

CHEMICAL CUISINE

Your guide to
food additives

Nutrition Action.com®

About *Nutrition Action Healthletter*

Nutrition Action Healthletter is the world's largest-circulation health newsletter. *NAH's* scientists and nutritionists sort through the latest studies and reports, and distill the results into clear and simple language. And *Nutrition Action* tells you exactly what's wrong—and what's right—with brand-name packaged foods, fresh foods, and restaurant dishes.

About NutritionAction.com

NutritionAction.com provides free practical tips—and sells guides—that help you eat right, cook delicious and healthy recipes, keep up on the latest research, and avoid unsafe food.

About CSPI

The Center for Science in the Public Interest (cspinet.org), publisher of *Nutrition Action Healthletter* and NutritionAction.com, is a consumer advocacy organization whose mission is to conduct innovative research and advocacy programs in health and nutrition and to provide consumers with up-to-date, useful information about their health and well-being. CSPI is completely independent. We accept no advertising and take no government or industry money.

About this book

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Dear food-safety-conscious consumer,

Thank you for ordering this special booklet from NutritionAction.com®. While most food additives are safe, some haven't been adequately tested ... and a few could be dangerous. That's why we've produced *Chemical Cuisine: Your guide to food additives*, so you can know which is which.

Deciding what foods to buy was simpler when most food came from farms. Now, factory-made foods with chemical additives have become a significant part of our diet. Though most of us cannot pronounce the names of these chemicals, we still need to know what they do, which ones are safe, and which ones are poorly tested or dangerous.

A simple general rule about additives is to avoid sodium nitrite, artificial sweeteners, and artificial food dyes. Not only are those some of the most questionable additives, but they are used primarily in foods of low nutritional value.

Knowing about additives is important, but so is knowing about the foods themselves. Eat whole grains, vegetables, fruits, and protein foods such as beans, nuts, fish, low-fat dairy foods, poultry, and a little lean meat. That nutritious diet is low in unhealthy fats, cholesterol, sodium, and sugar and high in fiber. It will help prevent tooth decay, obesity, heart disease, certain cancers, and high blood pressure. Nutritious, natural foods also contain few additives.

Thank you again for ordering this special food-safety booklet which will help you avoid the most dangerous food additives and not worry about the safe ones.

Sincerely,

A handwritten signature in blue ink that reads "Michael F. Jacobson". The signature is fluid and cursive, with a long, sweeping underline that extends to the right.

Michael F. Jacobson, Ph.D.

President

Center for Science in the Public Interest

P.S. Please take the summary on pages 6-7 with you to the supermarket.

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Key to Safety of Food Additives



Safe

Appears to be safe.



Cut Back

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



Avoid

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



Caution

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



Certain People Should Avoid

May trigger an acute, allergic reaction, intolerance, or other problem.

Summary of Food Additives by Safety Rating

Safe

Acetic Acid (8)	EDTA (29)	Lactic Acid (38)	Propylene Glycol Alginate (10)	Sucrose Acetate Isobutyrate (SAIB) (61)
Adipic Acid (9)	Erythorbic Acid (29)	Lecithin (38)	Pyridoxine (Vitamin B6) (50)	Tartaric Acid, Potassium Acid Tartrate, Sodium Potassium Tar- trate, Sodium Tartrate (63)
Advantame (9)	Erythritol (30)	Magnesium Com- pounds (39)	Riboflavin (Vitamin B2) (51)	Taurine (64)
Air (9)	Ferrous Gluconate (30)	Malic Acid (39)	Silicon Dioxide, Silica, Calcium Silicate (55)	Thaumatococcus (64)
Alginate (10)	Food-Starch, Modi- fied (30)	Maltodextrin (39)	Sodium Ascorbate (15)	Thiamin Mononi- trate (Vitamin B1) (65)
Alpha Tocopherol (Vitamin E) (11)	Fumaric Acid (31)	Maltotame (40)	Sodium Citrate (27)	Torula Yeast (65)
Ammonium Compounds (11)	Gelatin (32)	Mono- and Diglyc- erides (41)	Sodium Diacetate (56)	Triacetin (Glycerol Triacetate) (65)
Amylases (11)	Ginseng (32)	Natamycin (Pimar- cin) (43)	Sodium Erythor- bate, Erythorbic Acid, Sodium Isoascorbate (56)	Vanillin, Ethyl Vanillin (66)
Ascorbic Acid (Vitamin C) (15)	Gluconic Acid, Glucono Delta-Lactone, Magnesium Glu- conate, Sodium Gluconate, Zinc Gluconate (32)	Neotame (43)	Sodium Pectinate (46)	Vegetable Oil Stanols and Sterols (66)
Ascorbyl Palmitate (15)	Glycerin (Glycerol) (33)	Niacin (Vitamin B3) (43)	Sodium Stearoyl Fumarate or Lac- tylate (57)	Vitamin B2 (Riboflavin) (51)
Beta-Carotene (20)	Guanosine Mono- phosphate (GMP, Disodium Guanyl- ate) (33)	Nisin (43)	Sorbic Acid; Potas- sium Sorbate (57)	Vitamin B6 (Pyridoxine) (50)
Calcium (or Sodium) Propionate (22)	Helium (34)	Nitrous Oxide (43)	Sorbitan Monoste- arate (57)	Vitamin D (D3) (66)
Calcium (or Sodium) Stearoyl Fuma- rate or Lactylate (23)	Inosine Monophos- phate (IMP, Diso- dium Inosinate) (36)	Oat Fiber, Wheat Fiber (44)	Starch and Modi- fied Starch (58)	Vitamin E (Alpha Tocopherol) (11)
Carbon Dioxide (Carbonated Water) (24)	Inter-Esterified Oil (36)	Oligofructose (44)	Stearic Acid (58)	Yellow Prussiate of Soda (67)
Castoreum (26)	Inulin (37)	Pantothenic Acid (and Sodium Panto- thenate) (45)	Stevia Leaf Extract (Rebiana) (58)	
Cellulose (26)	Isolated Soy Pro- tein, Textured Vegetable Pro- tein (37)	Papain (45)		
Citric Acid (27)		Pectin (and Sodium Pectinate) (46)		
Cysteine (28)		Phytosterols And Phytostanols (47)		
DATEM (28)		Polyglycerol Polyri- cinoleate (PGPR) (48)		
Dextrin (28)		Potassium Chloride (49)		
Diacylglycerol (29)				

Cut Back

Corn Syrup (27)	High-Maltose Corn Syrup (35)	Isomalt (37)	Polydextrose (47)	Sugar (Sucrose) (61)
Dextrose (Corn Sugar, Glucose) (28)	Hydrogenated Starch Hydroly- sate (HSH) (36)	Lactitol (38)	Salatrim (53)	Tagatose (63)
Fructose (31)	Invert Sugar (37)	Maltitol (39)	Salt (53)	Xylitol (67)
High-Fructose Corn Syrup (HFCS) (34)		Mannitol (40)	Sea Salt (54)	
		Phosphoric Acid; Phosphates (47)	Sorbitol (57)	

Caution

Brazzein (20)	Carboxymethyl Cellulose (CMC, Cellulose Gum), Sodium Carboxymethyl Cellulose (24)	Carrageenan (25)	Polysorbate 60, 65 and 80 (48)	Transglutaminase ("Meat Glue") (65)
Butylated Hydroxytoluene (BHT) (21)		Diacetyl (29)	Sodium Carboxymethyl Cellulose (CMC) (56)	
		Monatin (40)		
		Monk Fruit Extract (41)		

Certain People Should Avoid

Annatto (11)	Caffeine (22)	Gums: Arabic, Furcelleran, Gel-lan, Ghatti, Guar, Karaya, Locust Bean, Traga-canth, Xanthan (33)	Hydrolyzed Veg-etable Protein (HVP) (36)	Quinine (51)
Artificial and Natu-ral Flavoring (14)	Carmine; Cochineal Extract (25)		Lactose (38)	Sodium Benzoate; Benzoic Acid (55)
Autolyzed Yeast Extract (18)	Casein (26)		Monosodium Glu-tamate (MSG) (41)	Sodium Caseinate (16)
Benzoic Acid (19)	Guarana (33)		Propylene Glycol (50)	Sulfites: Sulfur Dioxide, Sodium Bisulfite, Sodium Metabisulfite (63)

Avoid

Acesulfame-Potassium (8)	Aspartame (16)	Caramel Coloring (23)	Partially Hydroge-nated Vegetable Oil (<i>trans fat</i>) (45)	Saccharin (52)
Aloe Vera (10)	Azodicarbonamide (19)	Citrus Red 2 (27)	Potassium Bromate (48)	Sodium Nitrate, Sodium Nitrite (56)
Artificial Colorings (Synthetic Food Dyes): Blue 1 (12), Blue 2 (12), Citrus Red 2 (12), Green 3 (13), Orange B (13), Red 3 (13), Red 40 (13), Yellow 5 (13), Yellow 6 (14)	Blue 1 (20)	Cyclamate (<i>not legal in U.S.</i>) (27)	Potassium Iodate (49)	Sucralose (60)
	Blue 2 (20)	<i>Ginkgo Biloba</i> (32)	Propyl Gallate (50)	TBHQ (<i>Tert-Butylhy-droquinone</i>) (64)
	Brominated Vegetable Oil (BVO) (20)	Green 3 (33)	Quorn (51)	Trans Fat (65)
	Butylated Hydroxy-anisole (BHA) (21)	Mycoprotein (42)	Red 3 (51)	Yellow 5 (67)
		Olestra (<i>Olean</i>) (44)	Red 40 (51)	Yellow 6 (67)
		Orange B (45)		

A

**Acesulfame Potassium**

Artificial sweetener: “Diet,” “no sugar added,” “sugar-free,” and other products, including soft drinks, drink mixes, baked goods, gelatin desserts, frozen desserts, yogurt, candy, chewing gum, packaged (tabletop) sweeteners.

This artificial sweetener is widely used around the world. It is about 200 times sweeter than sugar. In the United States, for several years acesulfame-K (also called ace-K; the K is the chemical symbol for potassium) was permitted only in foods like sugar-free baked goods, chewing gum, and gelatin desserts. In July 1998, the FDA allowed it in soft drinks, thereby greatly increasing use and consumer exposure. It is often used with sucralose or aspartame.

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

A small study of 20 lactating women, 14 of whom reported using artificial sweeteners generally, and nine of whom reported using ace-K, found that ace-K was the most commonly found artificial sweetener in breast milk. The breast milk of 13 of the women—including some who reported no intake of artificial sweeteners—contained ace-K. Pregnant and nursing women may want to make a special effort to avoid ace-K and other artificial sweeteners.

FDA should require companies to conduct high-quality, modern-day studies of ace-K or withdraw approval of it.

**Acetic Acid**

Preservative, flavoring, acidulant.

Acetic acid is the chemical that gives vinegar its sharp taste and odor.



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Adipic Acid

Acid, flavoring agent, antioxidant: soft drinks, fruit-flavored drinks, edible oils, gelatin desserts.

Adipic acid is sometimes used in bottled drinks and throat lozenges. Because it has little tendency to pick up moisture, adipic acid may be used to supply tartness in highly manufactured powdered products like gelatin desserts and fruit-flavored drinks. It is occasionally added to edible oils to prevent them from going rancid. Rats, and presumably humans, metabolize adipic acid without any difficulty.



Advantame

Artificial sweetener: "Diet," "no sugar added", "sugar-free," and other products.

Advantame is the newest and sweetest artificial sweetener. An incredible 20,000 times sweeter than sucrose, it was approved by the U.S. Food and Drug Administration in May 2014. It is allowed in sodas, baked goods, chewing gum, confections and frostings, frozen desserts, gelatins and puddings, jams and jellies, processed fruits and fruit juices, toppings, and syrups. It is made from aspartame and vanillin, but is processed by the body differently from aspartame.

Two key safety studies on advantame were flawed. For example, in the cancer study in mice, the number of animals that survived to the end of the study was below FDA's own recommendations. An FDA statistician concluded that the low survival rate "probably masked the occurrence of late developing tumors." As for the cancer study in rats, some FDA scientists "strongly objected" to certain aspects because they "may have compromised and confounded the outcome of the results." CSPI objected to the FDA's failure to abide by its own published standards and its dismissal of concerns raised by some of its own scientists. Nevertheless, because the additive is so incredibly sweet, the amounts that will be added to foods are so minuscule that any possible cancer risk would be negligible.



Air

Snack foods, ice cream, breakfast cereals

Air is by far the cheapest food additive, and it's perfectly safe. Extruded snack foods such as Cheetos, breakfast cereals like Kix, and inexpensive ice creams are fluffed out with air. In the ice cream world, the amount of air whipped into the final product is called overrun. Ben & Jerry's and Häagen-Dazs vanilla ice creams weigh



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more than 100 grams per half cup and contain roughly 25 percent air. Breyers vanilla ice cream weighs 67 grams per half cup; about 45% of its volume is air. That's one reason why premium ice creams are higher in calories—they contain more ice cream per serving—and why the cheaper (and lower-calorie) ice creams are, well, cheaper.



Alginate, Propylene Glycol Alginate

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

Alginate, a 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 (soft drinks, salad dressing) and can stabilize the foam in beer.



Aloe Vera

Beverages, yogurt, desserts, flavoring.

Aloe vera, which comes from a succulent plant, is sold as a juice and is added to various other foods and supplements. It is also marketed in various skin care products, for example to treat wounds and burns. Companies make diverse health claims, but scientific evidence is scarce. The National Center for Complementary and Alternative Medicine of the National Institutes of Health concluded that *aloe vera* “may” help heal burns and abrasions (when used topically), but there is not enough evidence to support other claims. *Aloe vera* taken orally can cause diarrhea and cramps and is recognized by FDA as a laxative. However, in 2002 FDA banned it from over-the-counter laxatives due to a lack of safety information.

Carefully conducted studies by the U.S. government concluded that there was “clear” evidence that *aloe vera* extracts caused intestinal cancers in male and female rats, but not mice. The form tested, called non-decolorized whole-leaf extract of *aloe vera*, contains more of the components that are suspected of being cancer-causing—aloin and other anthraquinones—than do some *aloe vera* products on the market. (The outer leaf pulp of aloe leaves, known as the latex, contains anthraquinones). However, it is not known for sure what components of *aloe vera* are responsible for the tumors.

The National Center for Complementary and Alternative Medicine also notes several other possible concerns: (1) people with diabetes who use glucose-lowering medication should be cautious about taking *aloe vera* by mouth since preliminary studies suggest it may lower blood glucose levels; (2) there have been a few case reports of acute hepatitis following oral *aloe vera* use, but a cause-effect relationship has not been established; and (3) the diarrhea caused by the laxative effect of oral *aloe vera* can decrease the absorption of many drugs.



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Given the possible risks and unsubstantiated benefits, people should not consume *aloe vera*. People who choose to consume it should at least look for products made with a charcoal filtration process to decolorize and remove anthraquinones, and monitored to ensure that aloin levels are low (e.g., 1 part per million or less). Some solid or semi-solid products have much higher levels of aloin. However, low levels of aloin do not guarantee safety, since it is not known for sure exactly which components of *aloe vera* triggered cancers in rats.



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. The large amounts of vitamin E in some vitamin supplements do not appear to provide any health benefit.



Ammonium Compounds (Bicarbonate, Carbonate, Chloride, Hydroxide, Phosphate, Sulfate)

Acidity reducer: leavening agents.

Ammonium compounds are sources of ammonia, which is used in the body to synthesize nitrogen-containing compounds and to adjust the acidity of bodily fluids. Any excess is converted to urea and excreted in the urine.



Amylases

Enzymes that convert starch to sugar.

Amylases occur naturally in plants, saliva, pancreatic juice, and microorganisms. Bakers add amylase to bread dough to supplement the small amount found naturally in wheat flour. The sugars that the amylases produce from starch serve as food for the fermenting yeast and also makes for better-tasting, better-toasting bread. Amylases also improve the dough's consistency and the bread's keeping quality.



Annatto

Natural coloring: butter, cheese, other foods.

Annatto is a widely used food coloring obtained from the seeds of a tropical shrub. Its hue is yellow to orange. Unfortunately, natural does not always mean perfectly safe. Annatto causes hives in some people. In fact, allergic reactions to annatto may be more common than reactions to commonly used synthetic food dyes.



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ARTIFICIAL COLORINGS (SYNTHETIC FOOD DYES)

Most artificially colored foods are colored with synthetic petroleum-based chemicals—called dyes—that do not occur in nature. Because food dyes are used almost solely in foods of low nutritional value (candy, soft drinks, gelatin desserts, etc.), a good rule of thumb is simply avoid all dyed foods. (You may also see the term “lake” on the label—avoid those too. That is the technical term for the water-insoluble form of a dye, often used in fatty foods and low-moisture foods.). In addition to problems mentioned below, synthetic food dyes cause hyperactivity in some sensitive children. You can report adverse reactions to food dyes to www.cspi.net/foodyes.

Some foods are artificially colored with natural substances, such as beta-carotene or carmine. Just because they are natural does not mean that they are entirely safe. Carmine, for example, can cause severe allergic reactions. Please see their entries in the alphabetical listing.

The use of colorings, be they natural or synthetic, usually indicates that a natural ingredient is not used.



Blue 1

Artificial coloring: beverages, candy, baked goods.

One (unpublished) animal test suggested a small cancer risk, and a test-tube study indicated that the dye might affect neurons. Blue 1 also causes occasional allergic reactions. It should be better tested.



Blue 2

Artificial coloring: pet food, beverages, candy.

Animal studies found some—but not conclusive—evidence that Blue 2 causes brain cancer in male rats, but the FDA concluded that there is “reasonable certainty of no harm,” the safety standard for food additives.



Citrus Red 2

Artificial coloring: skin of some Florida oranges only.

The amounts of this rarely used dye that one might ingest, even from eating marmalade, are so small that the risk is not worth worrying about.



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Green 3

Artificial coloring: candy, beverages.

A 1981 industry-sponsored study showed hints of bladder and testes tumors in male rats, but the FDA re-analyzed the data using other statistical tests and concluded that the dye was safe. Fortunately, it is not widely used.



Orange B

Artificial coloring: only approved for sausage casings.

High doses of this dye can harm the liver and bile duct. However, Orange B has not been used for many years.



Red 3

Artificial coloring: candy, baked goods.

The evidence that Red 3 causes thyroid tumors in rats is “convincing,” according to a 1983 review committee report requested by the FDA. But the FDA’s recommendation that the dye be banned was overruled by pressure from the cherry industry and the U.S. Department of Agriculture. Red 3 is still used in a smattering of foods ranging from cake icing to fruit roll-ups to chewing gum.



Red 40

Artificial coloring: soft drinks, candy, gelatin desserts, pastries, pet food, sausage.

Red 40 is the most widely used food dye, but the key mouse tests were flawed and inconclusive. An FDA review committee acknowledged problems, but said that evidence of harm was not “consistent” or “substantial.” Red 40 can cause allergy-like reactions. Like other dyes, Red 40 is used mainly in junk foods.



Yellow 5

Artificial coloring: gelatin desserts, candy, pet food, baked goods.

The second most widely used coloring causes allergy-like hypersensitivity reactions, primarily in aspirin-sensitive people, and triggers hyperactivity in some children. In the 1990s, FDA scientists discovered Yellow 5 was contaminated with such cancer-causing substances as benzidine and 4-aminobiphenyl (or chemicals that the body



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converts to those substances). In 2011, the FDA rejected a request by the Center for Science in the Public Interest to determine if the carcinogenic contaminants were still present.



Yellow 6

Artificial coloring: beverages, candy, baked goods.

