or soluble fiber. Soluble fiber may lower blood cholesterol and blood sugar but doesn't prevent constipation.



OLESTRA (Olean)

Fat substitute: Lay's Light Chips, Pringles Light chips.

Olestra is Procter & Gamble's synthetic fat that is not absorbed as it passes through the digestive system, so it has no calories. Procter & Gamble suggests that replacing regular fat with olestra will help people lose weight and lower the risk of heart disease.

Olestra can cause diarrhea and loose stools, abdominal cramps, flatulence, and other adverse effects. Those symptoms are sometimes severe. [Afflicted consumers can file reports with the Center for Science in the Public Interest.](#)

Even more importantly, olestra reduces the body's ability to absorb fat-soluble carotenoids (such as alpha and beta-carotene, lycopene, lutein, and canthaxanthin) from fruits and vegetables. Those nutrients are thought by many experts to reduce the risk of cancer and heart disease. Olestra enables manufacturers to offer greasy-feeling low-fat snacks, but consumers would be much better off with baked snacks, which are perfectly safe and just as low in calories. Products made with olestra should not be called "fat free," because they contain substantial amounts of *indigestible* fat.



OLIGOFRACTOSE

Bulking agent, emulsifier, sweetener prebiotic: Frozen desserts, cookies, energy and granola bars.

Oligofructose, synthesized from sucrose or extracted from chicory roots, consists of up to several dozen fructose molecules linked end to end. Like inulin and other soluble fibers, oligofructose is digested by bacteria in the large intestine, but not by human enzymes. This slightly sweet ingredient provides less than about half as many calories per gram as fructose or other sugar. Oligofructose promotes the growth of "good" bifidus bacteria.



PARTIALLY HYDROGENATED VEGETABLE OIL, HYDROGENATED VEGETABLE OIL (Trans fat)

Fat, oil, shortening: Stick margarine, crackers, fried restaurant foods, baked goods, icing, microwave popcorn.

Vegetable oil, usually a liquid, can be made into a semi-solid shortening by reacting it with hydrogen. Partial hydrogenation reduces the levels of polyunsaturated oils - and also creates trans fats, which promote heart disease. A committee of the U.S. Food and Drug Administration (FDA) concluded in 2004 that on a gram-for-gram basis, trans fat is even more harmful than saturated fat. Ideally, food manufacturers would replace hydrogenated shortening with less-harmful ingredients. The Institute of Medicine has advised consumers to consume as little trans fat as possible, ideally less than about 2 grams a day (that much might come from naturally occurring trans fat in beef and dairy products). Harvard School of Public Health researchers estimate that trans fat had been causing about 50,000 premature heart attack deaths annually, making partially hydrogenated oil one of the most harmful ingredients in the food supply (see discussion of salt below).

Beginning in 2006, Nutrition Facts labels have had to list the amount of trans fat in a serving. That spurred many companies, including Frito-Lay, Kraft, ConAgra, and others, to replace most or all of the partially hydrogenated oil in almost all their products. Usually the substitutes are healthier and the total of saturated plus trans fat is no higher than it was. Foods labeled "0g trans fat" are permitted to contain 0.5g per serving, while

"no trans fat" means none at all. Consumers need to read labels carefully: foods labeled "0g trans" or "no trans" may still have large amounts of saturated fat.

Restaurants, which do not provide nutrition information, have been slower to change, but the pace of change has picked up. They use partially hydrogenated oil for frying chicken, potatoes, and fish, as well as in biscuits and other baked goods. McDonald's, Wendy's, KFC, Taco Bell, Ruby Tuesday, and Red Lobster are some of the large chains that have largely eliminated trans fat or soon will. Most large chains and many smaller independent restaurants continue to fry in partially hydrogenated oil and their French fries, fried chicken, fried fish, and pot pies contain substantial amounts of trans fat. Fortunately, the use of partially hydrogenated oil dropped by 50 percent from around 2000 to 2007.

In Denmark, the government has virtually banned partially hydrogenated oil. In 2004, the Center for Science in the Public Interest petitioned the FDA to immediately require restaurants to disclose when they use partially hydrogenated oil and to begin the process of eliminating partially hydrogenated oil from the entire food supply. While the FDA rejected the idea of requiring restaurants to disclose the presence of trans fat, New York City, Philadelphia, Boston, and other jurisdictions have set tight limits on the trans-fat content of restaurant foods. Meanwhile, the FDA is continuing to consider CSPI's petition to revoke the legal status of partially hydrogenated oil (the FDA considers that oil to be "generally recognized as safe," even though it and everyone else considers it to be "generally recognized as dangerous.")

Fully hydrogenated vegetable oil does not have any trans fat, but it also does not have any polyunsaturated oils. It is sometimes mixed (physically or chemically) with polyunsaturated liquid soybean oil to create trans-free shortening. When it is chemically combined with liquid oil, the ingredient is called inter-esterified vegetable oil. Meanwhile, oil processors are trying to improve the hydrogenation process so that less trans fat forms.



PHOSPHORIC ACID; PHOSPHATES

Acidulant, chelating agent, buffer, emulsifier, nutrient, discoloration inhibitor: Baked goods, cheese, powdered foods, cured meat, soda pop, breakfast cereals, dehydrated potatoes.

Phosphoric acid acidifies and flavors cola beverages. CALCIUM and IRON PHOSPHATES act as mineral supplements. SODIUM ALUMINUM PHOSPHATE is a leavening agent. CALCIUM and AMMONIUM PHOSPHATES serve as food for yeast in baking. SODIUM ACID PYROPHOSPHATE prevents discoloration in potatoes and sugar syrups. While excessive consumption of phosphates could lead to dietary imbalances that might contribute to osteoporosis, only a small fraction of the phosphate in the American diet comes from additives. Most comes from meat and dairy products.



PHYTOSTEROLS and PHYTOSTANOLS (PLANT STEROLS or STANOLS)

Cholesterol-lowering additive: Margarine, fruit juice, bread, dietary supplements.

These substances are minor components of membranes in many nuts, seeds, vegetable oils, fruits, vegetables and other foods. They are chemically related to cholesterol. They are more easily incorporated into foods (other than fruit juices) when they are converted to ester forms. Then, when consumed in high doses from foods or dietary supplements, the sterol or stanol esters reduce the absorption of cholesterol from food and can lower LDL ("bad") blood cholesterol levels by 10 to 15 percent. They are not toxic, but they may reduce the body's absorption of nutrients called carotenoids that are thought to reduce the risk of cancer and heart disease.



POLYDEXTROSE

Bulking agent: Reduced-calorie salad dressings, baked goods, candies, puddings, frozen desserts.

Polydextrose is made by combining dextrose (corn sugar) with sorbitol. The result is a slightly sweet, reduced-calorie (only one calorie per gram because it is poorly digested) bulking agent. The FDA requires that if a serving of a food would likely provide more than 15 grams of polydextrose, the label should advise consumers that "Sensitive individuals may experience a laxative effect from excessive consumption of this product."



POLYSORBATE 60

Emulsifier: Baked goods, frozen desserts, imitation cream.

Polysorbate 60 is short for polyoxyethylene-(20)- sorbitan monostearate. It and its close relatives, POLYSORBATE 65 and 80, work the same way as mono- and diglycerides, but smaller amounts are needed. They keep baked goods from going stale, keep dill oil dissolved in bottled dill pickles, help coffee whiteners dissolve in coffee, and prevent oil from separating out of artificial whipped cream.



POTASSIUM BROMATE

Flour improver: White flour, bread and rolls.

This additive has long been used to increase the volume of bread and to produce bread with a fine crumb (the

not-crust part of bread) structure. Most bromate rapidly breaks down to form innocuous bromide. However, bromate itself causes cancer in animals. The tiny amounts of bromate that may remain in bread pose a small risk to consumers. Bromate has been banned virtually worldwide except in Japan and the United States. It is rarely used in California because a cancer warning might be required on the label. In 1999, the Center for Science in the Public Interest petitioned the FDA to ban bromate. Since then, numerous millers and bakers have stopped using bromate.



PROPYL GALLATE

Antioxidant preservative: Vegetable oil, meat products, potato sticks, chicken soup base, chewing gum.

Propyl gallate retards the spoilage of fats and oils and is often used with BHA and BHT, because of the synergistic effects these preservatives have. The best studies on rats and mice were peppered with suggestions (but not proof) that this preservative might cause cancer.



QUININE

Flavoring: Tonic water, quinine water, bitter lemon.



This drug can cure malaria and is used as a bitter flavoring in a few soft drinks. There is a slight chance that quinine causes birth defects, so, to be on the safe side, pregnant women should avoid quinine-containing beverages and drugs. Relatively poorly tested.



QUORN: See [MYCOPROTEIN](#).



SACCHARIN

Artificial sweetener: Diet, no-sugar-added products, soft drinks, sweetener packets.