Industry-sponsored animal tests suggested that this dye, the third-most-widely-used, causes tumors of the adrenal gland. In addition, in the 1990s, FDA scientists discovered that several carcinogens, such as 4-aminobiphenyl and benzidine (or chemicals that the body converts to those substances), 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. The FDA refused to conduct new studies to determine whether Yellow 6 is still contaminated with carcinogens. Yellow 6 may cause occasional, but sometimes-severe, hypersensitivity reactions.



Artificial And Natural Flavoring

Flavoring: soft drinks, 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. Most flavoring chemicals also occur in nature and are probably safe, but FDA does not review their safety, and a few have been shown to cause cancer in animals and should not be permitted. 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 and are not required to list them on food labels. That secrecy is unfortunate, because some people may be sensitive to certain flavoring ingredients, such as MSG or HVP, and vegetarians and others may not want to consume flavors that are derived from animals.

Artificial Sweeteners And Other Sugar-Free Sweeteners

See also: Acesulfame-potassium, Advantame, Aspartame, Brazzein, Cyclamate, Monatin, Monk Fruit Extract, Neotame, Saccharin, Stevia Leaf Extract (Rebiana), Sucralose, Sugar Alcohols (Erythritol, Hydrogenated Starch Hydrolysate, Isomalt, Lactitol, Maltitol, Mannitol, Sorbitol, Xylitol), Thaumatin

Artificial sweeteners and other sugar substitutes are used in a wide range of foods to provide sweetness without or with fewer calories. The question is: are they safe? Controversies have swirled around most of the artificial sweeteners. Acesulfame-potassium, aspartame, saccharin, and sucralose may pose a slight risk of cancer. The artificial sweetener neotame and the natural “high-potency” sweeteners rebiana and



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thaumatin appear to be safe. But research on all of them is relatively limited. For instance, a 2010 study found that artificially sweetened drinks probably caused pre-term deliveries; the researchers suspected that aspartame was the culprit. Synthetic high-potency sweeteners were the rule until about 2009 when rebiana and other stevia leaf extracts became marketed widely in the United States. Rebiana and some of the other stevia leaf extracts, which have “taste challenges,” allowed companies to claim “all natural” on their artificially sweetened (with a “natural ingredient,” that is) products.

Sugar alcohols are sugar-free (and alcohol-free) sweeteners. Some occur in plants, but are typically manufactured. Most have about half the calories of sugar, though erythritol has one-twentieth as many. They appear to be safe, except that large amounts of most of them may have a laxative effect (except erythritol, which may cause nausea).

Companies advertise their artificially sweetened foods as being almost magical weight-loss potions. The fact is, though, that losing weight is difficult, and people need to make a real concerted effort to eat fewer calories and exercise more. Artificial sweeteners and other sugar substitutes can make the struggle a little more pleasant.



Ascorbic Acid (Vitamin C), Sodium Ascorbate

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

Ascorbic acid—or vitamin C—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 and breakfast cereals. It also helps prevent loss of color and flavor in foods by reacting with unwanted oxygen. Though megadoses of ascorbic acid were famously recommended by Dr. Linus Pauling as a cure for the common cold, subsequent research found only that they might only slightly reduce the severity of colds.

Sodium ascorbate, also safe, is a more soluble form of ascorbic acid.

See also ERYTHORBIC ACID (or SODIUM ERYTHORBATE).



Ascorbyl Palmitate

Antioxidant, nutrient.

Ascorbyl palmitate is a fat-soluble antioxidant formed by combining ascorbic acid (vitamin C) with palmitic acid (derived from fat). Studies indicate that ascorbyl palmitate is completely metabolized, the ascorbic acid becoming available as vitamin C and the palmitate portion converted to energy or fat. Though palmitate from palm and other vegetable oils can increase blood cholesterol levels, the amount derived from this additive is trivial.



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Avoid
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Aspartame

Artificial sweetener: “Diet,” “no sugar added,” “sugar-free,” and other products, including soft drinks, drink mixes, gelatin desserts, frozen desserts, jams and fruit spreads, yogurt, breakfast cereal, candy, chewing gum, condiments, packaged (tabletop) sweeteners.

Aspartame (sometimes marketed under the brand names Equal, NutraSweet, or Amino Sweet) is a chemical combination of two amino acids and methanol. Questions of cancer and neurological problems, such as dizziness or hallucinations, have swirled around aspartame for decades. A key 1970s industry-sponsored study initially sparked concerns that aspartame caused brain tumors in rats, but the FDA convinced an independent review panel to reverse its conclusion that aspartame was unsafe. The agency then approved its use in 1981 for use as a tabletop (packaged) sweetener and in breakfast cereals, powdered beverage mixes, and other dry packaged foods. Two years later FDA approved aspartame for use in soft drinks, by far the biggest and most lucrative market. Aspartame dominates the diet soft drink market, and the overall market for artificial sweeteners, although its use is declining.

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, published the first such study. The study found that rats exposed to aspartame starting at eight weeks of age and continuing through their entire lifetimes developed lymphomas, leukemias, and other tumors, including kidney tumors, which are extremely rare in the strain of rat used. In 2007, the same researchers published a follow-up study that exposed rats to aspartame beginning in the womb and continuing through their entire lifetimes. That study, too, found that aspartame caused leukemias/lymphomas, as well as mammary (breast) cancer. Then in 2010, they published a study on aspartame in mice, also exposing the animals starting in the womb and continuing throughout their entire lifetimes. That third study found that aspartame caused liver and lung cancer in male mice.

Those new studies may have found problems that earlier company-sponsored studies did not because the newer studies used far more animals and thus were more capable of detecting adverse effects. Also, the Italian researchers monitored the animals for their entire lifetimes: as long as three years for the rats and two-and-one-half years for the mice, instead of just two years in the company-sponsored studies. (Most chemicals are tested for just two years.) Two-year-old rats are roughly equivalent to 65-year-old people. The many tumors that occurred after two years would never have been seen in industry’s studies. Furthermore, two of the new studies included exposure before birth, which increased their ability to detect cancer (only one of the industry studies did).



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The food industry and the European Food Safety Authority (EFSA) have contested the Italian findings, pointing to what they consider serious flaws in the design and conduct of the study and evaluation of the results. The FDA, too, has disputed the validity of the Italian studies. However, scientists at CSPI and elsewhere, citing evaluations sponsored by the U.S. National Toxicology Program and the Environmental Protection Agency, found industry's and EFSA's allegations to have little merit.

As one defense of aspartame, industry and FDA point to a 2006 human study by U.S. National Cancer Institute researchers. That study involved a large number of adults 50 to 71 years of age over a five-year period. The study did not find any evidence that aspartame posed a risk. However, the NCI study had three major limitations: It did not involve truly elderly people (the Italian studies monitored rodents until they died a natural death), the subjects had not consumed very much aspartame or for very long, and it was not a well-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).

Meanwhile, the most careful long-term study of aspartame in humans, conducted by researchers at the Harvard School of Public Health, found the first human evidence that aspartame poses a slightly increased cancer risk to men, but not women. The researchers speculated that that might be due to the fact that men have higher levels of an enzyme that converts methanol (a breakdown product of aspartame) to formaldehyde, a human carcinogen. The Harvard study couldn't prove that aspartame was a carcinogen, but it certainly added to the safety concerns, especially since the cancers observed in the human study (multiple myeloma and non-Hodgkin's lymphoma) were similar to the cancers observed in two of the three animal studies (leukemias and lymphomas). Another study by researchers with the American Cancer Society, not quite as large as the Harvard study, did not find any link.

A recent review by the scientists who conducted the three positive animal studies urges governments to re-examine their positions on aspartame, and recommends that pregnant women and children not consume aspartame.

The bottom line is that three independent studies have found that consumption of aspartame causes cancer in rodents, and one epidemiology study found evidence that aspartame increases the risk of cancer in men. That should be reason enough for the FDA and other governments to eliminate aspartame from the food supply. Meanwhile, consumers should read labels carefully and avoid this artificial sweetener.

Another concern emerged in 2010, when Danish researchers linked the consumption of artificially sweetened soft drinks, but not sugar-sweetened soft drinks, to preterm delivery of babies. In 2012 another Scandinavian study found links between preterm delivery and both artificially sweetened and sugar-sweetened beverages. Though



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the studies couldn't distinguish between the various artificial sweeteners, aspartame and acesulfame-potassium were the most widely used in those countries. The fact that two large, independent studies found a link between artificially sweetened beverages and preterm delivery is troubling. Pregnant women should make a special effort to avoid or at least cut back on aspartame and acesulfame-K, as well as moderating their consumption of added sugars.

Since aspartame was first used, some people have contended that it causes headaches or dizziness. Some small studies have documented that finding, while others did not. Anyone experiencing such problems has one more reason to avoid aspartame.



AUTOLYZED YEAST EXTRACT

Flavoring: ready made meals, snack foods, meat products, gravies and sauces, soups, broths, and soup mixes.

Autolyzed yeast extract is a flavoring agent made from yeast, usually the same kind used to make bread rise or ferment beer. Generally, the yeast is heated or otherwise killed in a way that allows enzymes inside the cells to break down the yeast, including the proteins. (Other types of yeast extracts are made by adding enzymes, rather than using the enzymes already present inside the yeast cell.)

Some people who have allergic reactions to inhaling molds also react to ingesting yeast or yeast extracts.

All proteins are made up of amino acids, and one amino acid of interest—glutamic acid—is present in autolyzed yeast extract, as well as in many other foods and in our bodies. Glutamate is a form of glutamic acid and is responsible for “umami,” the savory taste associated with foods like meat and mushrooms. The sodium salt of glutamate is called sodium glutamate, better known as MONOSODIUM GLUTAMATE or MSG. A small number of people experience headache, numbness, flushing, tingling, or other short-term symptoms when consuming large amounts of MSG. Autolyzed yeast extract is sometimes used to substitute for MSG, but has much lower levels of glutamate so adverse reactions are unlikely.

Foods such as Parmesan cheese, seaweed, dried shitake mushrooms, and dried tomatoes naturally contain relatively high levels of glutamate, and so could also potentially be a problem for individuals sensitive to MSG, although that does not seem to be the case. FDA does not allow foods that contain autolyzed yeast extract (or yeast extract, hydrolyzed yeast, soy extracts, hydrolyzed vegetable protein, or protein isolate) to say “No MSG” or “No added MSG” on their packaging. Although autolyzed yeast extract affects the flavor of foods, FDA requires that it be identified on the label; it cannot be hidden under the term “natural or artificial flavoring.”

See also MONOSODIUM GLUTAMATE (MSG)



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Azodicarbonamide

Flour improver and bleaching agent: White flour, bread and rolls.

Azodicarbonamide (ADC) has long been used by commercial bakers to strengthen dough, but has been poorly tested. A 1999 review published by several United Nations agencies concluded that “There are no adequate data relating to carcinogenic, reproductive, or developmental effects, hence it is not possible to evaluate the risk to human health for these endpoints.”

Most of the concern about ADC relates to two suspicious chemicals that form when bread is baked. The first chemical is semicarbazide (SEM), which caused cancers of the lung and blood vessels in mice. It did not cause cancer in rats. In 1976 the International Agency for Research on Cancer considered SEM to be a carcinogen in mice, but in 1987 concluded that the animal data were “limited” and that SEM was “not classifiable” as to its carcinogenicity to humans.

A second breakdown product, urethane, is a recognized carcinogen. ADC used at its maximum allowable level (45 ppm in bread) leads to levels of urethane in bread that pose a small risk to humans. Toasting that bread increases the amount of urethane. However, when used at 20 ppm, which may be the amount used by some commercial bakeries, a 1997 FDA study found “only a slight increase” in urethane. (Some urethane forms in bread not made with azodicarbonamide.)

Considering that many breads don’t contain azodicarbonamide and that its use slightly increases exposure to a carcinogen, this is hardly a chemical that we need in our food supply. It appears that the Delaney amendment, which bars the use of additives that cause cancer in humans or animals, would require FDA to bar its use. At the very least, FDA should reduce the amount allowed to be used.

B



Benzoic Acid

See SODIUM BENZOATE, PAGE 55



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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 not take beta-carotene supplements, but the small amounts used as food additives are safe.



Brazzein

"Natural" high-potency sweetener

Brazzein has not yet been approved as a food additive, but some food manufacturers see it as a better-tasting alternative to stevia-derived rebiana. Brazzein is a small (54 amino acids) protein molecule that occurs naturally in the berries of a climbing vine found in West Africa, where it has been consumed by people and animals. It is about 1,000 times sweeter than sugar, but, as far as we can determine, it has not been tested for safety. Because it is a protein, it might cause food allergies. One company is planning to market the sweetener under the name Cweet.



Blue 1

See ARTIFICIAL COLORINGS, PAGE 12



Blue 2

See ARTIFICIAL COLORINGS, PAGE 12



Brominated Vegetable Oil (BVO)

Emulsifier, clouding agent: soft drinks.

BVO keeps flavor oils in suspension, giving a cloudy appearance to citrus-flavored soft drinks such as Mountain Dew and Fanta Orange. After some public pressure, PepsiCo agreed in 2013 to remove BVO from Gatorade, then in 2014 Coca-Cola and PepsiCo announced they would remove BVO from all their beverages, but as of mid-2016, BVO is still in Mountain Dew.



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Safety questions have been hanging over BVO since 1970, when the FDA removed BVO from its “Generally Recognized as Safe” list. In 1970, FDA permitted its use only on an “interim” basis pending additional study—one of only four such interim-allowed additives. Decades later, BVO is still poorly tested and remains on the interim list.

Health concerns start with the finding that eating BVO leaves residues in body fat and the fat in brain, liver, and other organs. Animal studies indicate that BVO is transferred from mother’s milk to the nursing infant and also can cause heart lesions, fatty changes in the liver, and impaired growth and behavioral development. Those studies suggest that BVO might be harmful to people who drink large amounts of soft drinks that contain BVO. Indeed, doctors have identified bromine toxicity in two people who drank extremely large amounts of such sodas. Sensitive, modern studies are urgently needed to better understand the risk, especially at the lower levels typically consumed by large numbers of children. Meanwhile, BVO should not be used (it is not permitted in Europe).



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 that 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 might well 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) or safer processes (e.g., packing foods under nitrogen instead of air), or can simply be left out (many brands of oily foods like potato chips don’t use any antioxidant).



Butylated Hydroxytoluene (BHT)

Antioxidant: cereals, chewing gum, potato chips, oils.

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 and easily replaced by safe substitutes (see discussion of BHA).



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C

**Caffeine**

Stimulant: naturally occurring in coffee, tea, cocoa, and coffee-flavored yogurt and frozen desserts. Added to soft drinks, energy drinks, waters, candy, chewing gum, cookies, energy and granola bars, other dessert and snack foods, and medications.

Caffeine is one of two drugs that are present naturally in 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 appears to increase the risk of adverse pregnancy outcomes, including miscarriages, preterm delivery, stillbirth, and childhood leukemia (and possibly birth defects) and inhibits fetal growth, women who are pregnant or may become pregnant should avoid caffeine. Caffeine also may make it harder to get pregnant. The less those women consume, the lower the risk.

Caffeine also keeps many people from sleeping, causes jitteriness, and affects calcium metabolism. However, on the positive side, drinking a couple of cups per day of regular (but not decaf) coffee appears to reduce the risk of Parkinson's disease, Alzheimer's disease, gallstones, and even suicide. It also can relieve headache pain, increase endurance, such as on a treadmill, and improve alertness.

The caffeine in a standard cup or two of coffee is harmless to most people. But be aware that one middle-size (16 oz.) cup of regular coffee at popular coffeehouses contains about 300 or more milligrams of caffeine. That is equivalent to the caffeine in three or four old-fashioned 5-ounce-cups of coffee. A 12 oz. can of Coca-Cola or most other caffeinated soft drinks contains about 35 to 40 milligrams; energy drinks typically contain much more. For a list of the caffeine content of many common beverages and foods visit <http://www.cspinet.org/new/cafchart.htm>. If you drink more than a couple of cups of coffee or several cans of caffeine-containing soda per day and experience insomnia or jitters, are at risk of osteoporosis, or are pregnant, you may want to rethink your habit.

**Calcium (Or Sodium) Propionate**

Preservative: breads, 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.

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Calcium (Or Sodium) Stearoyl Fumarate, Calcium (Or Sodium) Stearoyl Lactylate

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, and frozen egg whites and artificial whipped cream.



Caramel Coloring

Coloring: colas, baked goods, pre-cooked meats, soy and Worcestershire sauces, chocolate-flavored products, beer.

Caramel coloring is made by heating a sugar compound (usually high-dextrose corn syrup), often together with ammonium compounds, acids, or alkalis. It is the most widely used (by weight) coloring added to foods and beverages, with hues ranging from tannish-yellow to black, depending on the concentration and the food. Caramel coloring may be used to simulate the appearance of cocoa in baked goods, make meats and gravies look more attractive, and darken soft drinks and beer.

Caramel coloring, when produced with ammonia, contains the contaminants 2-methylimidazole (2-MI) and 4-methylimidazole (4-MI). In 2007, studies by the U.S. National Toxicology Program found that those two contaminants cause cancer in male and female mice and possibly in female rats. In 2011, the International Agency for Research on Cancer, a division of the World Health Organization, agreed that 2-MI and 4-MI are “possibly carcinogenic to humans.” After that, the State of California’s Environmental Protection Agency listed 2-MI and 4-MI as carcinogens under the state’s Proposition 65. The state lists chemicals when they pose a lifetime risk of cancer of at least 1 out of 100,000 people. California warned that as of January 7, 2012 products such as soft drinks that could expose people to more than 29 micrograms of 4-MI per day would have to bear a warning notice. In March 2012, when the Center for Science in the Public Interest published the results of a study that found levels up to 150 micrograms per can of Coca-Cola and Pepsi-Cola purchased in Washington, DC, the soft-drink giants announced that they had reduced the contaminant to below California’s threshold for action in products distributed in California, although subsequent testing by Consumer Reports revealed that some Pepsi products contained more than 29 micrograms. They said they would market the less-contaminated products throughout the country, which Coca-Cola did in 2013 and PepsiCo did by 2015. To the best of our knowledge, no sodas sold in California bear the warning notice.

The FDA has a limit that is 10 times stricter than California’s for substances contami-



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nated with cancer-causing chemicals. CSPI's analysis of a Coca-Cola purchased in 2012 in California found just 4 micrograms of 4-MI per 12 ounces. Even that much lower level might exceed the FDA's threshold for action of 1 cancer per million consumers.

It is worth avoiding or drinking less colas and other ammonia-caramel-colored beverages not only because of risk from 4-methylimidazole, but because the drinks contain about 10 teaspoons of added sugars per 12 ounces, and that promotes obesity and tooth decay. Soy sauces, baked goods, and other foods that contain ammoniated caramel coloring are much less of a problem because the amounts consumed are small.



Carbon Dioxide (Carbonated Water)

Carbon dioxide, a harmless gas, is responsible for the bubbles in beer, soft drinks, mineral water, and the like.



Carboxymethyl Cellulose (CMC, Cellulose Gum), Sodium Carboxymethyl Cellulose

Improve texture, stabilize foam (beer), prevent fruit from settling, prevent sugar from crystallizing (cake icings), bind water: Ice cream, beer, pie fillings, jellies, cake icings, diet foods.

Carboxymethylcellulose (CMC) is a thickening agent that is made by reacting CELLULOSE (wood pulp, cotton lint) with a derivative of acetic acid (the acid in vinegar). It is also called cellulose gum.

CMC has long been considered safe, but a 2015 study funded by the National Institutes of Health raised some doubts. It found that both CMC and another emulsifier (polysorbate 80) affected gut bacteria and triggered inflammatory bowel disease symptoms and other changes in the gut, as well as obesity and a set of obesity-related disease risk factors known as metabolic syndrome. In mice that were predisposed to colitis, the emulsifiers promoted the disease. It is possible that polysorbates, CMC, and other emulsifiers act like detergents to disrupt the mucous layer that lines the gut, and that the results of the study may apply to other emulsifiers as well. Research is needed to determine long-term effects of these and other emulsifiers at levels that people consume.

CMC is not absorbed or digested, so the FDA allows it to be included with "dietary fiber" on food labels. CMC isn't as healthful as fiber that comes from natural foods.



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Carmine; Cochineal Extract

Artificial coloring.

Cochineal extract is a coloring obtained from the cochineal insect, which lives on cactus plants in Peru, the Canary Islands, and elsewhere. Carmine is a more purified coloring made from cochineal, but in both cases, carminic acid actually provides the color. These colorings, which are extremely stable, are used in some red, pink, or purple candy, yogurts, ice creams, beverages, and other foods, as well as in drugs and cosmetics. They appear to be safe for most people. A small percentage of consumers suffer allergic reactions ranging from hives to life-threatening anaphylactic shock. Carmine and cochineal have long been listed on labels simply as “artificial coloring” or “color added.” In 2009, in response to a petition by the Center for Science in the Public Interest, the FDA gave the food industry until January 1, 2011, to clearly identify the colorings as carmine or cochineal extract on food labels. The FDA rejected CSPI’s request for labels to disclose that carmine is extracted from insects so vegetarians and others who want to avoid animal products could do so.



Carrageenan

Thickening, gelling, stabilizing agent: Dairy and non-dairy products, including ice cream, sorbet, frozen desserts, chocolate milk, soy milk, almond milk, yogurt, cottage cheese, whipping cream, jelly, infant formula, salad dressings, deli meat, frozen dinners.

Carrageenan is a family of indigestible large molecules obtained from certain seaweeds. It is used as a thickening or texturing agent in a wide variety of foods and beverages.

Large amounts of carrageenan have harmed test animals’ colons. The amounts in food are too small to be a concern for most people, but an independent committee of the World Health Organization (WHO) concluded that it is unclear whether people with episodes of gastrointestinal disease might absorb some carrageenan, which presumably could cause gastrointestinal or immune system problems. Some people have reported that eliminating carrageenan from their diet diminished or eliminated their gastrointestinal discomfort.

Carrageenan—at least in its natural, undegraded form—does not cause cancer in animals. In animal studies, high doses of carrageenan increase the potency of chemicals that cause cancer, and there has been controversy over whether it could do so at the low levels that people consume. The FDA and the WHO committee have concluded that food-grade carrageenan does not pose either a direct or an indirect cancer risk.



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Food-grade carrageenan contains small amounts of “degraded” carrageenan, and a bit more probably forms in the acidic conditions of the stomach. The International Agency for Research on Cancer, another unit of the WHO, considers degraded carrageenan to be “possibly carcinogenic in humans.” While any possible cancer risk would be quite small, some people may wish to err on the side of caution and avoid carrageenan.

Some experts have been concerned about the safety of carrageenan for infants, given that the GI tract of the infant is still developing. In 2014, however, the WHO committee reviewed new animal studies and concluded that infant formula made with carrageenan is safe.



Casein, Sodium Caseinate

Thickening and whitening agent: ice creams, sherbets, coffee creamers.

Casein, the principal protein in milk, contains 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.



Castoreum

Natural flavoring: Vanilla-flavored and other foods

This substance is occasionally used as a natural flavoring. Only about 1,000 pounds of castoreum are used annually, so it really isn’t a significant part of the food supply, and it shouldn’t pose any risk. The FDA considers it to be “generally recognized as safe.” But because castoreum is extracted from the anal castor sacs of beavers, it has been publicly lampooned.

Beavers mix castoreum with urine to mark their territory and make their fur and tail more water resistant. The food industry finds its strong, tar-like, musky odor to be useful in flavorings. Of course, you’ll never see “castoreum from anal sacs of beavers” on food labels; instead, it is just included in the broad term “natural flavorings.”



Cellulose

Prevents caking and clumping, binds water (used in diet foods), improves texture, thickens, emulsifies, used as a filler: Grated cheese, breads, diet foods, frozen dinners, sauces, salad dressings.

Cellulose is a safe and inexpensive carbohydrate that comprises the woody parts and cell walls of plants. It is a type of dietary fiber found naturally in fruits, vegetables, and cereals. The cellulose added to processed foods usually comes from



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wood pulp (saw dust) or cotton lint. It can prevent caking, such as in grated parmesan cheese, but some companies fraudulently use it as a cheap filler in their “100%” grated parmesan cheese. It is also a cheap way to boost the fiber content on food labels, but it isn’t as healthful as fiber that comes from natural foods.



Citric Acid, Sodium Citrate

Acid, flavoring, chelating agent: ice creams, sherbets, fruit drinks, 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, jams, ice creams, candy, and other foods.



Citrus Red 2

See ARTIFICIAL COLORINGS, PAGE 12



Cochineal Extract

See CARMINE, PAGE 25



Corn Syrup

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

Corn syrup, which consists mostly of dextrose (glucose), 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: Banned in the United States. Allowed as a packaged (tabletop) sweetener in Canada, and also in diet soft drinks and foods in some other countries.

This controversial high-potency sweetener was used in the United States in diet foods until 1970, at which time it was banned because animal studies suggested that it caused cancer. (It is still permitted in Canada, Europe, and some other countries.)



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Now, based on animal studies, cyclamate (or a byproduct) is believed not to cause cancer directly, but to increase the potency of other carcinogens and to harm the testes.



Cysteine

Antioxidant: Flour.

Cysteine, an amino acid, is a natural constituent of protein-containing foods. It is added to foods to prevent oxygen from destroying vitamin C. Bakers use cysteine to reduce the mixing time for dough.

D



DATEM (Diacetyl Tartaric Acid Ester Of Monoglycerides)

Emulsifier: Bread, biscuits.

This emulsifier is used to build a strong gluten network to improve bread volume and keep dough from getting sticky or collapsing.



Dextrin

Emulsifier: Prevents sugar from crystallizing, encapsulates flavor oils, thickening agent: Candy, powdered mixes.

Dextrin is the mixture of fragments that results from treating starch with acid, alkali, or enzymes. It is as safe as starch.



Dextrose (Corn Sugar, Glucose)

Sweetener: Bread, caramel, soft drinks, cookies, many other foods.

Dextrose (glucose) is a sugar and an important chemical in every living organism. It is a source of sweetness in fruits and honey. Added to foods as a sweetener, it provides empty calories and contributes to tooth decay. Dextrose reacts with other chemicals when heated and contributes to the color of bread crust and toast. Dextrose contributes a modest 2% of the 76 pounds of refined sugars that the average American consumes annually.



Safe

Appears to be safe.



Cut Back

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



Caution

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Diacetyl

Butter flavoring, preservative.

Diacetyl is one of many chemicals that give butter its characteristic flavor. Low levels are present in butter (extra diacetyl is added to unsalted butter 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 high levels of diacetyl causes obstructive lung disease, which is potentially fatal. Widespread publicity from 2005 to 2007 and several lawsuits persuaded most major American food manufacturers to protect their workers (and restaurant cooks) by switching to supposedly safer ingredients. But more recent studies indicate that one substitute, 2,3-pentanedione, chemically similar to diacetyl (also called 2,3-butanedione), may be just as damaging to the respiratory tract.



Diacylglycerol

Cooking oil.

This is the diglyceride part of the long-used emulsifier mono- and diglycerides. Don't count on this little-used ingredient providing any real benefit.

E



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, leaves 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 SODIUM ERYTHORBATE, PAGE 56



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Erythritol

Low calorie sugar-free sweetener: Drinks, hard candy, chocolate milk, frozen desserts, baked goods, packaged sweeteners (sometimes mixed with stevia leaf extract, monk fruit extract, or other sweeteners)

This sugar alcohol, which was first used commercially in the United States in about 2001, is about 60 to 70 percent as sweet as sugar, but provides at most only one-twentieth as many calories. Small amounts occur naturally in such fruits as pears, melons, and grapes, but virtually all of the erythritol used as a food additive is produced by fermenting glucose with various yeasts. Many companies mix it with high-potency sweeteners, such as stevia leaf extract or monk fruit extract, to keep the calories down while masking those other sweeteners' unpleasant aftertastes. Companies also value erythritol because it provides the bulk that sugar has and which high-potency sweeteners lack. Thus, it adds to the "mouthfeel" of low-sugar beverages. It does not promote tooth decay.

Other than occasional allergic reactions, the only safety concern about erythritol is that eating too much of it could cause nausea. Individual sensitivities vary greatly, but most adults can safely consume up to about 40 to 50 grams of erythritol per day. (For comparison, there are 12 grams in Blue Sky Zero Cola, 4 grams in a 12-ounce can of Zevia soda, and 3 grams in a packet of Truvia.) That's safer than most other sugar alcohols, such as sorbitol, mannitol, and lactitol. Erythritol's relative safety is due to its being mostly absorbed into the bloodstream and excreted unchanged in urine. Other sugar alcohols stir up trouble in the colon where they attract water (leading to laxation or diarrhea) or are digested by bacteria (causing gas).

F



Ferrous Gluconate

Coloring, nutrient: Black olives.

Ferrous gluconate is used by the olive industry to generate a uniform jet-black color and is added to pills as a source of iron.



Food Starch, Modified

See STARCH, MODIFIED, PAGE 58



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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 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 the foods are healthier than competing products that are sweetened with sugar or HFCS. The fructose that occurs in fruits and vegetables is certainly safe. However, the large amounts that come from added fructose, sucrose (ordinary table sugar), and HFCS increase triglyceride (fat) and small, dense LDL (“bad”) cholesterol levels in the blood and may thereby increase the risk of heart disease. Also, recent studies show that consuming 25 percent of one’s calories from fructose or HFCS may lead to more visceral (deep belly) fat or liver fat. Those changes may increase the risk of diabetes and heart disease. Finally, large amounts of fructose consumed on a regular basis also may affect levels of hormones like leptin and ghrelin, which help regulate appetite, thereby contributing to weight gain and obesity.

The Dietary Guidelines for Americans (America’s basic nutrition policy) recommends that people consume no more than about 10 percent of calories (12 teaspoons in a 2,000-calorie diet) in the form of refined sugars. The American Heart Association has a stricter recommendation: six teaspoons of refined sugars per day for women and nine teaspoons for men. That’s far less than the current average of 13 percent of calories. The bottom line: the less added sugars—fructose, dextrose, sucrose, or HFCS—one consumes the better (though, again, small amounts are safe).



Fumaric Acid

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

A solid at room temperature, inexpensive and highly acidic, fumaric acid is an 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.



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G

**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.

**Ginkgo Biloba**

Purported memory booster: Beverages.

Companies add small amounts of *Ginkgo biloba* to beverages because it supposedly boosts memory and thinking, but most studies in healthy people show little or no benefit, even at levels greater than what is added to foods and beverages. Since ginkgo appears to interfere with blood clotting, it should not be consumed before or after surgery, during labor and delivery, or by those with bleeding problems such as hemophilia.

Importantly, in 2013, the U.S. Government's National Toxicology Program published the first study that could evaluate Ginkgo's ability to cause cancer. The study found "clear evidence" that Ginkgo biloba caused liver cancer in male and female mice and "some evidence" that Ginkgo caused thyroid cancer in rats.

**Ginseng**

Purported energy booster and flavoring: Energy drinks.

Companies add small amounts to foods because of ginseng's reputation for boosting energy, sexual stamina, and mental effort, but there's little evidence for those claims, even at much higher levels than what is found in foods. The amount in foods and beverages is not likely to pose a safety risk.

**Gluconic Acid, Glucono Delta-Lactone, Magnesium Gluconate, Sodium Gluconate, Zinc Gluconate**

Sequestrant, acidifier, leavening agent, curing agent: Nonalcoholic beverages, processed fruit and fruit juices, baked goods, dairy products, cured meats.

Gluconic acid is a metabolite of the sugar glucose. Glucono delta-lactone is the most widely used of this family of compounds and is used to adjust the acidity or as a leavening agent in baked goods, processed fruits, and dairy products. It is also used in some cured meats to speed the formation of the pink color.

All of these substances are safe. See also FERROUS GLUCONATE.

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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.



Guanosine Monophosphate (GMP, Disodium Guanylate)

Flavor enhancer: Soups, sauces, seasonings.

GMP and INSONINE MONOPHOSPHATE (IMP) are used together to enhance the meaty (umami) flavor of soups and other foods. They are usually used together with monosodium glutamate (MSG), because they enhance its potency.



Green 3

See ARTIFICIAL COLORINGS, PAGE 13



Guarana

Stimulant: Energy drinks, teas.

Guarana is a plant whose seeds are high in caffeine. Companies add it to beverages as a “natural” source of caffeine, but too much caffeine from any source can cause insomnia, anxiety, and other problems (see CAFFEINE).



Gums (Arabic, Furcelleran, Gellan, 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 help replace fat in low-fat ice cream, baked goods, and salad dressings. Tragacanth has caused occasional severe allergic reactions. The FDA warns against giving a product called SimplyThick, which contains xanthan gum, to infants, since it may cause a life-threatening condition called necrotizing enterocolitis. It is not clear whether the gum itself, bacterial contamination of the gum, or some other cause is to blame.



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H



Helium

Inert, safe gas: Balloons or pressurized containers.

Helium is an inert, safe gas that is used to float balloons and sometimes to force foods out of pressurized containers.



High-Fructose Corn Syrup (HFCS)

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 some for the obesity epidemic, because rates of obesity have climbed right along with HFCS consumption. But that's an urban myth. HFCS and sugar are equally harmful. We're consuming far too much of both.

HFCS starts out as cornstarch. Companies use enzymes or acids to break down most of 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 2013, about 59 pounds of corn sweeteners, mostly HFCS, and 68 pounds of cane and beet sugar were produced per capita in the United States. A total of 128 pounds of all caloric sweeteners, down 15 percent from the 1999 high of 152 pounds, was produced per person. And, because of all the criticism (not fully deserved) of HFCS in recent years, HFCS consumption declined by about 32 percent between 1999 and 2013. Much of that decline resulted from declining soft drink consumption (thanks to increased health consciousness and to the popularity of bottled water), while the rest reflects food manufacturers switching back to ordinary sugar. Actual consumption (as opposed to production) of caloric sweeteners, according to the U.S. Department of Agriculture, was 76 pounds per person in 2013.

Some people think that HFCS is mostly fructose, which does probably play a significant role in obesity. However, HFCS, on average, is about half fructose and half glucose—the same as ordinary table sugar (sucrose) when it is metabolized by the body. When sugar is used in soft drinks, much of it is 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 would have little effect on consumption.



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Modest amounts of HFCS are safe. However, large amounts promote tooth decay, as well as increase triglyceride (fat) levels in blood, thereby increasing the risk of heart disease. Also, recent studies show that consuming 25 percent of calories from HFCS or fructose leads to more visceral (deep belly) fat or liver fat. Those changes may increase the risk of diabetes or heart disease. Finally, large amounts of fructose from HFCS or sugar 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. The HFCS 55 that is used in most soft drinks contains about 10 percent more fructose than sucrose. That makes most soft drinks a bit more harmful than if they were made with sugar.

The Dietary Guidelines for Americans (America's basic nutrition policy) recommends that people consume no more than about 10 percent of calories (12 teaspoons in a 2,000-calorie diet) in the form of refined sugars. The American Heart Association has a stricter recommendation: six teaspoons of refined sugars per day for women and nine teaspoons for men. That's far less than the current average of 13 percent of calories. The bottom line: the less added sugars—fructose, dextrose, sucrose, or HFCS—one consumes the better.



High-Maltose Corn Syrup

Sweetener, 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 the sugar maltose (35 percent or more). Maltose is composed of two units of glucose. High-maltose corn syrup, corn syrup solids, and maltodextrin are similar, in that each contain glucose but not fructose, and each is produced in a wide variety of formulations for different applications. Since high-maltose corn syrup doesn't contain any fructose, it is probably safer than table sugar or high fructose corn syrup, but still, the less added sugars one consumes, the better (though small amounts are safe). Fortunately, not much is used in foods.

See also DEXTROSE and HIGH-FRUCTOSE CORN SYRUP.



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Hydrogenated Starch Hydrolysate (HSH)

Sugar-free sweetener: Candy, chocolates, chewing gum, baked goods.

HSH is slightly sweet and poorly absorbed by the body. As with most sugar alcohols, eating significant amounts of HSH may cause intestinal gas and diarrhea. It has more calories than most other sugar alcohols: three calories per gram, compared to about 4 for sugar and about 2 for most other sugar alcohols.



Hydrolyzed Vegetable Protein (HVP)

Flavor enhancer: Instant soups, hot dogs, 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.



Inosine Monophosphate (IMP, Disodium Inosinate)

Flavor enhancer: Soups, sauces, seasonings.

IMP and guanosine monophosphate (GMP) are used together to enhance the meaty (umami) flavor of soups and other foods. They are often used together with monosodium glutamate (MSG), because they enhance its potency.



Inter-Esterified Oil

Shortening

With trans fat now being recognized as being the most harmful type of fatty acid of all, companies have sought to find safe substitutes for PARTIALLY HYDROGENATED VEGETABLE OIL, the source of artificial trans fat. One such substitute is inter-esterified oil. The oil is produced by chemically combining a polyunsaturated oil like soybean oil with fully hydrogenated soybean oil. Fully hydrogenated oils do not contain trans fat, but consist largely of saturated fatty acids. That particular type of saturated fat, stearic acid, is relatively innocuous compared to the other common types of saturated fat. By varying the proportions of normal and fully hydrogenated oil, companies can obtain oils that have the desired consistency. Inter-esterified oils are good substitutes for such saturated fats as palm oil, which increases the “bad” cholesterol.



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Inulin

Fiber and fat substitute: Margarine, baked goods, fillings, dairy foods, frozen desserts, salad dressing.

Inulin is a naturally occurring soluble fiber that is found in a variety of plants. It doesn't raise blood sugar levels, so it may help people with diabetes. It also stimulates the growth of beneficial bacteria in the large intestine. However, because it is a purified fiber, it doesn't come with the various vitamins and minerals that accompany the dietary fiber that one gets from whole foods.



Invert Sugar

Sweetener: Candy, soft drinks, many other foods.

Invert sugar, a 50-50 mixture of two sugars, dextrose (glucose) 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.



Isolated soy protein, textured vegetable protein

Nutrient.

Isolated soy protein is simply protein purified from soybeans. Textured vegetable protein (TVP) is soy protein that has been combined with chemical additives and processed into granules, chunks, or strips that resemble meat.



Isomalt

Sugar-free sweetener: Hard candies, chocolates, chewing gum, baked goods.

This slightly sweet ingredient is manufactured from sugar and does not promote tooth decay. Isomalt is poorly absorbed by the body, and thus has only about half the calories of sugar. Chemically, it is a disaccharide sugar-alcohol consisting of glucose and mannitol or sorbitol sub-units. Like many other sugar alcohols, large amounts can cause diarrhea or other GI distress.



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L

**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**

Sugar-free sweetener: Candy, chocolates, baked goods, ice cream, other sugar-free foods.

Lactitol is a sugar alcohol. It is made from lactose (milk sugar). Like most other sugar alcohols, lactitol is not absorbed well by the body (which means it has only about half the calories of sugar), and it does not promote tooth decay. However, large amounts (above 20 to 30 grams) may cause loose stools or diarrhea.

**Lactose**

Nutrient, sweetener: Whipped topping mixes, fortified breakfast pastries.

Lactose, a carbohydrate that is found only in milk, is nature's way of delivering calories to infant mammals. One-sixth as sweet as sugar, it is used as a slightly sweet source of carbohydrate. The intestine secretes an enzyme that splits lactose into its two principal sugars: glucose and galactose. Children suffering from galactosemia, a rare genetic disease, can suffer serious harm by consuming lactose. Far more common is "lactose intolerance," where undigested lactose is metabolized by bacteria, producing gas, bloating, and flatulence. Most Asians and people of black African heritage cannot tolerate as much lactose as Caucasians can after early childhood. Some people are acutely lactose intolerant, but most people with lactose intolerance can safely eat smaller amounts of dairy products or foods with added lactose.