Saccharin (Sweet 'N Low) is 350 times sweeter than sugar and is used in diet foods or as a tabletop sugar substitute. Many studies on animals have shown that saccharin can cause cancer of the urinary bladder. In other rodent studies, saccharin has caused cancer of the uterus, ovaries, skin, blood vessels, and other organs. Other studies have shown that saccharin increases the potency of other cancer-causing chemicals. And the best epidemiology study (done by the National Cancer Institute) found that the use of artificial sweeteners (saccharin and cyclamate) was associated with a higher incidence of bladder cancer.

In 1977, the FDA proposed that saccharin be banned, because of studies that it causes cancer in animals. However, Congress intervened and permitted it to be used, provided that foods bear a warning notice. It has been replaced in many products by aspartame (NutraSweet). In 1997, the diet-food industry began pressuring the U.S. and Canadian governments and the World Health Organization to take saccharin off their lists of cancer-causing chemicals. The industry acknowledges that saccharin causes bladder cancer in male rats, but argues that those tumors are caused by a mechanism that would not occur in humans. Many public health experts respond by stating that, even if that still-unproved mechanism were correct in male rats, saccharin could cause cancer by additional mechanisms and that, in some studies, saccharin has caused bladder cancer in mice and in female rats and other cancers in both rats and mice.

In May 2000, the U.S. Department of Health and Human Services removed saccharin from its list of cancer-causing chemicals. Later that year, Congress passed a law removing the warning notice that likely will result in increased use in soft drinks and other foods and in a slightly greater incidence of cancer.



SALATRIM

Modified fat: Baked goods, candy.

This manufactured fat (developed by Nabisco) has the physical properties of regular fat, but the manufacturer claims it provides only about 5/9 as many calories. Its use can enable companies to make reduced-calorie claims on their products. Salatrim's low calorie content results from its content of stearic acid, which the manufacturer says is absorbed poorly, and short-chain fatty acids, which provide fewer calories per unit weight.

Critics have charged that it does not provide as big a calorie reduction as claimed by Nabisco. Moreover, only very limited testing has been done to determine effects on humans. Eating small amounts of salatrim is probably safe, but large amounts (30g or more per day) increase the risk of such side effects as stomach cramps and nausea. No tests have been done to determine if the various food additives (salatrim, olestra, mannitol, and sorbitol) that cause gastrointestinal symptoms can act in concert to cause greater effects.

Nabisco declared salatrim safe and has marketed it, as the law allows, without formal FDA approval. (Nabisco has since sold salatrim to another company, Cultor.) In June 1998, the Center for Science in the Public Interest

urged the FDA to ban salatrim until better tests were done and demonstrated safety. The FDA rejected that recommendation, but salatrim is not widely used, if at all.



SALT (Sodium Chloride)

Flavoring, preservative: Most processed foods, cured meats, soup, snack chips, crackers, and others.

Salt, at the levels present in the diets of most people around the world, is probably the single most harmful substance in the food supply. Salt is used liberally in many processed foods and restaurant meals, with some meals containing far more than a day's worth of sodium. Other additives, such as monosodium glutamate and sodium benzoate, contribute additional sodium. Salt serves many purposes in foods, such as acting as a preservative, adding a salty flavor, masking bitter flavors, and fostering expected texture or other property.

A diet high in sodium increases blood pressure in most people, thereby increasing the risk of heart attack and stroke. In 2004, the director of the U.S. National Heart, Lung, and Blood Institute and two colleagues estimated that cutting the amount of sodium in packaged and restaurant foods by half would save 150,000 lives a year. Everyone should avoid salty processed foods and restaurant meals, use salt sparingly in cooking and at the table, and enjoy other seasonings.

The Food and Drug Administration considers salt to be "generally recognized as safe" (GRAS), even though it recognizes that diets high in salt are a major cause of cardiovascular disease and even though its own advisory committee in 1979 concluded that salt should not be considered GRAS. In 1978 and 2005 the Center for Science in the Public Interest [petitioned the FDA](#) to revoke salt's GRAS status and take other steps to lower sodium levels in the food supply. In response, the FDA held a public hearing in November, 2007. Meanwhile, the [British government](#) has made salt reduction one of its top health goals and has been having significant success.

Many companies defend the amounts of salt used, saying that using less would sacrifice taste or safety. However, comparisons of different brands of the same product frequently show wide differences in [sodium content](#). That indicates that many companies could use less salt (or other sodium-containing ingredients) to the levels used by competitors and still have perfectly marketable products.