**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.

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M



Magnesium Compounds

Carbonate, Chloride, Hydroxide, Phosphate, Stearate, Sulfate: Anticaking agent, alkali, nutrient, water corrective.

Magnesium is a mineral that is a crucial component of many enzymes in the human body and plays a unique role in muscle contraction. We get about half our magnesium from nuts, beans, whole grains, fruits, and vegetables, but it's also in many other foods. About half of the body's magnesium is stored in bone.



Malic Acid

Acidulant, flavoring: Fruit-flavored drinks, candy, lemon-flavored ice-tea mix, ice cream, preserves.

L-Malic acid is an important metabolite present in all living cells. It is abundant in apples, which is why it is sometimes called "apple acid." The food industry uses malic acid as an acidulant and flavoring agent in fruit-flavored drinks, candy, lemon-flavored ice-tea mix, ice cream, and preserves.

While adults can probably utilize the stereoisomers D-malic acid (the unnatural form), infants may not, so synthetic DL-malic acid should not be added to baby food.



Maltitol

Sugar-free sweetener: Candy, chocolates, jams, other sugar-free foods.

Maltitol, a sugar alcohol, is made by hydrogenating maltose, which is obtained from corn syrup. (Unlike hydrogenated oils, no trans fat forms when maltose is hydrogenated.) Like other sugar alcohols, maltitol is not absorbed well by the body (which means it has only about half as many calories as sugar), and it does not promote tooth decay. However, large amounts (above 20 to 30 grams) may have a laxative effect. It is almost as sweet as sugar.



Maltodextrin

Texturizer in processed foods.

Maltodextrin is 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



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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.

Maltodextrin is usually made from starch from corn, potato, or rice, but is sometimes made from wheat starch. If maltodextrin is made from wheat, food labels will indicate that fact to inform people who are allergic to wheat.



Maltotame

Artificial Sweetener: Diet drinks, snacks.

A blend of neotame and maltodextrin that one company calls maltotame. Some food manufacturers illegally state maltotame in the ingredient lists on their products instead of identifying the actual additives. (Maltodextrin, an ingredient made from corn starch, is safe).

See also Neotame.



Mannitol

Sugar-free sweetener: “Dust” on chewing gum, other sugar-free foods.

Mannitol, like most other sugar alcohols, is not as sweet as sugar, not absorbed well by the body (which means it provides only less than half as many calories per gram as table sugar), and does not promote tooth decay. However, large amounts may have a laxative effect and may 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 warning: “Excess consumption may have a laxative effect.”



Monatin

“Natural” high-potency sweetener

Monatin is not yet used as a food additive, but Cargill, PepsiCo, and other companies see that as a possibility in the future. Like stevia leaf extracts, monatin was first identified in a plant—in this case the root bark of a shrub that grows in South Africa, where the plant has been consumed by people. The substance, which can be synthesized more efficiently in a factory, is about 3,000 times sweeter than sugar and supposedly does not have the unpleasant aftertaste that most current stevia extracts have. Monatin has undergone only rudimentary safety testing.



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Monk Fruit Extract

“Natural” high-potency sweetener: Frozen desserts, soft drinks, packaged sweeteners, other sugar-free foods. Also called monk fruit, Swingle fruit extracts (SGFE), Luo Han Guo, Lo Han Kuo.

This high potency sweetener is about 200 times sweeter than sugar. Like artificial sweeteners and stevia leaf extracts, monk fruit extract can be used to replace some or all of the added sugars in a wide range of foods and beverages. This product has not been well tested in animals. It is derived from a fruit that has been consumed in China for at least several hundred years and used as an herbal medicine for the past several decades, so it may well be safe, although any chronic adverse effects would likely have escaped detection.

Monk fruit extract contains several intensely sweet substances called mogrosides. One company’s purest product contains more than 50 percent mogroside V. Labels may call the ingredient monk fruit, but don’t think you’re getting any whole fruit; manufacturers use a multi-step process to extract mostly the sweet mogrosides.



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 react to large amounts of MSG. Reactions include headache, nausea, weakness, and a burning sensation on the back of the neck and forearms. Some people complain of wheezing, changes in heart rate, and difficulty breathing. Some claim to be sensitive to very small amounts of MSG,



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but no good studies demonstrate that. To protect the public's health, manufacturers and restaurateurs should use less or no MSG. People who believe they are sensitive to MSG should be aware that other ingredients, such as natural flavoring, Torula yeast, and hydrolyzed vegetable protein, also contain glutamate. Also, foods such as Parmesan cheese and tomatoes naturally contain glutamate, 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*), and **can cause serious and even fatal allergic reactions**. 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, Scandinavia, and Australia. Quorn foods have been marketed in the United States since 2002 and in Scandinavia, Australia, and New Zealand more recently. 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. Some people suffer adverse effects the first time they eat Quorn foods, while others suffer adverse effects only after eating the products several times. Many people have gone to emergency rooms for treatment of Quorn-related reactions. In 2013, an 11-year-old boy who had asthma died after eating a Quorn Turk'y Burger.

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 people are allergic or intolerant to Quorn foods, but so far have rejected CSPI's recommendations to bar the use of mycoprotein or require Quorn foods to bear a label warning of possible severe adverse reactions. (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.)

Consumers who believe they have been sickened by Quorn foods **may file an adverse-reaction report** (go to <http://www.cspinet.org/cgi-bin/quorn/quorn.cgi>) with the Center for Science in the Public Interest.



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N



Natamycin (pimaricin)

Antimicrobial: Cheese.

This antimicrobial agent is produced by bacteria and used to prevent mold growth in cheese.



Neotame

Artificial sweetener: "Diet," "no-sugar added," "sugar-free" and other products, including soft drinks, dairy products, frozen desserts, and baked goods.

Neotame (brand name Newtame), produced by NutraSweet Co., is a remarkable 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, and it is handled differently by the body. It likely will be used mostly in low-calorie foods, but may also be used to adjust the flavor of other foods. To compensate for taste flaws, you will probably find neotame mixed with sugar or with other artificial sweeteners. It was approved by the U.S. FDA in 2002 and the European Union in 2010, but is still rarely used.



Niacin (Vitamin B3)

Nutrient: Enriched flour, breakfast cereals, and other fortified foods.

Niacin, or vitamin B3, is safe. Niacin deficiency causes pellagra, which is characterized by mental disturbances and potentially death.



Nisin

Preservative: meat and poultry products, cheese, liquid eggs, salad dressings

Nisin is a short polypeptide (small protein molecule) that is produced by lactic acid bacteria and has anti-bacterial properties. It is unclear how widely this preservative is used.



Nitrous Oxide

Propellant.

Nitrous oxide, also known as laughing gas, is often used as a propellant to drive foods out of pressurized containers.



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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. Finally, isolated fibers don’t contain the micronutrients and phytochemicals that foods with naturally occurring fiber contain.



Olestra (Olean)

Fat substitute: Lay’s Light chips, Pringles Light chips.

Olestra is a synthetic fat that is not absorbed as it passes through the digestive system, so it has no calories. Procter & Gamble, the developer, suggests that replacing regular fat with olestra will help people lose weight and lower the risk of heart disease. Originally envisioned as a replacement for fat in everything from cheese to ice cream, the ingredient is now only used in a couple of brands of snack chips.

Olestra can cause diarrhea and loose stools, abdominal cramps, flatulence, and other adverse effects, sometimes severe. Afflicted consumers can file reports with the Center for Science in the Public Interest at www.cspi.net/olestra.

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, but an occasional serving wouldn’t be a problem. 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 better off with baked snacks, which are 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.



Oligofructose

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



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calories per gram as fructose or other sugar. Oligofructose promotes the growth of “good” bifidus bacteria.



Orange B

See ARTIFICIAL COLORINGS, PAGE 13

P



Pantothenic Acid (And Sodium Pantothenate)

Nutrient.

Pantothenic acid is one of the water-soluble B vitamins. Human deficiencies have never been observed.



Papain

Meat tenderizer.

Papain is a harmless enzyme obtained from papaya that is used to break down tough muscle protein in meat.



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. That finding encouraged a few food manufacturers to begin replacing hydrogenated shortening with less-harmful ingredients. Similarly, the Institute of Medicine 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).



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Beginning in 2006, Nutrition Facts labels have had to list the amount of trans fat in a serving. That spurred many more companies, including Frito-Lay, Kraft, ConAgra, and others, to replace most or all of the partially hydrogenated oil in almost all their products. The substitutes are invariably more healthful, and the total of saturated plus trans fat (which both boost the “bad” LDL cholesterol when replaced by polyunsaturated vegetable oils) is generally no higher than it was before companies switched. Confusing label reading, though, is that foods labeled “0g trans fat” are permitted to contain 0.5g of trans fat per serving, while “no trans fat” means none at all. Consumers need to read labels carefully for another reason: foods labeled “0g trans” or “no trans” may still have large amounts of saturated fat.

Restaurants, which do not provide nutrition information, were 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. By 2016, McDonald’s, Wendy’s, KFC, Taco Bell, Ruby Tuesday, Red Lobster, and other large chains, and most smaller restaurants, eliminated trans fat.

Denmark virtually banned partially hydrogenated oil as of January 1, 2004. Later that year, the Center for Science in the Public Interest petitioned the FDA to 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, Austria, Hungary, Iceland, Norway, and Switzerland adopted Denmark-like restrictions.

In 2013 the FDA responded to CSPI’s petition to revoke the legal status of partially hydrogenated oil (the FDA considered that oil to be “generally recognized as safe,” even though it and everyone else considers it to be “generally recognized as dangerous”) by proposing that that oil be eliminated from the food supply. In 2015 the FDA finally concluded that partially hydrogenated oil was no longer safe and gave the food industry three years to eliminate it from its products. Already the industry has replaced about seven billion pounds of the manufactured oil, and FDA’s action will spur companies to eliminate the remaining billion pounds. Still, the Grocery Manufacturers Association, the industry’s largest trade association, has petitioned the FDA to approve numerous small uses of partially hydrogenated oil.



Pectin (And Sodium Pectinate)

Gelling agent: Jams, jellies.

Pectin is a safe carbohydrate that strengthens cell walls in citrus fruits, apples, beets, carrots, and other fruits and vegetables. Pectin forms gels that are the basis of fruit jellies, and may be used to thicken barbeque sauce, cranberry sauce, canned frosting, and yogurt.



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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; the acidity erodes tooth enamel. 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 reduces levels of the carcinogen acrylamide in French fries, prevents discoloration in potatoes and sugar syrups, and prevents the formation of harmless mineral (struvite) crystals in canned seafood. Sodium phosphates help retain moisture in processed meats and prevent struvite crystals from forming in canned tuna. Most people consume far more phosphorus than they need, which may have adverse effects on kidney, bone, and cardiovascular health, especially for people suffering from kidney disease.



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 might 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, a sugar alcohol. 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.”



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Polyglycerol Polyricinoleate (PGPR)

Emulsifier: Chocolate candy, margarine.

PGPR is one of those mysterious chemicals that manufacturers use in food production. It stabilizes low-fat, high-water margarines and helps the “flow properties” in candy production.



Polysorbate 60, 65, And 80

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. A 2015 study of polysorbate 80 and another emulsifier (carboxymethylcellulose) in mice found that both affected gut bacteria and triggered inflammation and other changes in the gut, as well as obesity and metabolic syndrome. In mice that were predisposed to colitis, the emulsifiers promoted the disease. It is possible that polysorbates and other emulsifiers act like detergents to disrupt the mucous layer that lines the gut, and that the results of this study may apply to other emulsifiers as well. Research needs to be done to determine long-term effects of these and other emulsifiers at levels that people consume.



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. (Calcium bromate, which likely is toxicologically similar to potassium bromate, occasionally may be used.)



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Potassium Chloride

Salt substitute.

Potassium chloride, also called potassium salt, is used in some foods as a means of lowering sodium levels. The typical American diet contains too much sodium, increasing the risk of high blood pressure, heart disease, and strokes.

More and more people are filling their salt shakers with potassium chloride or with “lite salts” that are half potassium chloride and half sodium chloride. The amount of potassium chloride used in foods is almost self-limiting, because most people perceive excessive amounts of potassium chloride to taste extremely bitter.

Potassium chloride is not just safe, but positively healthful. However, people with kidney disease and certain heart conditions need to talk to their doctors about avoiding large amounts.



POTASSIUM IODATE

Dough strengthener: Bread, rolls.

Potassium iodate is sometimes used as a dough strengthener in bread and rolls. Some bakers may switch to this ingredient when they stop using its chemical cousin potassium bromate, which poses a small cancer risk. However, potassium iodate, too, is not well tested and may also pose a slight cancer risk. It conceivably could lead to excessive iodine intake.

Potassium iodate is a source of iodine, an essential trace element, necessary for the body to make thyroid hormones. That’s the good news. But too little or too much iodine can be harmful. A committee of the World Health Organization concluded that use of potassium iodate as a flour treatment agent was unacceptable because it could result in an excessive intake of iodine. At the same time, the committee endorsed the use of potassium iodate to fortify salt, since use in salt results in a lower intake of iodine than widespread use in bread and rolls and is used to prevent iodine deficiency disorders such as goiter and mental retardation, to name a few.

In the United States, potassium iodide, not potassium iodate, is used in iodized salt, but in other countries, especially tropical countries, potassium iodate is favored because it is more stable in warm, humid conditions. Iodized salt has virtually eliminated iodine deficiency in the United States, Canada, and several other countries.

Some people, such as those with thyroid disease, are especially sensitive to iodine intake and should make a special effort to avoid potassium iodate in bread and rolls. One other possible concern is that iodate breaks down in dough and in the body to form iodide. In a study conducted by Japanese government scientists, high doses of



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potassium iodide caused cancer in rats, suggesting it may be a weak carcinogen. The same research found that it also increased the potency of a known carcinogen.

As a sidelight, both potassium iodate and potassium iodide can also be used to prevent damage to the thyroid in the event of an accident at a nuclear reactor, although the iodide form is generally recommended.

Bottom line: Potassium iodate is not widely used in baked goods, and any risk is small. Still, it may be worth choosing baked goods without this ill-tested additive, and bakers should stop using it.



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 together with two other antioxidants, BHA and BHT, because of the synergistic effects those preservatives have with one another. The best safety studies, which were published by the U.S. government, yielded unusual results. Propyl gallate appeared to cause more cancers (in several organs) in rats treated with a low dose than with either a zero dose (the controls) or a high dose. That finding (and others) suggest it may be an "endocrine disruptor," as well as a carcinogen. This additive needs to be better studied.



Propylene Glycol

Maintains moisture, thickener, emulsifier, antioxidant, anticaking agent: ice cream, cake mixes, creamers, frozen meals, frosting, baked goods, snacks, candy, nuts, pickles, dressings, condiments.

Propylene glycol is used in a wide range of food products, often to maintain moisture, as well as thicken, emulsify, and preserve foods. It can also lower the freezing point of water, like its more toxic chemical cousin, ethylene glycol, used in anti-freeze. Some people are allergic to propylene glycol in foods, as well as in personal care products and topical cortisone creams, and should avoid it.



Pyridoxine (Vitamin B6)

Nutrient: Breakfast cereals, instant breakfasts, health-food bars.

Pyridoxine, or vitamin B6, serves a variety of functions in the body and performs a central role in amino acid metabolism. Wheat germ, brown rice, and yeast are rich sources of pyridoxine. It is safe.



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Q



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. In 1994, the U.S. Food and Drug Administration banned quinine from over-the-counter drugs used to treat leg cramps, saying it was not safe and effective for that use. Then in 2006 FDA ordered companies to stop marketing unapproved products containing quinine. And in 2010 and 2012 FDA warned against using the only approved quinine-containing anti-malaria drug for any purpose other than to treat malaria. The higher levels used in drugs are more likely to cause adverse reactions than the low levels used in food, but to be on the safe side, pregnant women and the elderly should avoid quinine-containing beverages.



Quorn

See MYCOPROTEIN, PAGE 42

The Center for Science in the Public Interest has received well over 2,000 reports of adverse reactions. If you have experienced a reaction to Quorn foods, please report it at www.cspi.net/quorn.

R



Riboflavin (Vitamin B2)

Nutrient: Enriched flour, breakfast cereals, and other vitamin-fortified foods.

Riboflavin is simply vitamin B2. Riboflavin plays a crucial role in activating numerous enzymes. It is safe.



Red 3

See ARTIFICIAL COLORINGS, PAGE 13



Red 40

See ARTIFICIAL COLORINGS, PAGE 13



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S

**Saccharin**

Artificial sweetener: "Diet," "no-sugar-added," "sugar-free" soft drinks and packaged (tabletop) sweeteners.

Saccharin (one brand is Sweet 'N Low) is about 350 times sweeter than sugar and is used in diet foods and as a packaged (tabletop) sugar substitute. Saccharin is the original artificial sweetener, having been discovered accidentally in 1879 at Johns Hopkins University. Many studies on rodents have shown that saccharin can cause cancer of the urinary bladder, especially in males. In some animal studies, saccharin also caused cancer of the uterus, ovaries, skin, blood vessels, and other organs. Additional studies have shown that saccharin increases the potency of other cancer-causing chemicals. And the best epidemiology (human) study, which was conducted by the National Cancer Institute, found that the use of artificial sweeteners (saccharin and cyclamate) was associated with a higher incidence of bladder cancer. That said, other animal and human studies did not identify a cancer risk.

In 1977, the FDA proposed that saccharin be banned because of the studies showing that it causes cancer in animals. However, Congress intervened and permitted it to be used, provided that foods carried a warning notice. 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 large amounts of saccharin cause bladder cancer in male rats, but argues that those tumors are caused by a mechanism that would not occur in humans. Some public health experts respond by stating that, even if that still-unproved mechanism was 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.

Saccharin has been replaced in almost all foods by aspartame and other better-tasting sweeteners. Coca-Cola Company's Tab, one of the first diet sodas, still contains saccharin, but now also contains aspartame. In 2014, Health Canada lifted its decades-long ban on saccharin in foods, allowing it to be added to some beverages, canned fruits, frozen desserts, and other foods. Saccharin passes into the breast milk of nursing mothers.

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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 a desirable texture or other property.

A diet high in sodium increases blood pressure in most people, thereby increasing the risk of heart attack and stroke. Hypertension experts and epidemiologists have estimated that cutting sodium in packaged and restaurant foods by half would save as many as 100,000 deaths per year. Everyone should avoid salty processed foods and restaurant meals, use salt sparingly in cooking and at the table, and enjoy other seasonings. Potassium chloride—either from natural foods or a shaker—helps counteract the adverse effects of high-sodium diets.



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The Food and Drug Administration (FDA) 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. Then in 2010 the Institute of Medicine concluded that voluntary efforts over the previous 40 years to reduce sodium were worthless and that the FDA should phase in mandatory restrictions. As a result of a lawsuit filed by CSPI, in mid-2016 the FDA may propose voluntary targets for sodium in various categories of food.

In response to the scientific evidence and public pressure, numerous major companies like General Mills, Sara Lee, Walmart, and McDonald’s have begun making moderate reductions in sodium. As a result, sodium consumption from packaged foods has declined by about 15 percent since 2010, but sodium levels in most restaurant foods have barely changed. That’s important progress that should save thousands of lives each year.

Indeed, major companies like General Mills and McDonald’s have begun making moderate reductions. As a result, sodium consumption from packaged goods has declined by another 15 percent since 2010, but sodium levels in most restaurant foods have barely changed. Meanwhile, the British government 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 cut salt (or other sodium-containing ingredients) to the levels used by competitors and still have perfectly marketable products.



Sea Salt (Sodium Chloride)

Flavoring, preservative: Seasoning, soup, snack chips, crackers, and other processed foods.

Sea salt is obtained from the evaporation of sea water, unlike most table salt, which is mined from salt deposits, and then further processed to remove impurities. Many sea salts have slightly different flavors than regular salt—due to their slightly different mineral content—but the typical variety used in processed foods does not.

Sales of sea salt and sea-salted products are booming, and marketers would have you believe sea salt is a healthier, more natural form of salt. Although a majority of people surveyed by the American Heart Association believed sea salt was a lower-sodium alternative to table salt, sea salt has just as much sodium as table salt. (You



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can find lower-sodium sea salt and other salts; these are made by mixing the salt (sodium chloride) with potassium chloride and other ingredients.) The trace amounts of magnesium, potassium, calcium, and other minerals in sea salt are so minor as to be insignificant to health. However, some sea salts, as well as kosher salt (which sometimes is from the sea), have larger crystal sizes with irregular shapes so they do not pack as tightly as table salt and therefore they have less sodium per teaspoon.

Most people should consume less salt (be it regular or sea salt), because diets high in sodium increase blood pressure and the risk of heart attacks, strokes, and kidney disease.

See SALT (Sodium Chloride) and POTASSIUM CHLORIDE



Silicon Dioxide, Silica, Calcium Silicate

Anti-caking agent: salt, soups, coffee creamer, and other dry, powdery foods.

This chemical is just sand. Silicon dioxide occurs naturally in foods, especially foods derived from plants. Breathed in, silica dust can cause lung disease, even cancer. For use in food, it is finely ground and added to salt and other foods to help powders flow more easily. Aluminium calcium silicate and tricalcium silicate are also used in foods, and calcium silicate is used in some dietary supplements.



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 and they appear to be safe for most people, though they cause hives, asthma, or other allergic reactions in sensitive individuals.

Another problem occurs when sodium benzoate is used in beverages that also contain ascorbic acid (vitamin C) or erythorbic acid (also known as d-ascorbic acid). 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 urged companies not to use benzoate in products that also contain ascorbic acid, but in the early 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 United States to reformulate affected beverages, typically fruit-flavored products.



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Avoid
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Sodium Carboxymethyl Cellulose (CMC)

See CARBOXYMETHYL CELLULOSE, PAGE 24



Sodium Diacetate

Preservative, acidulant, flavor: baked goods, snack foods, fats and oils, meat products, candy, gravies, sauces, soups, soup mixes.

A salt of ACETIC ACID, the main ingredient (other than water) of vinegar. It has a vinegar flavor and can prevent the growth of mold and bacteria.



Sodium Erythorbate, Erythorbic Acid, Sodium Isoascorbate

Antioxidant, color retainer: Processed meat, beverages, baked goods, potato salad.

Chemically, sodium erythorbate is a stereoisomer of vitamin C (ascorbic acid), but it itself has no nutritional value. (Stereoisomers have the same atoms linked in an identical manner, but differ only in their spatial arrangement.) It is used most commonly in processed meats, where it retards nitrosamine (a carcinogen) formation and color fading.



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. In 2015 the International Agency for Research on Cancer, part of the World Health Organization, concluded that processed meat is carcinogenic to humans. In 2016 CSPI petitioned the USDA to require a warning label on packages of bacon, ham, hot dogs, and other processed meat products to inform consumers that eating those foods can increase the risk of colorectal cancer. All consumers, including in particular pregnant women, would be



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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.

The labels on some "natural" hot dogs and other cured meats brag about "no added nitrite." Be skeptical. While those products may not contain added sodium nitrite, they sometimes are made with celery powder or celery juice, which are naturally high in nitrite. Indeed in 2011 The New York Times revealed that the "natural" cured meats could have 10 times as much nitrite as conventional products. The bottom line: nitrite aside, those "no added nitrites" products typically are high in salt and sometimes saturated fat, so they'd be worth eating only occasionally or avoiding entirely.



Sodium Stearoyl Fumarate, Sodium Stearoyl Lactylate

See CALCIUM (or SODIUM) STEAROYL FUMARATE, CALCIUM (or SODIUM) STEAROYL LACTYLATE, PAGE 23



Sorbic Acid, Potassium Sorbate

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

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



Sorbitan Monostearate

Emulsifier: Cakes, candy, frozen pudding, icing.

Like mono- and diglycerides and polysorbates, sorbitan monostearate 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

Sugar-free sweetener, thickening agent, maintains moisture: Frozen desserts, candy, shredded coconut, chewing gum, other sugar-free foods.

Sorbitol, a sugar alcohol and close relative of sugar, occurs naturally in fruits and berries. It is half as sweet as sugar and does not cause tooth decay. Moderate amounts of



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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 that problem by reacting starch with various chemicals to create MODIFIED STARCHES (see next entry).

Starch made from breeds of high-amylose corn is relatively resistant to digestion. That “resistant starch” has some of the same benefits of naturally occurring dietary fiber.

Starch is made up of two different kinds of large carbohydrate molecules. Amylose is insoluble carbohydrate made up of long chains of glucose molecules. Amylopectin is a large, water-soluble, branched-chain polysaccharide.



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. The starches were eliminated when the Center for Science in the Public Interest charged that some baby foods contained only about 30 percent food (such as strained bananas), with the rest being water, modified starch, and sugar.



Stearic Acid

Antioxidant, chewing gum base, flavoring, anti-caking agent (calcium stearate).

Stearic acid is a fatty acid that occurs in virtually all fats. Though it is a saturated fat, it does not appear to affect blood cholesterol levels. The trivial amounts used as an additive are harmless.



Stevia Leaf Extract (Rebiana)

“Natural” high-potency sweetener: “Diet,” “no-sugar,” “sugar-free” and other products, including beverages, packaged sweeteners, and various foods. Also called by the names of the individual sweet substances (steviol glycosides) that



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can be extracted from the stevia leaf, including rebiana (also called rebaudioside A or reb A), reb D, reb F, reb M (same as reb X), stevioside; sold under such brand names as Truvia, Pure Via, and Sweet Leaf.

Stevia rebaudiana is a shrub (yerba dulce) that traditionally grew in Brazil, Paraguay, and even parts of Arizona. It is now grown commercially in California, China, southeast Asia, and elsewhere. Stevia leaves, which are about 30 times as sweet as sugar, contain sweet substances called steviol glycosides, which are 200–300 times sweeter than sugar. Among the sweetest ones are rebaudioside A, also called reb A or rebiana, and stevioside.

The food industry and many consumers who are trying to avoid sugar and artificial sweeteners have high hopes for stevia leaf extracts. Crude stevia leaf extracts have long been used as a sweetener in Japan and several other countries. One flaw, though, is that many people perceive stevia leaf and its sweet derivatives to have an unpleasant aftertaste. Companies are racing to develop better-tasting extracts, which have been dubbed rebaudioside D, F, M, X, “enzymatically modified steviol glycosides,” and others. Companies are also seeking to mask the aftertaste of rebiana with various ingredients, including ERYTHRITOL, substances that block some of the bitterness receptors in taste buds, or modest amounts of sugar.

In the 1990s, the FDA (and Canada and the European Union) rejected whole-leaf stevia and crude stevia extracts for use as a food ingredient. High dosages fed to rats reduced sperm production and increased cell proliferation in their testicles, which, at least at those dosages, could cause infertility or other problems. FDA also was concerned that stevia might interfere with the absorption of carbohydrates and the conversion of food into energy within cells, as well as with effects on kidney function and the cardiovascular system.

In the early 2000s, Cargill and Merisant (a marketer of sugar substitutes) developed highly purified extracts of stevia that are 95 percent pure rebaudioside A and 200 times as sweet as sugar. Since then, other companies have also developed highly purified extracts of stevia, some containing rebaudioside A, some containing stevioside, and some containing a combination of those or related substances. Truvia and Pure Via are the brand names for packaged or tabletop sweeteners containing rebiana, and SweetLeaf is the brand name of a packaged sweeteners containing both rebiana and stevioside. Like other packaged sugar substitutes, packets of those products contain mostly a carrier ingredient, since the tiny bits of sweetener would otherwise get lost in the packets. Thus, Truvia packets are mostly erythritol, Pure Via mostly dextrose and cellulose powder, and SweetLeaf mostly inulin.

The one nagging concern (other than taste) about stevia leaf extracts is that they have not been adequately tested for cancer. Several (but not most) genotoxicity tests found that some stevia-related substances caused mutations and other changes to DNA or chromosomes. Because such findings may indicate a cancer risk, FDA should have required additional cancer studies in animals. Testing guidelines for



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widely used food additives generally call for two-year feeding studies in both rats and mice, but both studies of a stevia leaf extract (stevioside) were in rats.

Despite the incomplete testing, in late 2008 the FDA did not object to rebaudioside A as “generally recognized as safe” (GRAS) and since then has raised no objections to extracts containing stevioside and other steviol glycosides (rebaudiosides D, F, M) as GRAS. Companies quickly started marketing a wide range of lower-calorie products sweetened with stevia leaf extracts, replacing some or all of the sugar or other high-potency sweeteners. Eventually, substances derived from stevia leaf—and possibly other natural non-caloric sweeteners might play an important role in reducing the harm caused by artificial sweeteners like ASPARTAME and the huge amounts of SUGAR and HIGH-FRUCTOSE CORN SYRUP that so many people are consuming.



Sucralose

Artificial sweetener: “No sugar added,” “sugar-free,” “diet” and other products, including baked goods, kettle corn, frozen desserts, ice cream, soft drinks, prepared meals, packaged (tabletop) sweeteners (Splenda).

Approved in the United States in 1998, sucralose—sometimes marketed as Splenda—is used in soft drinks, baked goods, ice cream, and other products, including ones you might not expect, such as frozen dinners and English muffins. It is widely used around the world. Unlike aspartame, sucralose does not break down at high temperatures and so can be used in baked goods.

In 2016 an independent Italian laboratory published a large study on mice. The study found that sucralose caused leukemia and related blood cancers in male mice that were exposed to it throughout their lives starting from before birth. The study is superior to previous industry-sponsored studies that did not find a link with cancer, since those tested fewer animals, started exposing the animals much later, and terminated the study earlier. In addition, treated animals in the industry-sponsored studies had significantly decreased body weight compared to controls, which can decrease cancer rates. This Italian lab is the same one that several years earlier published studies that found that aspartame caused cancers in rats and mice.

When sucralose was first being considered for approval by the FDA, CSPI 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.

Several researchers contend that sucralose negatively impacts the gut, including changes in the microbiome and enzymes. That could have a range of consequences, including effects on blood sugar, regulation of body weight, inflammatory bowel disease, and how drugs and other chemicals are absorbed and metabolized by the body. For example, a 2008 study (funded by the sugar industry) reported that Splenda significantly



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reduced beneficial bacteria and had other effects in the gastrointestinal tract of rats that could affect the bioavailability of drugs. Unfortunately, the study was small and had other significant shortcomings. A 2012 study found a close correlation between the use of sucralose and saccharin and changes in the incidence of inflammatory bowel disease (IBD) in different regions around the world. However, finding a correlation is a long way from demonstrating a cause–effect relationship. Meanwhile, people experiencing IBD or other GI symptoms could see if avoiding sucralose provides any relief.

Even setting aside these concerns, young children could exceed the FDA’s “acceptable daily intake” for sucralose (5 mg/kg), especially given sucralose’s popularity (more products containing sugar substitutes use sucralose than any other sweetener). For example, a 6-year old child weighing 45 pounds would exceed the FDA limit by drinking two or three 12-ounce sodas containing the typical 40-60 mg of sucralose per can. In addition, sucralose passes into breast milk at levels high enough to make the milk sweeter.

A final point: 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. (The mere fact that sucralose is synthetic does not make it unsafe.) The lawsuit was settled without any announcement of the terms, but McNeil has dropped that “made from sugar” slogan.



Sucrose Acetate Isobutyrate (SAIB)

Emulsifier: Citrus-flavored beverages, including “energy,” “sport,” and “electrolyte” drinks, as well as such alcoholic beverages as wine coolers, malt beverage coolers, and premixed cocktail products.

Sucrose acetate isobutyrate (SAIB), like brominated vegetable oil, is used primarily in citrus-flavored drinks to keep the flavor oils in suspension, giving them a cloudy appearance. In January 2013 it was announced as a replacement for brominated vegetable oil (BVO) in Gatorade, following widespread consumer protest over BVO.

FDA has approved its use in non-alcoholic and alcoholic beverages up to 300 ppm. SAIB has been subjected to short- and long-term studies in laboratory animals and people, at high doses, with little, if any, evidence of harm. It is also approved for use in Europe.



Sugar (Sucrose)

Sweetener: Table sugar, sweetened foods.

Sucrose, ordinary table sugar, occurs naturally in fruit, sugar cane, and sugar beets. Industry produced 68 pounds of sugar per person in 2013. That figure was down from 102 pounds per year in 1970, but the decrease has been more than made up



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for by increased use of high-fructose corn syrup and dextrose. In 2013, industry produced a total of about 128 pounds of total refined sugars per person, though because of waste and spoilage the average American actually consumed only about 76 pounds of all refined sugars (about 1.5 pounds per week). That represents a 15-percent reduction from the 1999 high of 89 pounds. That historic decline resulted largely from declining soft drink consumption (due partly to increased health concerns and to the popularity of bottled water).

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 13 percent of the average diet, but provide no vitamins, minerals, or protein. That means a person would have to get 100 percent of his or her nutrients from only 87 percent of his or her food. And, of course, some people, especially teen-aged boys, consume as much as 25 percent of their calories from refined sugars.

When sugar is digested, it breaks down into one fructose and one glucose (dextrose) molecule. Small amounts of fructose and glucose from fruits, vegetables, sugar, HFCS, or other sources are safe. However, large amounts of refined sugars promote tooth decay and displace nutrient-rich foods with empty calories. Furthermore, large amounts of glucose boost blood sugar levels and large amounts of fructose increase triglyceride (fat) levels and small, dense LDL (“bad”) cholesterol levels in blood, and may thereby increase the risk of heart disease. Also, recent studies show that consuming 25 percent of calories from fructose or HFCS (which is about half fructose) leads to more visceral (deep belly) fat or liver fat. Those changes may increase the risk of diabetes and heart disease. Finally, preliminary research suggests that large amounts of fructose may upset levels of such hormones as leptin and ghrelin, which regulate appetite, thereby contributing to weight gain and obesity.

The Dietary Guidelines for Americans (America’s basic nutrition policy) recommends that people consume no more than about 10 percent of calories (12 teaspoons in a 2,000-calorie diet) in the form of refined sugars. The American Heart Association has a stricter recommendation: six teaspoons of refined sugars per day for women and nine teaspoons for men. That’s far less than the current average of 13 percent of calories. The bottom line: the less added sugars—fructose, glucose, sucrose, or HFCS—one consumes the better (though small amounts are safe).

Some companies have been replacing high-fructose corn syrup with sugar, pretending that that makes their products more healthful. In fact, there’s essentially no nutritional difference between sugar and high-fructose corn syrup, so just ignore the marketing hype.



Sulfites (Sulfur Dioxide, Sodium Bisulfite,



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Sodium Metabisulfite)

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 B1 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.

T



Tagatose

Sugar substitute: breakfast cereals, cereal bars, diet and non-diet soft drinks, jelly, pudding, meal replacement drink mix, coffee mix powder, candy, chewing gum.

This relatively new additive is the mirror image of 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. It is 92 percent as sweet as sugar. It is found at low levels in apples, oranges, raisins, heated cow’s milk, and other foods.



Tartaric Acid, Potassium Acid Tartrate, Sodium Potassium Tartrate, Sodium Tartrate

Antioxidant: Beverages, candy, ice cream, baked goods, yogurt, gelatin desserts, baking powder.

Tartaric acid occurs naturally in grapes, other fruits, and coffee beans. It has an extremely tart, acidic taste, which is useful in some foods. Most of the tartaric acid we ingest is digested by bacteria in the intestines. The 20 percent that is absorbed is rapidly excreted in the urine.



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When tartaric acid is partially neutralized with potassium hydroxide, the result is potassium acid tartrate, or cream of tartar. That ingredient is used in baking powder and to stabilize egg whites.



Taurine

Pretend benefits: Energy drinks.

Taurine occurs naturally in shellfish, other seafood, and meat. Companies add large amounts to energy drinks because it's supposedly energizing, but no credible evidence exists for that claim.



TBHQ (Tert-Butylhydroquinone)

Antioxidant: vegetable oil, snack foods, cereals, other fat-containing foods.

This preservative prevents rancidity. It is sometimes used along with similar preservatives, including BHA, BHT, and propyl gallate, with which it has a synergistic effect. (TBHQ is chemically related to BHA and forms when BHA is metabolized by the body.) One benefit of TBHQ over those other preservatives is that it does not cause discoloration in the presence of iron.

In a government study which used a better design than other similar studies, TBHQ increased the incidence of tumors in rats.



Thaumatococin

Natural high-potency sweetener: used as a flavor modifier in a variety of foods and beverages.

This sweetener, which has the brand name Talin, consists of a couple of proteins extracted from the katemfe fruit grown in West Africa. It is about 2,000 times sweeter than sugar. Although approved as a sweetener in Europe, Australia/New Zealand, Canada, Mexico, and a number of other countries, you won't find it at the store or listed on food labels in the United States. That's because it has not been approved as a sweetener in the United States, although it has been designated "generally recognized as safe" (GRAS) as a flavor modifier. Like rebiana and mogrosides, other natural, high-potency sweeteners, it is said to have a "licorice-like" aftertaste, which consumers may find distasteful and might be the reason it is rarely used. As a protein it is presumably safe, but might cause occasional allergic reactions.



Thiamin Mononitrate (Vitamin B1)



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



Torula Yeast

Natural flavoring and flavor enhancer: snack foods, crackers, dips, seasoning blends, processed meats, soups and bouillons, gravies and sauces, salad dressings, rice and pasta dishes.

Torula yeast can be grown on wood sugars obtained as a byproduct of paper production, as well as other sources of sugar. It is inactivated and then used as a flavoring or taste enhancer, thanks to its monosodium glutamate (MSG) content and umami taste. People who believe they are sensitive to MSG might try to avoid foods containing Torula, but there have not been any studies testing Torula for MSG-type reactions. On food labels, Torula yeast may be listed by name or hidden under the term “natural flavorings.”

When Germany experienced food shortages in World War I, Torula yeast was used as a protein-rich food source.



Triacetin (Glycerol Triacetate)

Wetting agent: Beverages.

This 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, PAGE 45



Transglutaminase (“Meat Glue”)

Enzyme to bind proteins: Beef, poultry dairy, seafood, and other protein-rich products.

You’ll never see this ingredient listed on food labels, because it appears to be used primarily by restaurant chefs. Transglutaminase’s marketer (Ajinomoto) calls it “a revolutionary new way to improve existing food products or allow ‘out of the box’ thinking in making new food products.” What it does is enable a chef to “glue” together a bunch of scraps of meat and sell it as a steak, bind bacon to meat, improve the texture of cheese, and do other tricks. Transglutaminase is a naturally occurring enzyme that is presumably safe, but used to deceive consumers. Also, binding two pieces of food together puts into the protected center of meat or seafood any bacteria that were on the outside and, hence, easily killed in cooking. Inside the food, bacteria are protected from heat and could multiply and cause illnesses when consumed. It is for that reason that this ingredient is a potential safety risk.



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V



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.



Vegetable Oil Stanols And Sterols

See PHYTOSTEROLS AND PHYTOSTANOLS, PAGE 47



Vitamin D (D3)

Nutrient: Fortified milk.