SODIUM BENZOATE, BENZOIC ACID

Preservative: Fruit juice, carbonated drinks, pickles.

Manufacturers have used sodium benzoate (and its close relative benzoic acid) for a century to prevent the growth of microorganisms in acidic foods. The substances occur naturally in many plants and animals. They appear to be safe for most people, though they cause hives, asthma, or other allergic reactions in sensitive individuals. In children, sodium benzoate may adversely affect behavior (especially in children with Attention Deficit-Hyperactivity Disorder).

Another problem occurs when sodium benzoate is used in beverages that also contain ascorbic acid (vitamin C). The two substances, in an acidic solution, can react together to form small amounts of benzene, a chemical that causes leukemia and other cancers. Though the amounts of benzene that form are small, leading to only a very small risk of cancer, there is no need for consumers to experience any risk. In the early 1990s the FDA had urged companies not to use benzoate in products that also contain ascorbic acid, but in the 2000s companies were still using that combination. A lawsuit filed in 2006 by private attorneys ultimately forced Coca-Cola, PepsiCo, and other soft-drink makers in the U.S. to reformulate affected beverages, typically fruit-flavored products.



SODIUM CARBOXYMETHYL- CELLULOSE (CMC)

Thickening and stabilizing agent, prevents sugar from crystallizing: Ice cream, beer, pie fillings, icings, diet foods, candy.

CMC is made by reacting cellulose with a derivative of acetic acid. Studies indicate it is safe.



SODIUM NITRITE, SODIUM NITRATE

Preservative, coloring, flavoring: Bacon, ham, frankfurters, luncheon meats, smoked fish, corned beef.

Meat processors love sodium nitrite because it stabilizes the red color in cured meat (without nitrite, hot dogs and bacon would look gray) and gives a characteristic flavor. Sodium nitrate is used in dry cured meat, because it slowly breaks down into nitrite. Adding nitrite to food can lead to the formation of small amounts of potent cancer-causing chemicals (nitrosamines), particularly in fried bacon. Nitrite, which also occurs in saliva and forms from nitrate in several vegetables, can undergo the same chemical reaction in the stomach. Companies now add ascorbic acid or erythorbic acid to bacon to inhibit nitrosamine formation, a measure that has greatly reduced the problem. While nitrite and nitrate cause only a small risk, they are still worth avoiding.

Several studies have linked consumption of cured meat and nitrite by children, pregnant women, and adults with various types of cancer. Although those studies have not yet proven that eating nitrite in bacon, sausage, and ham causes cancer in humans, pregnant women would be prudent to avoid those products.

The meat industry justifies its use of nitrite and nitrate by claiming that it prevents the growth of bacteria that cause botulism poisoning. That's true, but freezing and refrigeration could also do that, and the U.S. Department of Agriculture has developed a safe method using lactic-acid-producing bacteria. The use of nitrite and nitrate has decreased greatly over the decades, because of refrigeration and restrictions on the amounts used. The meat industry could do the public's health a favor by cutting back even further. Because nitrite is used primarily in fatty, salty foods, consumers have important nutritional reasons for avoiding nitrite-preserved foods.



SODIUM STEAROYL FUMARATE: See [CALCIUM \(or SODIUM\) STEAROYL LACTYLATE](#)



SORBIC ACID, POTASSIUM SORBATE

Prevents growth of mold: Cheese, syrup, jelly, cake, wine, dry fruits.

Sorbic acid occurs naturally in many plants. These additives are safe.



SORBITAN MONOSTEARATE

Emulsifier: Cakes, candy, frozen pudding, icing.

Like mono- and diglycerides and polysorbates, this additive keeps oil and water mixed together. In chocolate candy, it prevents the discoloration that normally occurs when the candy is warmed up and then cooled down.



SORBITOL

Sweetener, thickening agent, maintains moisture: Dietetic drinks and foods, candy, shredded coconut, chewing gum.

Sorbitol occurs naturally in fruits and berries and is a close relative of sugars. It is half as sweet as sugar. It is used in many dietetic foods. It is used in non-cariogenic (non-decay-causing) chewing gum because oral bacteria do not metabolize it well. Some diabetics use sorbitol-sweetened foods because it is absorbed slowly and does not cause blood sugar to increase rapidly. Moderate amounts of sorbitol are safe, but large amounts may have a strong laxative effect and even cause diarrhea. The FDA requires foods "whose reasonably foreseeable consumption may result in a daily ingestion of 50 grams of sorbitol" to bear the label statement: "Excess consumption may have a laxative effect."



STARCH

Thickening agent: Soup, gravy, frozen foods.

Starch, the major component of flour, potatoes, and corn, is used in many foods as a thickening agent. However, starch does not dissolve in cold water. Chemists have solved this problem by reacting starch with various chemicals to create MODIFIED STARCHES (see next entry).



STARCH, MODIFIED

Thickening agent: Soup, gravy, frozen foods.

Modified starches are used in processed foods to improve their consistency and keep the solids suspended. Starch and modified starches used to be used in baby foods to replace large percentages of more nutritious ingredients, such as fruit.



STEVIA

Natural, high-potency sweetener: powdered dietary supplement. (Not approved as a food additive in the U.S., Canada, E.U.).

[Stevia](#), which is about 100 times sweeter than sugar, is obtained from a shrub (yerba dulce) that grow in Brazil and Paraguay. The name of the actual sweet chemical is stevioside. The health-food industry advocates stevia extract as a safe alternative to synthetic sweeteners, like saccharin, aspartame, and sucralose. It is said to be widely used in Japan and several other countries. However, just because a substance is natural, does not mean that it is safe.

The U.S. FDA has rejected stevia (or stevioside) for use as a food additive. Likewise, Canada has not approved stevia, and a European Community scientific panel declared that stevia is unacceptable for use in food. Studies found that high dosages fed to rats caused reduced sperm production and an increase in cell proliferation in their testicles, which could cause infertility or other problems. When pregnant hamsters were fed large amounts of a derivative of stevioside called steviol, they had fewer and smaller offspring. In the laboratory, steviol can be

converted into a mutagenic compound, which may promote cancer by causing mutations in the cells genetic material (DNA). In addition, very large amounts of stevioside can interfere with the absorption of carbohydrates in animals and disrupt the conversion of food into energy within cells. In sum, small amounts of stevia are probably safe, but it is inappropriate to endorse wide use of this sweetener.

Cargill and Merisant (which marks aspartame-based Equal) have developed purified extracts of stevia called Truvia and PureVia, respectively. Cargill is partnering with Coca-Cola, and Merisant with PepsiCo. The extracts are 95 percent pure rebaudioside A, which is 200 times as sweet as sugar. That substance is nicknamed rebiana. In 2008, Cargill published several toxicology studies and, on the basis of those studies, told the FDA that rebiana should be considering "generally recognized as safe," or GRAS. GRAS substances are given less scrutiny by the FDA than standard food additives. Merisant also told the FDA that PureVia should be GRAS. Meanwhile, a third company, Wisdom Natural Brands, declared that its stevia-related product is GRAS without even notifying the FDA.

Notwithstanding the new evidence, [UCLA toxicologists and the Center for Science in the Public Interest have urged the FDA to reject the GRAS claims for rebiana](#). They emphasized that cancer studies were done with stevioside, which is closely related, but not identical, to rebiana. More importantly, they noted that FDA's guidelines call for testing major new food additives in both rats and mice. The toxicologists and CSPI said that testing of rebiana itself, in both rats and mice, is particularly important, because several tests found that rebiana-related substances damaged chromosomes or DNA.



SUCRALOSE

Artificial sweetener: No-sugar-added baked goods, frozen desserts, ice cream, soft drinks, tabletop sweetener (Splenda).

Approved in the United States in 1998, sucralose — marketed as Splenda — is used in soft drinks, baked goods, ice cream, sweetener packets, and other products. It previously had been used in Canada, Europe, and elsewhere. Sucralose is safer than saccharin, acesulfame-K, and cyclamate, but it is often used in combination with acesulfame-K. Unlike aspartame, sucralose can be used in baked goods.

When sucralose was first being considered for approval by the FDA, the Center for Science in the Public Interest objected. A study in rats had indicated that the additive might cause premature shrinkage of the thymus gland, which is part of the immune system. However, a subsequent study did not find any problem. Likewise, studies designed to detect whether sucralose could cause cancer in lab animals did not find any problems.

The manufacturer, McNeil Nutritionals, long advertised Splenda as being "made from sugar, so it tastes like sugar." That statement may be literally true, but is misleading, as the Sugar Association charged in a lawsuit. In fact, the sweetener is a synthetic chemical made by chemically reacting sugar (sucrose) with chlorine. However, the fact that sucralose is synthetic does not make it unsafe.



SUGAR (SUCROSE)

Sweetener: Table sugar, sweetened foods.