Vitamin D is an essential nutrient that is produced in the skin by sunlight and that occurs naturally in such animal foods as fatty fish, eggs, butter, and liver. Recent research indicates, but has not yet proven, that the great majority of people are not getting enough vitamin D from sunlight or consuming enough in the form of foods or dietary supplements (look for vitamin D3). Increasing vitamin D consumption might reduce the risks of colon cancer, high blood pressure, and heart disease. Though the official recommended intake of D is 400 IU per day, shoot for closer to 1,000. (Talk to your doctor about any special concerns related to your specific health situation.)

X



Xylitol



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Sugar-free sweetener: Chewing gum, packaged sweeteners, other sugar-free foods.

The sweetest of the sugar alcohols, xylitol is about as sweet as sugar. Like most other sugar alcohols, xylitol is not well absorbed by the body, so it has fewer calories than table sugar (although slightly more than most other sugar alcohols). It does not promote tooth decay. Large amounts may have a laxative effect, leading to diarrhea.

While xylitol is harmless to humans, even small amounts (such as in several sticks of chewing gum) can kill dogs. Dogs quickly absorb xylitol into their bloodstream, which may trigger a potent release of insulin from the pancreas. The insulin, in turn, may cause a rapid, steep decrease in blood sugar (hypoglycemia), an effect that can occur within 10 to 60 minutes. Untreated, that can quickly be life-threatening. Xylitol also causes fatal liver disease in dogs.

Y



Yellow 5

See ARTIFICIAL COLORINGS, PAGE 13



Yellow 6

See ARTIFICIAL COLORINGS, PAGE 14



Yellow Prussiate Of Soda

Anticaking agent: Salt.

Some salt manufacturers add yellow prussiate of soda (sodium ferrocyanide) to salt when they crystallize it. The additive generates jagged and bulky crystals which resist caking. That mitigates the need for extra anticaking agents. Although this additive contains cyanide, it is not toxic because the cyanide is tightly bound to iron atoms.



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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 because of known risks or inadequate testing. 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.

ARTIFICIAL COLORINGS	FUNCTION	SOURCE	YEAR BANNED	PROBLEM
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 (<i>ban never finalized</i>)	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 (<i>it had been used to stamp the Department of Agriculture's inspection mark on beef carcasses</i>).
Yellow 1 & 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.
OTHER ADDITIVES	FUNCTION	SOURCE	YEAR BANNED	PROBLEM
agene (<i>nitrogen trichloride</i>)	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.
cinnamyl anthranilate	artificial flavoring	synthetic	1982	Liver cancer
cobalt salts	stabilize beer foam	synthetic	1966	Toxic effects on heart
coumarin	flavoring	tonka bean	1970	Liver poison
cyclamate	artificial sweetener	synthetic	1969	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 (<i>p-ethoxy-phenylurea</i>)	artificial sweetener	synthetic	1950	Liver cancer
ethylene glycol	solvent	synthetic	1998	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

More Loophole Than Law: The Food Additives Testing and Approval Process

Although consumers likely presume that a federal agency ensures the safety of ingredients in the food supply, in reality, this isn't the case.

First, many additives have not been thoroughly tested. And the vast majority of safety testing of food additives is done by manufacturers (or by people hired by them), not the government or independent laboratories. Second, because of a loophole in the law, companies can declare on their own that an additive is "Generally Recognized As Safe" (GRAS), and start adding it to food without even informing the government. Such ingredients are required to be listed on labels although in some cases they appear simply as "artificial flavorings."

Some additives do undergo a more formal government approval process, but even that is no guarantee of safety. There are approved additives that have been shown in subsequent independent studies to harm health, and are in the "Avoid" category in Chemical Cuisine. But the FDA rarely reviews the safety of additives (including GRAS substances) once they enter the food supply.

A Word about Cancer Testing

Chemicals usually are tested for their ability to cause cancer by feeding large dosages to rats and mice. Large dosages are used to compensate for the small number of animals 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, 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 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 study using low dosages and a small number of animals would be extraordinarily insensitive. It would also be nice if test-tube studies or computer models not using any animals could cheaply and accurately identify cancer-causing chemicals. While some progress has been made in that direction, current methods have not yet 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. Ideally, faster, cheaper, more reliable tests that don't involve animals will be developed in the next few years.

The Delaney Clause is an important part of the federal Food, Drug, and Cosmetic Act. It bans any additive "found to induce cancer when ingested by man or animal." The food and chemical industries have tried, but so far failed, to weaken or repeal that law, and the Food and Drug Administration rarely invokes it.

Glossary

ACIDULANTS are used to make foods more acidic for reasons of taste, preservation, or other purpose.

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 water, thereby making food thicker. They “stabilize” factory-made foods by keeping the complex mixtures of oils, water, acids, and solids well mixed.

EAT HEALTHY. STAY HEALTHY.



VEGGIE NICE! VEGETARIAN & VEGAN MAIN DISHES FROM THE HEALTHY COOK
NEW. Trying to eat more plant-based meals? Never know what to make for vegetarian dinner guests? *Veggie Nice* gives you more than a month's worth of meatless main dishes. Try the Yellow Split Pea & Spinach Stew. Or the Pepper, Onion, & Sweet Potato Frittata. All are from the kitchen of Healthy Cook Kate Sherwood. That means they're good for you...and their flavor will knock your socks off. (48 pages)



HEALTHY FOODS: YOUR GUIDE TO THE BEST BASIC FOODS
Which vegetables deliver the most potassium? Is the chicken thigh leaner than the drumstick? How can you tell when a papaya is at its peak? Discover how to make your food choices wiser with this practical guide to the best basic foods in the grocery store. (21 pages)



121 GOOD-EATING TIPS
Whether you're a seasoned cook or a kitchen novice, you'll find loads of helpful tips in this collection of food-prep secrets, safe-food-handling suggestions, recipes for quick and healthy sides, snacks, soups, dips, shakes, and desserts, and more. (21 pages)



FROM SUPERMARKET TO LEFTOVERS: A CONSUMER'S GUIDE TO BUYING, PREPARING, COOKING, AND STORING FOOD SAFELY
Buy your fish just before leaving the supermarket. Hard cheeses like cheddar and parmesan are much less likely to make you sick than soft cheeses like Brie and Camembert. Store your eggs on a refrigerator shelf, not in the door. Learn the 2-2-4 Rule for leftovers. If it has to do with shopping for, cooking, or storing food safely, you'll find it in this definitive guide. (91 pages)



FAST & FRESH SALADS
You've never eaten salads this good...and this good for you. The 10 quick and easy salad dressings alone are worth the price of admission. Each recipe was developed and taste-tested in the test kitchen of *Nutrition Action Healthletter*. (30 pages)



FOR WOMEN ONLY
NEW. The signs of a heart attack or a stroke are different in women than in men. Women have a higher risk of osteoporosis and, of course, breast cancer. And they're more likely to suffer from constipation and muscle loss. Here's what women need to know to stay strong and healthy. (62 pages)



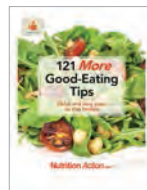
FAST & FRESH MAIN COURSES
Cooks dream about crowd-pleasing main courses that are easy, quick, healthy, and made from ingredients that are probably already in their pantry. Bingo! Each recipe was developed and taste-tested in the test kitchen of *Nutrition Action Healthletter*. (42 pages)



FROM THE HEART: HEART-HEALTHY DISHES FROM THE HEALTHY COOK
NEW. Looking for heart-healthy recipes that excite your taste buds and expand your palate? *Nutrition Action's Healthy Cook*, Kate Sherwood, delivers. Her latest collection features dishes that help you follow the top-rated, research-tested DASH and OmniHeart diets. Get healthy while enjoying Tropical Black Beans, Mediterranean Fish Stew, Turkish-Spiced Chicken, Quinoa & Winter Fruit Salad, and dozens of other dishes. Bonus: Kate also shows you what a day's worth of healthy food looks like. (48 pages)



FAST & FRESH SOUPS & SIDE DISHES
No salty soups or lifeless grain and vegetable stews and side dishes in this collection. What you will find are great-tasting, great-for-you recipes that will brighten up any meal. Each was developed and taste-tested in our test kitchen. (31 pages)



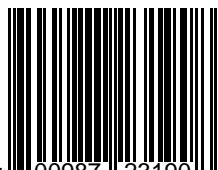
121 MORE GOOD-EATING TIPS
What's a simple—and delicious—way to add veggies to your pasta? Should you refrigerate whole tomatoes? How can you slash the arsenic in your rice? What are the four rules for a perfect stir-fry? If you buy, store, and cook food, you need this booklet. (13 pages)



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more than 100 grams per half cup and contain roughly 25 percent air. Breyers vanilla ice cream weighs 67 grams per half cup; about 45% of its volume is air. That's one reason why premium ice creams are higher in calories—they contain more ice cream per serving—and why the cheaper (and lower-calorie) ice creams are, well, cheaper.



Alginate, Propylene Glycol Alginate

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

Alginate, a 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 (soft drinks, salad dressing) and can stabilize the foam in beer.



Aloe Vera

Beverages, yogurt, desserts, flavoring.

Aloe vera, which comes from a succulent plant, is sold as a juice and is added to various other foods and supplements. It is also marketed in various skin care products, for example to treat wounds and burns. Companies make diverse health claims, but scientific evidence is scarce. The National Center for Complementary and Alternative Medicine of the National Institutes of Health concluded that *aloe vera* “may” help heal burns and abrasions (when used topically), but there is not enough evidence to support other claims. *Aloe vera* taken orally can cause diarrhea and cramps and is recognized by FDA as a laxative. However, in 2002 FDA banned it from over-the-counter laxatives due to a lack of safety information.

Carefully conducted studies by the U.S. government concluded that there was “clear” evidence that *aloe vera* extracts caused intestinal cancers in male and female rats, but not mice. The form tested, called non-decolorized whole-leaf extract of *aloe vera*, contains more of the components that are suspected of being cancer-causing—aloin and other anthraquinones—than do some *aloe vera* products on the market. (The outer leaf pulp of aloe leaves, known as the latex, contains anthraquinones). However, it is not known for sure what components of *aloe vera* are responsible for the tumors.

The National Center for Complementary and Alternative Medicine also notes several other possible concerns: (1) people with diabetes who use glucose-lowering medication should be cautious about taking *aloe vera* by mouth since preliminary studies suggest it may lower blood glucose levels; (2) there have been a few case reports of acute hepatitis following oral *aloe vera* use, but a cause-effect relationship has not been established; and (3) the diarrhea caused by the laxative effect of oral *aloe vera* can decrease the absorption of many drugs.



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Cut Back
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Given the possible risks and unsubstantiated benefits, people should not consume *aloe vera*. People who choose to consume it should at least look for products made with a charcoal filtration process to decolorize and remove anthraquinones, and monitored to ensure that aloin levels are low (e.g., 1 part per million or less). Some solid or semi-solid products have much higher levels of aloin. However, low levels of aloin do not guarantee safety, since it is not known for sure exactly which components of *aloe vera* triggered cancers in rats.



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. The large amounts of vitamin E in some vitamin supplements do not appear to provide any health benefit.



Ammonium Compounds (Bicarbonate, Carbonate, Chloride, Hydroxide, Phosphate, Sulfate)

Acidity reducer: leavening agents.

Ammonium compounds are sources of ammonia, which is used in the body to synthesize nitrogen-containing compounds and to adjust the acidity of bodily fluids. Any excess is converted to urea and excreted in the urine.



Amylases

Enzymes that convert starch to sugar.

Amylases occur naturally in plants, saliva, pancreatic juice, and microorganisms. Bakers add amylase to bread dough to supplement the small amount found naturally in wheat flour. The sugars that the amylases produce from starch serve as food for the fermenting yeast and also makes for better-tasting, better-toasting bread. Amylases also improve the dough's consistency and the bread's keeping quality.



Annatto

Natural coloring: butter, cheese, other foods.

Annatto is a widely used food coloring obtained from the seeds of a tropical shrub. Its hue is yellow to orange. Unfortunately, natural does not always mean perfectly safe. Annatto causes hives in some people. In fact, allergic reactions to annatto may be more common than reactions to commonly used synthetic food dyes.



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ARTIFICIAL COLORINGS (SYNTHETIC FOOD DYES)

Most artificially colored foods are colored with synthetic petroleum-based chemicals—called dyes—that do not occur in nature. Because food dyes are used almost solely in foods of low nutritional value (candy, soft drinks, gelatin desserts, etc.), a good rule of thumb is simply avoid all dyed foods. (You may also see the term “lake” on the label—avoid those too. That is the technical term for the water-insoluble form of a dye, often used in fatty foods and low-moisture foods.). In addition to problems mentioned below, synthetic food dyes cause hyperactivity in some sensitive children. You can report adverse reactions to food dyes to www.cspi.net/foodyes.

Some foods are artificially colored with natural substances, such as beta-carotene or carmine. Just because they are natural does not mean that they are entirely safe. Carmine, for example, can cause severe allergic reactions. Please see their entries in the alphabetical listing.

The use of colorings, be they natural or synthetic, usually indicates that a natural ingredient is not used.



Blue 1

Artificial coloring: beverages, candy, baked goods.

One (unpublished) animal test suggested a small cancer risk, and a test-tube study indicated that the dye might affect neurons. Blue 1 also causes occasional allergic reactions. It should be better tested.



Blue 2

Artificial coloring: pet food, beverages, candy.

Animal studies found some—but not conclusive—evidence that Blue 2 causes brain cancer in male rats, but the FDA concluded that there is “reasonable certainty of no harm,” the safety standard for food additives.



Citrus Red 2

Artificial coloring: skin of some Florida oranges only.

The amounts of this rarely used dye that one might ingest, even from eating marmalade, are so small that the risk is not worth worrying about.



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Green 3

Artificial coloring: candy, beverages.

A 1981 industry-sponsored study showed hints of bladder and testes tumors in male rats, but the FDA re-analyzed the data using other statistical tests and concluded that the dye was safe. Fortunately, it is not widely used.



Orange B

Artificial coloring: only approved for sausage casings.

High doses of this dye can harm the liver and bile duct. However, Orange B has not been used for many years.



Red 3

Artificial coloring: candy, baked goods.

The evidence that Red 3 causes thyroid tumors in rats is “convincing,” according to a 1983 review committee report requested by the FDA. But the FDA’s recommendation that the dye be banned was overruled by pressure from the cherry industry and the U.S. Department of Agriculture. Red 3 is still used in a smattering of foods ranging from cake icing to fruit roll-ups to chewing gum.



Red 40

Artificial coloring: soft drinks, candy, gelatin desserts, pastries, pet food, sausage.

Red 40 is the most widely used food dye, but the key mouse tests were flawed and inconclusive. An FDA review committee acknowledged problems, but said that evidence of harm was not “consistent” or “substantial.” Red 40 can cause allergy-like reactions. Like other dyes, Red 40 is used mainly in junk foods.



Yellow 5

Artificial coloring: gelatin desserts, candy, pet food, baked goods.

The second most widely used coloring causes allergy-like hypersensitivity reactions, primarily in aspirin-sensitive people, and triggers hyperactivity in some children. In the 1990s, FDA scientists discovered Yellow 5 was contaminated with such cancer-causing substances as benzidine and 4-aminobiphenyl (or chemicals that the body



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converts to those substances). In 2011, the FDA rejected a request by the Center for Science in the Public Interest to determine if the carcinogenic contaminants were still present.



Yellow 6

Artificial coloring: beverages, candy, baked goods.

Industry-sponsored animal tests suggested that this dye, the third-most-widely-used, causes tumors of the adrenal gland. In addition, in the 1990s, FDA scientists discovered that several carcinogens, such as 4-aminobiphenyl and benzidine (or chemicals that the body converts to those substances), 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. The FDA refused to conduct new studies to determine whether Yellow 6 is still contaminated with carcinogens. Yellow 6 may cause occasional, but sometimes-severe, hypersensitivity reactions.



Artificial And Natural Flavoring

Flavoring: soft drinks, 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. Most flavoring chemicals also occur in nature and are probably safe, but FDA does not review their safety, and a few have been shown to cause cancer in animals and should not be permitted. 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 and are not required to list them on food labels. That secrecy is unfortunate, because some people may be sensitive to certain flavoring ingredients, such as MSG or HVP, and vegetarians and others may not want to consume flavors that are derived from animals.

Artificial Sweeteners And Other Sugar-Free Sweeteners

See also: Acesulfame-potassium, Advantame, Aspartame, Brazzein, Cyclamate, Monatin, Monk Fruit Extract, Neotame, Saccharin, Stevia Leaf Extract (Rebiana), Sucralose, Sugar Alcohols (Erythritol, Hydrogenated Starch Hydrolysate, Isomalt, Lactitol, Maltitol, Mannitol, Sorbitol, Xylitol), Thaumatin

Artificial sweeteners and other sugar substitutes are used in a wide range of foods to provide sweetness without or with fewer calories. The question is: are they safe? Controversies have swirled around most of the artificial sweeteners. Acesulfame-potassium, aspartame, saccharin, and sucralose may pose a slight risk of cancer. The artificial sweetener neotame and the natural “high-potency” sweeteners rebiana and



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thaumatin appear to be safe. But research on all of them is relatively limited. For instance, a 2010 study found that artificially sweetened drinks probably caused pre-term deliveries; the researchers suspected that aspartame was the culprit. Synthetic high-potency sweeteners were the rule until about 2009 when rebiana and other stevia leaf extracts became marketed widely in the United States. Rebiana and some of the other stevia leaf extracts, which have “taste challenges,” allowed companies to claim “all natural” on their artificially sweetened (with a “natural ingredient,” that is) products.

Sugar alcohols are sugar-free (and alcohol-free) sweeteners. Some occur in plants, but are typically manufactured. Most have about half the calories of sugar, though erythritol has one-twentieth as many. They appear to be safe, except that large amounts of most of them may have a laxative effect (except erythritol, which may cause nausea).

Companies advertise their artificially sweetened foods as being almost magical weight-loss potions. The fact is, though, that losing weight is difficult, and people need to make a real concerted effort to eat fewer calories and exercise more. Artificial sweeteners and other sugar substitutes can make the struggle a little more pleasant.



Ascorbic Acid (Vitamin C), Sodium Ascorbate

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

Ascorbic acid—or vitamin C—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 and breakfast cereals. It also helps prevent loss of color and flavor in foods by reacting with unwanted oxygen. Though megadoses of ascorbic acid were famously recommended by Dr. Linus Pauling as a cure for the common cold, subsequent research found only that they might only slightly reduce the severity of colds.

Sodium ascorbate, also safe, is a more soluble form of ascorbic acid.

See also ERYTHORBIC ACID (or SODIUM ERYTHORBATE).



Ascorbyl Palmitate

Antioxidant, nutrient.

Ascorbyl palmitate is a fat-soluble antioxidant formed by combining ascorbic acid (vitamin C) with palmitic acid (derived from fat). Studies indicate that ascorbyl palmitate is completely metabolized, the ascorbic acid becoming available as vitamin C and the palmitate portion converted to energy or fat. Though palmitate from palm and other vegetable oils can increase blood cholesterol levels, the amount derived from this additive is trivial.



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Aspartame

Artificial sweetener: "Diet," "no sugar added," "sugar-free," and other products, including soft drinks, drink mixes, gelatin desserts, frozen desserts, jams and fruit spreads, yogurt, breakfast cereal, candy, chewing gum, condiments, packaged (tabletop) sweeteners.

Aspartame (sometimes marketed under the brand names Equal, NutraSweet, or Amino Sweet) is a chemical combination of two amino acids and methanol. Questions of cancer and neurological problems, such as dizziness or hallucinations, have swirled around aspartame for decades. A key 1970s industry-sponsored study initially sparked concerns that aspartame caused brain tumors in rats, but the FDA convinced an independent review panel to reverse its conclusion that aspartame was unsafe. The agency then approved its use in 1981 for use as a tabletop (packaged) sweetener and in breakfast cereals, powdered beverage mixes, and other dry packaged foods. Two years later FDA approved aspartame for use in soft drinks, by far the biggest and most lucrative market. Aspartame dominates the diet soft drink market, and the overall market for artificial sweeteners, although its use is declining.

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, published the first such study. The study found that rats exposed to aspartame starting at eight weeks of age and continuing through their entire lifetimes developed lymphomas, leukemias, and other tumors, including kidney tumors, which are extremely rare in the strain of rat used. In 2007, the same researchers published a follow-up study that exposed rats to aspartame beginning in the womb and continuing through their entire lifetimes. That study, too, found that aspartame caused leukemias/lymphomas, as well as mammary (breast) cancer. Then in 2010, they published a study on aspartame in mice, also exposing the animals starting in the womb and continuing throughout their entire lifetimes. That third study found that aspartame caused liver and lung cancer in male mice.

Those new studies may have found problems that earlier company-sponsored studies did not because the newer studies used far more animals and thus were more capable of detecting adverse effects. Also, the Italian researchers monitored the animals for their entire lifetimes: as long as three years for the rats and two-and-one-half years for the mice, instead of just two years in the company-sponsored studies. (Most chemicals are tested for just two years.) Two-year-old rats are roughly equivalent to 65-year-old people. The many tumors that occurred after two years would never have been seen in industry's studies. Furthermore, two of the new studies included exposure before birth, which increased their ability to detect cancer (only one of the industry studies did).



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The food industry and the European Food Safety Authority (EFSA) have contested the Italian findings, pointing to what they consider serious flaws in the design and conduct of the study and evaluation of the results. The FDA, too, has disputed the validity of the Italian studies. However, scientists at CSPI and elsewhere, citing evaluations sponsored by the U.S. National Toxicology Program and the Environmental Protection Agency, found industry's and EFSA's allegations to have little merit.

As one defense of aspartame, industry and FDA point to a 2006 human study by U.S. National Cancer Institute researchers. That study involved a large number of adults 50 to 71 years of age over a five-year period. The study did not find any evidence that aspartame posed a risk. However, the NCI study had three major limitations: It did not involve truly elderly people (the Italian studies monitored rodents until they died a natural death), the subjects had not consumed very much aspartame or for very long, and it was not a well-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).

Meanwhile, the most careful long-term study of aspartame in humans, conducted by researchers at the Harvard School of Public Health, found the first human evidence that aspartame poses a slightly increased cancer risk to men, but not women. The researchers speculated that that might be due to the fact that men have higher levels of an enzyme that converts methanol (a breakdown product of aspartame) to formaldehyde, a human carcinogen. The Harvard study couldn't prove that aspartame was a carcinogen, but it certainly added to the safety concerns, especially since the cancers observed in the human study (multiple myeloma and non-Hodgkin's lymphoma) were similar to the cancers observed in two of the three animal studies (leukemias and lymphomas). Another study by researchers with the American Cancer Society, not quite as large as the Harvard study, did not find any link.

A recent review by the scientists who conducted the three positive animal studies urges governments to re-examine their positions on aspartame, and recommends that pregnant women and children not consume aspartame.

The bottom line is that three independent studies have found that consumption of aspartame causes cancer in rodents, and one epidemiology study found evidence that aspartame increases the risk of cancer in men. That should be reason enough for the FDA and other governments to eliminate aspartame from the food supply. Meanwhile, consumers should read labels carefully and avoid this artificial sweetener.

Another concern emerged in 2010, when Danish researchers linked the consumption of artificially sweetened soft drinks, but not sugar-sweetened soft drinks, to preterm delivery of babies. In 2012 another Scandinavian study found links between preterm delivery and both artificially sweetened and sugar-sweetened beverages. Though



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the studies couldn't distinguish between the various artificial sweeteners, aspartame and acesulfame-potassium were the most widely used in those countries. The fact that two large, independent studies found a link between artificially sweetened beverages and preterm delivery is troubling. Pregnant women should make a special effort to avoid or at least cut back on aspartame and acesulfame-K, as well as moderating their consumption of added sugars.

Since aspartame was first used, some people have contended that it causes headaches or dizziness. Some small studies have documented that finding, while others did not. Anyone experiencing such problems has one more reason to avoid aspartame.



AUTOLYZED YEAST EXTRACT

Flavoring: ready made meals, snack foods, meat products, gravies and sauces, soups, broths, and soup mixes.

Autolyzed yeast extract is a flavoring agent made from yeast, usually the same kind used to make bread rise or ferment beer. Generally, the yeast is heated or otherwise killed in a way that allows enzymes inside the cells to break down the yeast, including the proteins. (Other types of yeast extracts are made by adding enzymes, rather than using the enzymes already present inside the yeast cell.)

Some people who have allergic reactions to inhaling molds also react to ingesting yeast or yeast extracts.

All proteins are made up of amino acids, and one amino acid of interest—glutamic acid—is present in autolyzed yeast extract, as well as in many other foods and in our bodies. Glutamate is a form of glutamic acid and is responsible for “umami,” the savory taste associated with foods like meat and mushrooms. The sodium salt of glutamate is called sodium glutamate, better known as MONOSODIUM GLUTAMATE or MSG. A small number of people experience headache, numbness, flushing, tingling, or other short-term symptoms when consuming large amounts of MSG. Autolyzed yeast extract is sometimes used to substitute for MSG, but has much lower levels of glutamate so adverse reactions are unlikely.

Foods such as Parmesan cheese, seaweed, dried shitake mushrooms, and dried tomatoes naturally contain relatively high levels of glutamate, and so could also potentially be a problem for individuals sensitive to MSG, although that does not seem to be the case. FDA does not allow foods that contain autolyzed yeast extract (or yeast extract, hydrolyzed yeast, soy extracts, hydrolyzed vegetable protein, or protein isolate) to say “No MSG” or “No added MSG” on their packaging. Although autolyzed yeast extract affects the flavor of foods, FDA requires that it be identified on the label; it cannot be hidden under the term “natural or artificial flavoring.”

See also MONOSODIUM GLUTAMATE (MSG)



Safe
Appears to be safe.



Cut Back
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Avoid
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Azodicarbonamide

Flour improver and bleaching agent: White flour, bread and rolls.

Azodicarbonamide (ADC) has long been used by commercial bakers to strengthen dough, but has been poorly tested. A 1999 review published by several United Nations agencies concluded that “There are no adequate data relating to carcinogenic, reproductive, or developmental effects, hence it is not possible to evaluate the risk to human health for these endpoints.”

Most of the concern about ADC relates to two suspicious chemicals that form when bread is baked. The first chemical is semicarbazide (SEM), which caused cancers of the lung and blood vessels in mice. It did not cause cancer in rats. In 1976 the International Agency for Research on Cancer considered SEM to be a carcinogen in mice, but in 1987 concluded that the animal data were “limited” and that SEM was “not classifiable” as to its carcinogenicity to humans.

A second breakdown product, urethane, is a recognized carcinogen. ADC used at its maximum allowable level (45 ppm in bread) leads to levels of urethane in bread that pose a small risk to humans. Toasting that bread increases the amount of urethane. However, when used at 20 ppm, which may be the amount used by some commercial bakeries, a 1997 FDA study found “only a slight increase” in urethane. (Some urethane forms in bread not made with azodicarbonamide.)

Considering that many breads don’t contain azodicarbonamide and that its use slightly increases exposure to a carcinogen, this is hardly a chemical that we need in our food supply. It appears that the Delaney amendment, which bars the use of additives that cause cancer in humans or animals, would require FDA to bar its use. At the very least, FDA should reduce the amount allowed to be used.

B



Benzoic Acid

See SODIUM BENZOATE, PAGE 55



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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 not take beta-carotene supplements, but the small amounts used as food additives are safe.



Brazzein

“Natural” high-potency sweetener

Brazzein has not yet been approved as a food additive, but some food manufacturers see it as a better-tasting alternative to stevia-derived rebiana. Brazzein is a small (54 amino acids) protein molecule that occurs naturally in the berries of a climbing vine found in West Africa, where it has been consumed by people and animals. It is about 1,000 times sweeter than sugar, but, as far as we can determine, it has not been tested for safety. Because it is a protein, it might cause food allergies. One company is planning to market the sweetener under the name Cweet.



Blue 1

See ARTIFICIAL COLORINGS, PAGE 12



Blue 2

See ARTIFICIAL COLORINGS, PAGE 12



Brominated Vegetable Oil (BVO)

Emulsifier, clouding agent: soft drinks.

BVO keeps flavor oils in suspension, giving a cloudy appearance to citrus-flavored soft drinks such as Mountain Dew and Fanta Orange. After some public pressure, PepsiCo agreed in 2013 to remove BVO from Gatorade, then in 2014 Coca-Cola and PepsiCo announced they would remove BVO from all their beverages, but as of mid-2016, BVO is still in Mountain Dew.



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Safety questions have been hanging over BVO since 1970, when the FDA removed BVO from its “Generally Recognized as Safe” list. In 1970, FDA permitted its use only on an “interim” basis pending additional study—one of only four such interim-allowed additives. Decades later, BVO is still poorly tested and remains on the interim list.

Health concerns start with the finding that eating BVO leaves residues in body fat and the fat in brain, liver, and other organs. Animal studies indicate that BVO is transferred from mother’s milk to the nursing infant and also can cause heart lesions, fatty changes in the liver, and impaired growth and behavioral development. Those studies suggest that BVO might be harmful to people who drink large amounts of soft drinks that contain BVO. Indeed, doctors have identified bromine toxicity in two people who drank extremely large amounts of such sodas. Sensitive, modern studies are urgently needed to better understand the risk, especially at the lower levels typically consumed by large numbers of children. Meanwhile, BVO should not be used (it is not permitted in Europe).



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 that 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 might well 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) or safer processes (e.g., packing foods under nitrogen instead of air), or can simply be left out (many brands of oily foods like potato chips don’t use any antioxidant).



Butylated Hydroxytoluene (BHT)

Antioxidant: cereals, chewing gum, potato chips, oils.

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 and easily replaced by safe substitutes (see discussion of BHA).



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C

**Caffeine**

Stimulant: naturally occurring in coffee, tea, cocoa, and coffee-flavored yogurt and frozen desserts. Added to soft drinks, energy drinks, waters, candy, chewing gum, cookies, energy and granola bars, other dessert and snack foods, and medications.

Caffeine is one of two drugs that are present naturally in 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 appears to increase the risk of adverse pregnancy outcomes, including miscarriages, preterm delivery, stillbirth, and childhood leukemia (and possibly birth defects) and inhibits fetal growth, women who are pregnant or may become pregnant should avoid caffeine. Caffeine also may make it harder to get pregnant. The less those women consume, the lower the risk.

Caffeine also keeps many people from sleeping, causes jitteriness, and affects calcium metabolism. However, on the positive side, drinking a couple of cups per day of regular (but not decaf) coffee appears to reduce the risk of Parkinson's disease, Alzheimer's disease, gallstones, and even suicide. It also can relieve headache pain, increase endurance, such as on a treadmill, and improve alertness.

The caffeine in a standard cup or two of coffee is harmless to most people. But be aware that one middle-size (16 oz.) cup of regular coffee at popular coffeehouses contains about 300 or more milligrams of caffeine. That is equivalent to the caffeine in three or four old-fashioned 5-ounce-cups of coffee. A 12 oz. can of Coca-Cola or most other caffeinated soft drinks contains about 35 to 40 milligrams; energy drinks typically contain much more. For a list of the caffeine content of many common beverages and foods visit <http://www.cspinet.org/new/cafchart.htm>. If you drink more than a couple of cups of coffee or several cans of caffeine-containing soda per day and experience insomnia or jitters, are at risk of osteoporosis, or are pregnant, you may want to rethink your habit.

**Calcium (Or Sodium) Propionate**

Preservative: breads, 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.

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Calcium (Or Sodium) Stearoyl Fumarate, Calcium (Or Sodium) Stearoyl Lactylate

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, and frozen egg whites and artificial whipped cream.



Caramel Coloring

Coloring: colas, baked goods, pre-cooked meats, soy and Worcestershire sauces, chocolate-flavored products, beer.

Caramel coloring is made by heating a sugar compound (usually high-dextrose corn syrup), often together with ammonium compounds, acids, or alkalis. It is the most widely used (by weight) coloring added to foods and beverages, with hues ranging from tannish-yellow to black, depending on the concentration and the food. Caramel coloring may be used to simulate the appearance of cocoa in baked goods, make meats and gravies look more attractive, and darken soft drinks and beer.

Caramel coloring, when produced with ammonia, contains the contaminants 2-methylimidazole (2-MI) and 4-methylimidazole (4-MI). In 2007, studies by the U.S. National Toxicology Program found that those two contaminants cause cancer in male and female mice and possibly in female rats. In 2011, the International Agency for Research on Cancer, a division of the World Health Organization, agreed that 2-MI and 4-MI are “possibly carcinogenic to humans.” After that, the State of California’s Environmental Protection Agency listed 2-MI and 4-MI as carcinogens under the state’s Proposition 65. The state lists chemicals when they pose a lifetime risk of cancer of at least 1 out of 100,000 people. California warned that as of January 7, 2012 products such as soft drinks that could expose people to more than 29 micrograms of 4-MI per day would have to bear a warning notice. In March 2012, when the Center for Science in the Public Interest published the results of a study that found levels up to 150 micrograms per can of Coca-Cola and Pepsi-Cola purchased in Washington, DC, the soft-drink giants announced that they had reduced the contaminant to below California’s threshold for action in products distributed in California, although subsequent testing by Consumer Reports revealed that some Pepsi products contained more than 29 micrograms. They said they would market the less-contaminated products throughout the country, which Coca-Cola did in 2013 and PepsiCo did by 2015. To the best of our knowledge, no sodas sold in California bear the warning notice.

The FDA has a limit that is 10 times stricter than California’s for substances contami-



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nated with cancer-causing chemicals. CSPI's analysis of a Coca-Cola purchased in 2012 in California found just 4 micrograms of 4-MI per 12 ounces. Even that much lower level might exceed the FDA's threshold for action of 1 cancer per million consumers.

It is worth avoiding or drinking less colas and other ammonia-caramel-colored beverages not only because of risk from 4-methylimidazole, but because the drinks contain about 10 teaspoons of added sugars per 12 ounces, and that promotes obesity and tooth decay. Soy sauces, baked goods, and other foods that contain ammoniated caramel coloring are much less of a problem because the amounts consumed are small.



Carbon Dioxide (Carbonated Water)

Carbon dioxide, a harmless gas, is responsible for the bubbles in beer, soft drinks, mineral water, and the like.



Carboxymethyl Cellulose (CMC, Cellulose Gum), Sodium Carboxymethyl Cellulose

Improve texture, stabilize foam (beer), prevent fruit from settling, prevent sugar from crystallizing (cake icings), bind water: Ice cream, beer, pie fillings, jellies, cake icings, diet foods.

Carboxymethylcellulose (CMC) is a thickening agent that is made by reacting CELLULOSE (wood pulp, cotton lint) with a derivative of acetic acid (the acid in vinegar). It is also called cellulose gum.

CMC has long been considered safe, but a 2015 study funded by the National Institutes of Health raised some doubts. It found that both CMC and another emulsifier (polysorbate 80) affected gut bacteria and triggered inflammatory bowel disease symptoms and other changes in the gut, as well as obesity and a set of obesity-related disease risk factors known as metabolic syndrome. In mice that were predisposed to colitis, the emulsifiers promoted the disease. It is possible that polysorbates, CMC, and other emulsifiers act like detergents to disrupt the mucous layer that lines the gut, and that the results of the study may apply to other emulsifiers as well. Research is needed to determine long-term effects of these and other emulsifiers at levels that people consume.

CMC is not absorbed or digested, so the FDA allows it to be included with "dietary fiber" on food labels. CMC isn't as healthful as fiber that comes from natural foods.



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Carmine; Cochineal Extract

Artificial coloring.

Cochineal extract is a coloring obtained from the cochineal insect, which lives on cactus plants in Peru, the Canary Islands, and elsewhere. Carmine is a more purified coloring made from cochineal, but in both cases, carminic acid actually provides the color. These colorings, which are extremely stable, are used in some red, pink, or purple candy, yogurts, ice creams, beverages, and other foods, as well as in drugs and cosmetics. They appear to be safe for most people. A small percentage of consumers suffer allergic reactions ranging from hives to life-threatening anaphylactic shock. Carmine and cochineal have long been listed on labels simply as “artificial coloring” or “color added.” In 2009, in response to a petition by the Center for Science in the Public Interest, the FDA gave the food industry until January 1, 2011, to clearly identify the colorings as carmine or cochineal extract on food labels. The FDA rejected CSPI’s request for labels to disclose that carmine is extracted from insects so vegetarians and others who want to avoid animal products could do so.



Carrageenan

Thickening, gelling, stabilizing agent: Dairy and non-dairy products, including ice cream, sorbet, frozen desserts, chocolate milk, soy milk, almond milk, yogurt, cottage cheese, whipping cream, jelly, infant formula, salad dressings, deli meat, frozen dinners.

Carrageenan is a family of indigestible large molecules obtained from certain seaweeds. It is used as a thickening or texturing agent in a wide variety of foods and beverages.

Large amounts of carrageenan have harmed test animals’ colons. The amounts in food are too small to be a concern for most people, but an independent committee of the World Health Organization (WHO) concluded that it is unclear whether people with episodes of gastrointestinal disease might absorb some carrageenan, which presumably could cause gastrointestinal or immune system problems. Some people have reported that eliminating carrageenan from their diet diminished or eliminated their gastrointestinal discomfort.

Carrageenan—at least in its natural, undegraded form—does not cause cancer in animals. In animal studies, high doses of carrageenan increase the potency of chemicals that cause cancer, and there has been controversy over whether it could do so at the low levels that people consume. The FDA and the WHO committee have concluded that food-grade carrageenan does not pose either a direct or an indirect cancer risk.



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Food-grade carrageenan contains small amounts of “degraded” carrageenan, and a bit more probably forms in the acidic conditions of the stomach. The International Agency for Research on Cancer, another unit of the WHO, considers degraded carrageenan to be “possibly carcinogenic in humans.” While any possible cancer risk would be quite small, some people may wish to err on the side of caution and avoid carrageenan.

Some experts have been concerned about the safety of carrageenan for infants, given that the GI tract of the infant is still developing. In 2014, however, the WHO committee reviewed new animal studies and concluded that infant formula made with carrageenan is safe.



Casein, Sodium Caseinate

Thickening and whitening agent: ice creams, sherbets, coffee creamers.

Casein, the principal protein in milk, contains 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.



Castoreum

Natural flavoring: Vanilla-flavored and other foods

This substance is occasionally used as a natural flavoring. Only about 1,000 pounds of castoreum are used annually, so it really isn’t a significant part of the food supply, and it shouldn’t pose any risk. The FDA considers it to be “generally recognized as safe.” But because castoreum is extracted from the anal castor sacs of beavers, it has been publicly lampooned.

Beavers mix castoreum with urine to mark their territory and make their fur and tail more water resistant. The food industry finds its strong, tar-like, musky odor to be useful in flavorings. Of course, you’ll never see “castoreum from anal sacs of beavers” on food labels; instead, it is just included in the broad term “natural flavorings.”



Cellulose

Prevents caking and clumping, binds water (used in diet foods), improves texture, thickens, emulsifies, used as a filler: Grated cheese, breads, diet foods, frozen dinners, sauces, salad dressings.