Sucrose, ordinary table sugar, occurs naturally in fruit, sugar cane, and sugar beets. Americans consume about 65 pounds of sucrose per year. That figure is down from 102 pounds per year around 1970, but the decrease has been more than made up for with HIGH-FRUCTOSE CORN SYRUP and DEXTROSE. About 156 pounds of all refined sugars are produced per person per year, an increase of 28 percent since 1983. Interestingly that's just when the use of ASPARTAME started skyrocketing. In other words, it appears that artificial sweeteners have not replaced sugar, but may have stimulated America's sweet tooth.

Sugar and sweetened foods may taste good and supply energy, but most people eat too much of them. Sugar, corn syrup, and other refined sweeteners make up 16 percent of the average diet, but provide no vitamins, minerals, or protein. That means that a person would have to get 100 percent of his or her nutrients from only 84 percent of his or her food. Sugar and other refined sugars can promote obesity, tooth decay, and, in people with high triglycerides, heart disease.



SULFITES (SULFUR DIOXIDE, SODIUM BISULFITE)

Preservative, bleach: Dried fruit, wine, processed potatoes.

Sulfiting agents prevent discoloration (dried fruit, some "fresh" shrimp, and some dried, fried, or frozen potatoes) and bacterial growth (wine). They also destroy vitamin B-1 and, most important, can cause severe reactions, especially in asthmatics. To non-sensitive individuals, sulfites are safe. If you think you may be sensitive, avoid all forms of this additive, because it caused at least twelve identifiable deaths in the 1980s and probably many, many more in the preceding decades. Deaths and less severe reactions were linked most commonly to restaurant foods. Sulfite levels in the lettuce and potatoes served at restaurants were often

extremely high, because workers would allow the vegetable to sit in a sulfite solution for far too long a time. As a result of pressure from the Center for Science in the Public Interest (CSPI), a congressional hearing, and media attention, the FDA banned the most dangerous uses of sulfites and required that wine labels list sulfite, when used. Since those actions, CSPI has not been aware of any additional deaths.



TAGATOSE
Sugar substitute.

This new synthetic additive is chemically related to fructose, but is poorly absorbed by the body. That's why it yields only about one-third as many calories and why large amounts cause diarrhea, nausea, and flatulence. In one study, 20 grams (about five teaspoons) caused nausea. Tagatose does not promote tooth decay.



THIAMIN MONONITRATE
Vitamin B-1.

Perfectly safe, despite adding minuscule amounts of nitrate to our food.



TRIACETIN (GLYCEROL TRIACETATE)
Wetting agent: Beverages.

This perfectly safe chemical is used in small amounts in foods and drinks to reduce the surface tension of water.



TRANS FAT: See [PARTIALLY HYDROGENATED VEGETABLE OIL](#).



VANILLIN, ETHYL VANILLIN
Substitute for vanilla: Ice cream, baked goods, beverages, chocolate, candy, gelatin desserts.

Vanilla flavoring is derived from a bean, but vanillin, the major flavor component of vanilla, is cheaper to produce in a factory. A derivative, ethyl vanillin, comes closer to matching the taste of real vanilla. Both chemicals are safe except for the small number of people who are allergic.



VEGETABLE OIL STEROLS: See [PHYTOSTEROLS OR PHYTOSTANOLS](#).




XYLITOL
Sweetener: Sugar-free chewing gum, low-calorie foods.

Like other sugar alcohols (maltitol, mannitol, sorbitol), xylitol is not well absorbed by the body, so it has fewer calories than table sugar. Also, it does not promote tooth decay. Large amounts may have a laxative effect.

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Safety Summary

SAFE	CUTBACK	CAUTION	AVOID
These appear to be safe, though a few people may be allergic to any additive.	Not toxic, but large amounts may be unsafe or promote bad nutrition.	These additives may pose a risk and need to be better tested. Try to avoid	The additive is unsafe in the amounts consumed or is very poorly tested.
-ALGINATE -ALPHA TOCOPHEROL (Vitamin E) -ASCORBIC ACID (Vitamin C) -BETA-CAROTENE -CALCIUM PROPIONATE -CALCIUM STEAROYL LACTYLATE -CARRAGEENAN	-CAFFEINE -CORN SYRUP -DEXTROSE (CORN SUGAR, GLUCOSE) -FRUCTOSE -HIGH-FRUCTOSE CORN SYRUP -HYDROGENATED STARCH HYDROLYSATE -INVERT SUGAR	-ARTIFICIAL COLORINGS: CITRUS RED 2, RED 40 -BROMINATED VEGETABLE OIL (BVO) -BUTYLATED HYDROXYTOLUENE (BHT) -DIACETYL -HEPTYL PARABEN -QUININE -STEVIA	-ACESULFAME POTASSIUM -ARTIFICIAL COLORINGS: BLUE 1, BLUE 2, GREEN 3, RED 3, YELLOW 6 -ASPARTAME (NutraSweet) -BUTYLATED HYDROXYANISOLE (BHA) -CYCLAMATE (not legal in U.S.) -HYDROGENATED VEGETABLE OIL

<ul style="list-style-type: none"> -CITRIC ACID -DIACYLGLYCEROL -EDTA -ERYTHORBIC ACID -FERROUS GLUCONATE -FUMARIC ACID -GELATIN -GLYCERIN (Glycerol) -GUMS: Arabic, Furcelleran, Ghatti, Guar, Karaya, Locust Bean, Xanthan -HIGH MALTOSSE CORN SYRUP -INULIN -LACTIC ACID -LECITHIN -MALTODEXTRIN -MONO- and DIGLYCERIDES -NEOTAME -OAT FIBER, WHEAT FIBER -OLIGOFRUCTOSE -PHOSPHATE SALTS -PHOSPHORIC ACID -PHYTOSTEROLS and PHYTOSTANOLS -POLYSORBATE 60, 65, 80 -POTASSIUM SORBATE -PROPYLENE GLYCOL ALGINATE -SODIUM ASCORBATE -SODIUM CARBOXY-METHYLCELLULOSE (CMC) -SODIUM CITRATE -SODIUM PROPIONATE -SODIUM STEAROYL LACTYLATE -SORBIC ACID -SORBITAN MONOSTEARATE -STARCH and MODIFIED STARCH -SUCRALOSE -THIAMIN MONONITRATE -TRIACETIN (GLYCEROL TRIACETATE) -VEGETABLE OIL STEROL ESTERS 	<ul style="list-style-type: none"> -LACTITOL -MALTITOL -MANNITOL -POLYDEXTROSE -SALATRIM -SALT -SORBITOL -SUGAR -TAGATOSE -XYLITOL 	<div style="text-align: center;">  <p>CERTAIN PEOPLE SHOULD AVOID</p> </div> <p>May cause allergic reactions or other problems.</p> <ul style="list-style-type: none"> -ARTIFICIAL COLORING: YELLOW 5 -ARTIFICIAL AND NATURAL FLAVORING -BENZOIC ACID -CAFFEINE -CARMINE -COCHINEAL -CASEIN -GUM TRAGACANTH -HVP (HYDROLYZED VEGETABLE PROTEIN) -LACTOSE -MSG (MONOSODIUM GLUTAMATE) -MYCOPROTEIN -QUININE -SODIUM BENZOATE -SODIUM BISULFITE -SODIUM CASEINATE -SULFITES -SULFUR DIOXIDE -VANILLIN, ETHYL VANILLIN 	<ul style="list-style-type: none"> -OLESTRA (Olean) -PARTIALLY HYDROGENATED VEGETABLE OIL -POTASSIUM BROMATE -PROPYL GALLATE -SACCHARIN -SODIUM NITRATE -SODIUM NITRITE
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Banned Additives

The food and chemical industries have said for decades that all food additives are well tested and safe. And most additives are safe. However, the history of food additives is riddled with additives that, after many years of use, were found to pose health risks. Those listed below have been banned. The moral of the story is that when someone says that all food additives are well tested

and safe you should take their assurances with a grain of salt.

Additive	Function	Natural or Synthetic	Year Banned	Problem
Agene (nitrogen trichloride)	flour bleaching and aging agent	synthetic	1949	Dogs that ate bread made from treated flour suffered epileptic-like fits; the toxic agent was methionine sulfoxime.
Artificial colorings:				
Butter yellow	artificial coloring	synthetic	1919	Toxic, later found to cause liver cancer.
Green 1	artificial coloring	synthetic	1965	Liver cancer
Green 2	artificial coloring	synthetic	1965	Insufficient economic importance to be tested
Orange 1	artificial coloring	synthetic	1956	Organ damage
Orange 2	artificial coloring	synthetic	1960	Organ damage
Orange B	artificial coloring	synthetic	1978 (ban never finalized)	Contained low levels of a cancer-causing contaminant. Orange B was used only in sausage casings to color sausages, but is no longer used in the United States.
Red 1	artificial coloring	synthetic	1961	Liver cancer
Red 2	artificial coloring	synthetic	1976	Possible carcinogen
Red 4	artificial coloring	synthetic	1976	High levels damaged adrenal cortex of dog; after 1965 it was used only in maraschino cherries and certain pills; it is still allowed in externally applied drugs and cosmetics.
Red 32	artificial coloring	synthetic	1956	Damages internal organs and may be a weak carcinogen; since 1956 it continues to be used under the name Citrus Red 2 only to color oranges (2 ppm).
Sudan 1	artificial coloring	synthetic	1919	Toxic, later found to be carcinogenic.
Violet 1	artificial coloring	synthetic	1973	Cancer (it had been used to stamp the Department of Agriculture's inspection mark on beef carcasses).
Yellow 1 and 2	artificial coloring	synthetic	1959	Intestinal lesions at high dosages.
Yellow 3	artificial coloring	synthetic	1959	Heart damage at high dosages.
Yellow 4	artificial coloring	synthetic	1959	Heart damage at high dosages.
cinnamyl anthranilate	artificial flavoring	synthetic	1982	Liver cancer
cobalt salts	stabilize beer foam	synthetic	1966	Toxic effects on heart
coumarin	flavoring	tonka bean	1954	Liver poison
cyclamate	artificial sweetener	synthetic	1970	Bladder cancer, damage to testes; now not thought to cause cancer directly, but to increase the potency of other carcinogens.
diethyl pyrocarbonate (DEPC)	preservative (beverages)	synthetic	1972	Combines with ammonia to form urethane, a carcinogen
dulcin (p-ethoxy-phenylurea)	artificial sweetener	synthetic	1950	Liver cancer
ethylene glycol	solvent	humectant	synthetic	Kidney damage
monochloroacetic acid	preservative	synthetic	1941	Highly toxic
nordihydroguaiaretic acid (NDGA)	antioxidant	desert plant	1968 (FDA), 1971 (USDA)	Kidney damage
oil of calamus	flavoring	root of calamus	1968	Intestinal cancer
polyoxyethylene-8-stearate (Myrj 45)	emulsifier	synthetic	1952	High levels caused bladder stones and tumors
safrole	flavoring (root beer)	sassafras	1960	Liver cancer
thiourea	preservative	synthetic	c.1950	Liver cancer

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Glossary

ANTIOXIDANTS retard the oxidation of unsaturated fats and oils, colorings, and flavorings. Oxidation leads to rancidity, flavor changes, and loss of color. Most of those effects are caused by reaction of oxygen in the air with fats.

CARCINOGEN is a chemical or other agent that causes cancer in animals or humans.

CHELATING AGENTS trap trace amounts of metal atoms that would otherwise cause food to discolor or go rancid.

EMULSIFIERS keep oil and water mixed together.

FLAVOR ENHANCERS have little or no flavor of their own, but accentuate the natural flavor of foods. They are often used when very little of a natural ingredient is present.

THICKENING AGENTS are natural or chemically modified carbohydrates that absorb some of the water that is present in food, thereby making the food thicker. Thickening agents "stabilize" factory-made foods by keeping the complex mixtures of oils, water, acids, and solids well mixed.

Cancer Testing

Chemicals usually are tested for an ability to cause cancer by feeding large dosages to small numbers of rats and mice. Large dosages are used to compensate for the small number of animals that can be used (a few hundred is considered a big study, though it is tiny compared to the U.S. population of more than 300 million). Also, the large dosages can compensate for the possibility that rodents may be less sensitive than people to a particular chemical (as happened with thalidomide). Some people claim that such tests are improper and that large amounts of any chemical would cause cancer. That is not true. Huge amounts of most chemicals do not cause cancer. When a large dosage causes cancer, most scientists believe that a smaller amount would also cause cancer, but less frequently.

It would be nice if lower, more realistic dosages could be used, but a test using low dosages and a small number of animals would be extraordinarily insensitive. It would also be nice if test-tube tests not using any animals were developed that could cheaply and accurately identify cancer-causing chemicals. While some progress has been made in that direction, those tests have not proven reliable. Thus, the standard high-dosage cancer test on small numbers of animals is currently the only practical, reasonably reliable way to identify food additives (and other chemicals) that might cause cancer.

The Delaney Clause is an important part of the federal Food, Drug, and Cosmetic Act. That important consumer-protection clause specifically bans any additive that "is found to induce cancer when ingested by man or animal." The food and chemical industries are seeking to weaken or repeal that law.

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