Cellulose is a safe and inexpensive carbohydrate that comprises the woody parts and cell walls of plants. It is a type of dietary fiber found naturally in fruits, vegetables, and cereals. The cellulose added to processed foods usually comes from



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wood pulp (saw dust) or cotton lint. It can prevent caking, such as in grated parmesan cheese, but some companies fraudulently use it as a cheap filler in their “100%” grated parmesan cheese. It is also a cheap way to boost the fiber content on food labels, but it isn’t as healthful as fiber that comes from natural foods.



Citric Acid, Sodium Citrate

Acid, flavoring, chelating agent: ice creams, sherbets, fruit drinks, 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, jams, ice creams, candy, and other foods.



Citrus Red 2

See ARTIFICIAL COLORINGS, PAGE 12



Cochineal Extract

See CARMINE, PAGE 25



Corn Syrup

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

Corn syrup, which consists mostly of dextrose (glucose), 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: Banned in the United States. Allowed as a packaged (tabletop) sweetener in Canada, and also in diet soft drinks and foods in some other countries.

This controversial high-potency sweetener was used in the United States in diet foods until 1970, at which time it was banned because animal studies suggested that it caused cancer. (It is still permitted in Canada, Europe, and some other countries.)



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Now, based on animal studies, cyclamate (or a byproduct) is believed not to cause cancer directly, but to increase the potency of other carcinogens and to harm the testes.



Cysteine

Antioxidant: Flour.

Cysteine, an amino acid, is a natural constituent of protein-containing foods. It is added to foods to prevent oxygen from destroying vitamin C. Bakers use cysteine to reduce the mixing time for dough.

D



DATEM (Diacetyl Tartaric Acid Ester Of Monoglycerides)

Emulsifier: Bread, biscuits.

This emulsifier is used to build a strong gluten network to improve bread volume and keep dough from getting sticky or collapsing.



Dextrin

Emulsifier: Prevents sugar from crystallizing, encapsulates flavor oils, thickening agent: Candy, powdered mixes.

Dextrin is the mixture of fragments that results from treating starch with acid, alkali, or enzymes. It is as safe as starch.



Dextrose (Corn Sugar, Glucose)

Sweetener: Bread, caramel, soft drinks, cookies, many other foods.

Dextrose (glucose) is a sugar and an important chemical in every living organism. It is a source of sweetness in fruits and honey. Added to foods as a sweetener, it provides empty calories and contributes to tooth decay. Dextrose reacts with other chemicals when heated and contributes to the color of bread crust and toast. Dextrose contributes a modest 2% of the 76 pounds of refined sugars that the average American consumes annually.



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Diacetyl

Butter flavoring, preservative.

Diacetyl is one of many chemicals that give butter its characteristic flavor. Low levels are present in butter (extra diacetyl is added to unsalted butter 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 high levels of diacetyl causes obstructive lung disease, which is potentially fatal. Widespread publicity from 2005 to 2007 and several lawsuits persuaded most major American food manufacturers to protect their workers (and restaurant cooks) by switching to supposedly safer ingredients. But more recent studies indicate that one substitute, 2,3-pentanedione, chemically similar to diacetyl (also called 2,3-butanedione), may be just as damaging to the respiratory tract.



Diacylglycerol

Cooking oil.

This is the diglyceride part of the long-used emulsifier mono- and diglycerides. Don't count on this little-used ingredient providing any real benefit.

E



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, leaves 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 SODIUM ERYTHORBATE, PAGE 56



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Erythritol

Low calorie sugar-free sweetener: Drinks, hard candy, chocolate milk, frozen desserts, baked goods, packaged sweeteners (sometimes mixed with stevia leaf extract, monk fruit extract, or other sweeteners)

This sugar alcohol, which was first used commercially in the United States in about 2001, is about 60 to 70 percent as sweet as sugar, but provides at most only one-twentieth as many calories. Small amounts occur naturally in such fruits as pears, melons, and grapes, but virtually all of the erythritol used as a food additive is produced by fermenting glucose with various yeasts. Many companies mix it with high-potency sweeteners, such as stevia leaf extract or monk fruit extract, to keep the calories down while masking those other sweeteners' unpleasant aftertastes. Companies also value erythritol because it provides the bulk that sugar has and which high-potency sweeteners lack. Thus, it adds to the "mouthfeel" of low-sugar beverages. It does not promote tooth decay.

Other than occasional allergic reactions, the only safety concern about erythritol is that eating too much of it could cause nausea. Individual sensitivities vary greatly, but most adults can safely consume up to about 40 to 50 grams of erythritol per day. (For comparison, there are 12 grams in Blue Sky Zero Cola, 4 grams in a 12-ounce can of Zevia soda, and 3 grams in a packet of Truvia.) That's safer than most other sugar alcohols, such as sorbitol, mannitol, and lactitol. Erythritol's relative safety is due to its being mostly absorbed into the bloodstream and excreted unchanged in urine. Other sugar alcohols stir up trouble in the colon where they attract water (leading to laxation or diarrhea) or are digested by bacteria (causing gas).

F



Ferrous Gluconate

Coloring, nutrient: Black olives.

Ferrous gluconate is used by the olive industry to generate a uniform jet-black color and is added to pills as a source of iron.



Food Starch, Modified

See STARCH, MODIFIED, PAGE 58



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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 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 the foods are healthier than competing products that are sweetened with sugar or HFCS. The fructose that occurs in fruits and vegetables is certainly safe. However, the large amounts that come from added fructose, sucrose (ordinary table sugar), and HFCS increase triglyceride (fat) and small, dense LDL (“bad”) cholesterol levels in the blood and may thereby increase the risk of heart disease. Also, recent studies show that consuming 25 percent of one’s calories from fructose or HFCS may lead to more visceral (deep belly) fat or liver fat. Those changes may increase the risk of diabetes and heart disease. Finally, large amounts of fructose consumed on a regular basis also may affect levels of hormones like leptin and ghrelin, which help regulate appetite, thereby contributing to weight gain and obesity.

The Dietary Guidelines for Americans (America’s basic nutrition policy) recommends that people consume no more than about 10 percent of calories (12 teaspoons in a 2,000-calorie diet) in the form of refined sugars. The American Heart Association has a stricter recommendation: six teaspoons of refined sugars per day for women and nine teaspoons for men. That’s far less than the current average of 13 percent of calories. The bottom line: the less added sugars—fructose, dextrose, sucrose, or HFCS—one consumes the better (though, again, small amounts are safe).



Fumaric Acid

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

A solid at room temperature, inexpensive and highly acidic, fumaric acid is an 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.



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G

**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.

**Ginkgo Biloba**

Purported memory booster: Beverages.

Companies add small amounts of *Ginkgo biloba* to beverages because it supposedly boosts memory and thinking, but most studies in healthy people show little or no benefit, even at levels greater than what is added to foods and beverages. Since ginkgo appears to interfere with blood clotting, it should not be consumed before or after surgery, during labor and delivery, or by those with bleeding problems such as hemophilia.

Importantly, in 2013, the U.S. Government's National Toxicology Program published the first study that could evaluate Ginkgo's ability to cause cancer. The study found "clear evidence" that Ginkgo biloba caused liver cancer in male and female mice and "some evidence" that Ginkgo caused thyroid cancer in rats.

**Ginseng**

Purported energy booster and flavoring: Energy drinks.

Companies add small amounts to foods because of ginseng's reputation for boosting energy, sexual stamina, and mental effort, but there's little evidence for those claims, even at much higher levels than what is found in foods. The amount in foods and beverages is not likely to pose a safety risk.

**Gluconic Acid, Glucono Delta-Lactone, Magnesium Gluconate, Sodium Gluconate, Zinc Gluconate**

Sequestrant, acidifier, leavening agent, curing agent: Nonalcoholic beverages, processed fruit and fruit juices, baked goods, dairy products, cured meats.

Gluconic acid is a metabolite of the sugar glucose. Glucono delta-lactone is the most widely used of this family of compounds and is used to adjust the acidity or as a leavening agent in baked goods, processed fruits, and dairy products. It is also used in some cured meats to speed the formation of the pink color.

All of these substances are safe. See also FERROUS GLUCONATE.

**Safe**

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**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**

May trigger an acute, allergic reaction, intolerance, or other problem.

**Avoid**

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



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.



Guanosine Monophosphate (GMP, Disodium Guanylate)

Flavor enhancer: Soups, sauces, seasonings.

GMP and INSONINE MONOPHOSPHATE (IMP) are used together to enhance the meaty (umami) flavor of soups and other foods. They are usually used together with monosodium glutamate (MSG), because they enhance its potency.



Green 3

See ARTIFICIAL COLORINGS, PAGE 13



Guarana

Stimulant: Energy drinks, teas.

Guarana is a plant whose seeds are high in caffeine. Companies add it to beverages as a “natural” source of caffeine, but too much caffeine from any source can cause insomnia, anxiety, and other problems (see CAFFEINE).



Gums (Arabic, Furcelleran, Gellan, 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 help replace fat in low-fat ice cream, baked goods, and salad dressings. Tragacanth has caused occasional severe allergic reactions. The FDA warns against giving a product called SimplyThick, which contains xanthan gum, to infants, since it may cause a life-threatening condition called necrotizing enterocolitis. It is not clear whether the gum itself, bacterial contamination of the gum, or some other cause is to blame.



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H



Helium

Inert, safe gas: Balloons or pressurized containers.

Helium is an inert, safe gas that is used to float balloons and sometimes to force foods out of pressurized containers.



High-Fructose Corn Syrup (HFCS)

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 some for the obesity epidemic, because rates of obesity have climbed right along with HFCS consumption. But that's an urban myth. HFCS and sugar are equally harmful. We're consuming far too much of both.

HFCS starts out as cornstarch. Companies use enzymes or acids to break down most of 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 2013, about 59 pounds of corn sweeteners, mostly HFCS, and 68 pounds of cane and beet sugar were produced per capita in the United States. A total of 128 pounds of all caloric sweeteners, down 15 percent from the 1999 high of 152 pounds, was produced per person. And, because of all the criticism (not fully deserved) of HFCS in recent years, HFCS consumption declined by about 32 percent between 1999 and 2013. Much of that decline resulted from declining soft drink consumption (thanks to increased health consciousness and to the popularity of bottled water), while the rest reflects food manufacturers switching back to ordinary sugar. Actual consumption (as opposed to production) of caloric sweeteners, according to the U.S. Department of Agriculture, was 76 pounds per person in 2013.

Some people think that HFCS is mostly fructose, which does probably play a significant role in obesity. However, HFCS, on average, is about half fructose and half glucose—the same as ordinary table sugar (sucrose) when it is metabolized by the body. When sugar is used in soft drinks, much of it is 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 would have little effect on consumption.



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Modest amounts of HFCS are safe. However, large amounts promote tooth decay, as well as increase triglyceride (fat) levels in blood, thereby increasing the risk of heart disease. Also, recent studies show that consuming 25 percent of calories from HFCS or fructose leads to more visceral (deep belly) fat or liver fat. Those changes may increase the risk of diabetes or heart disease. Finally, large amounts of fructose from HFCS or sugar 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. The HFCS 55 that is used in most soft drinks contains about 10 percent more fructose than sucrose. That makes most soft drinks a bit more harmful than if they were made with sugar.

The Dietary Guidelines for Americans (America's basic nutrition policy) recommends that people consume no more than about 10 percent of calories (12 teaspoons in a 2,000-calorie diet) in the form of refined sugars. The American Heart Association has a stricter recommendation: six teaspoons of refined sugars per day for women and nine teaspoons for men. That's far less than the current average of 13 percent of calories. The bottom line: the less added sugars—fructose, dextrose, sucrose, or HFCS—one consumes the better.



High-Maltose Corn Syrup

Sweetener, 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 the sugar maltose (35 percent or more). Maltose is composed of two units of glucose. High-maltose corn syrup, corn syrup solids, and maltodextrin are similar, in that each contain glucose but not fructose, and each is produced in a wide variety of formulations for different applications. Since high-maltose corn syrup doesn't contain any fructose, it is probably safer than table sugar or high fructose corn syrup, but still, the less added sugars one consumes, the better (though small amounts are safe). Fortunately, not much is used in foods.

See also DEXTROSE and HIGH-FRUCTOSE CORN SYRUP.



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Hydrogenated Starch Hydrolysate (HSH)

Sugar-free sweetener: Candy, chocolates, chewing gum, baked goods.

HSH is slightly sweet and poorly absorbed by the body. As with most sugar alcohols, eating significant amounts of HSH may cause intestinal gas and diarrhea. It has more calories than most other sugar alcohols: three calories per gram, compared to about 4 for sugar and about 2 for most other sugar alcohols.



Hydrolyzed Vegetable Protein (HVP)

Flavor enhancer: Instant soups, hot dogs, 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.



Inosine Monophosphate (IMP, Disodium Inosinate)

Flavor enhancer: Soups, sauces, seasonings.

IMP and guanosine monophosphate (GMP) are used together to enhance the meaty (umami) flavor of soups and other foods. They are often used together with monosodium glutamate (MSG), because they enhance its potency.



Inter-Esterified Oil

Shortening

With trans fat now being recognized as being the most harmful type of fatty acid of all, companies have sought to find safe substitutes for PARTIALLY HYDROGENATED VEGETABLE OIL, the source of artificial trans fat. One such substitute is inter-esterified oil. The oil is produced by chemically combining a polyunsaturated oil like soybean oil with fully hydrogenated soybean oil. Fully hydrogenated oils do not contain trans fat, but consist largely of saturated fatty acids. That particular type of saturated fat, stearic acid, is relatively innocuous compared to the other common types of saturated fat. By varying the proportions of normal and fully hydrogenated oil, companies can obtain oils that have the desired consistency. Inter-esterified oils are good substitutes for such saturated fats as palm oil, which increases the “bad” cholesterol.



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Inulin

Fiber and fat substitute: Margarine, baked goods, fillings, dairy foods, frozen desserts, salad dressing.

Inulin is a naturally occurring soluble fiber that is found in a variety of plants. It doesn't raise blood sugar levels, so it may help people with diabetes. It also stimulates the growth of beneficial bacteria in the large intestine. However, because it is a purified fiber, it doesn't come with the various vitamins and minerals that accompany the dietary fiber that one gets from whole foods.



Invert Sugar

Sweetener: Candy, soft drinks, many other foods.

Invert sugar, a 50-50 mixture of two sugars, dextrose (glucose) 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.



Isolated soy protein, textured vegetable protein

Nutrient.

Isolated soy protein is simply protein purified from soybeans. Textured vegetable protein (TVP) is soy protein that has been combined with chemical additives and processed into granules, chunks, or strips that resemble meat.



Isomalt

Sugar-free sweetener: Hard candies, chocolates, chewing gum, baked goods.

This slightly sweet ingredient is manufactured from sugar and does not promote tooth decay. Isomalt is poorly absorbed by the body, and thus has only about half the calories of sugar. Chemically, it is a disaccharide sugar-alcohol consisting of glucose and mannitol or sorbitol sub-units. Like many other sugar alcohols, large amounts can cause diarrhea or other GI distress.



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L

**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**

Sugar-free sweetener: Candy, chocolates, baked goods, ice cream, other sugar-free foods.

Lactitol is a sugar alcohol. It is made from lactose (milk sugar). Like most other sugar alcohols, lactitol is not absorbed well by the body (which means it has only about half the calories of sugar), and it does not promote tooth decay. However, large amounts (above 20 to 30 grams) may cause loose stools or diarrhea.

**Lactose**

Nutrient, sweetener: Whipped topping mixes, fortified breakfast pastries.

Lactose, a carbohydrate that is found only in milk, is nature's way of delivering calories to infant mammals. One-sixth as sweet as sugar, it is used as a slightly sweet source of carbohydrate. The intestine secretes an enzyme that splits lactose into its two principal sugars: glucose and galactose. Children suffering from galactosemia, a rare genetic disease, can suffer serious harm by consuming lactose. Far more common is "lactose intolerance," where undigested lactose is metabolized by bacteria, producing gas, bloating, and flatulence. Most Asians and people of black African heritage cannot tolerate as much lactose as Caucasians can after early childhood. Some people are acutely lactose intolerant, but most people with lactose intolerance can safely eat smaller amounts of dairy products or foods with added lactose.

**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.

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M



Magnesium Compounds

Carbonate, Chloride, Hydroxide, Phosphate, Stearate, Sulfate: Anticaking agent, alkali, nutrient, water corrective.

Magnesium is a mineral that is a crucial component of many enzymes in the human body and plays a unique role in muscle contraction. We get about half our magnesium from nuts, beans, whole grains, fruits, and vegetables, but it's also in many other foods. About half of the body's magnesium is stored in bone.



Malic Acid

Acidulant, flavoring: Fruit-flavored drinks, candy, lemon-flavored ice-tea mix, ice cream, preserves.

L-Malic acid is an important metabolite present in all living cells. It is abundant in apples, which is why it is sometimes called "apple acid." The food industry uses malic acid as an acidulant and flavoring agent in fruit-flavored drinks, candy, lemon-flavored ice-tea mix, ice cream, and preserves.

While adults can probably utilize the stereoisomers D-malic acid (the unnatural form), infants may not, so synthetic DL-malic acid should not be added to baby food.



Maltitol

Sugar-free sweetener: Candy, chocolates, jams, other sugar-free foods.

Maltitol, a sugar alcohol, is made by hydrogenating maltose, which is obtained from corn syrup. (Unlike hydrogenated oils, no trans fat forms when maltose is hydrogenated.) Like other sugar alcohols, maltitol is not absorbed well by the body (which means it has only about half as many calories as sugar), and it does not promote tooth decay. However, large amounts (above 20 to 30 grams) may have a laxative effect. It is almost as sweet as sugar.



Maltodextrin

Texturizer in processed foods.

Maltodextrin is 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



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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.

Maltodextrin is usually made from starch from corn, potato, or rice, but is sometimes made from wheat starch. If maltodextrin is made from wheat, food labels will indicate that fact to inform people who are allergic to wheat.



Maltotame

Artificial Sweetener: Diet drinks, snacks.

A blend of neotame and maltodextrin that one company calls maltotame. Some food manufacturers illegally state maltotame in the ingredient lists on their products instead of identifying the actual additives. (Maltodextrin, an ingredient made from corn starch, is safe).

See also Neotame.



Mannitol

Sugar-free sweetener: “Dust” on chewing gum, other sugar-free foods.

Mannitol, like most other sugar alcohols, is not as sweet as sugar, not absorbed well by the body (which means it provides only less than half as many calories per gram as table sugar), and does not promote tooth decay. However, large amounts may have a laxative effect and may 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 warning: “Excess consumption may have a laxative effect.”



Monatin

“Natural” high-potency sweetener

Monatin is not yet used as a food additive, but Cargill, PepsiCo, and other companies see that as a possibility in the future. Like stevia leaf extracts, monatin was first identified in a plant—in this case the root bark of a shrub that grows in South Africa, where the plant has been consumed by people. The substance, which can be synthesized more efficiently in a factory, is about 3,000 times sweeter than sugar and supposedly does not have the unpleasant aftertaste that most current stevia extracts have. Monatin has undergone only rudimentary safety testing.



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Monk Fruit Extract

“Natural” high-potency sweetener: Frozen desserts, soft drinks, packaged sweeteners, other sugar-free foods. Also called monk fruit, Swingle fruit extracts (SGFE), Luo Han Guo, Lo Han Kuo.

This high potency sweetener is about 200 times sweeter than sugar. Like artificial sweeteners and stevia leaf extracts, monk fruit extract can be used to replace some or all of the added sugars in a wide range of foods and beverages. This product has not been well tested in animals. It is derived from a fruit that has been consumed in China for at least several hundred years and used as an herbal medicine for the past several decades, so it may well be safe, although any chronic adverse effects would likely have escaped detection.

Monk fruit extract contains several intensely sweet substances called mogrosides. One company’s purest product contains more than 50 percent mogroside V. Labels may call the ingredient monk fruit, but don’t think you’re getting any whole fruit; manufacturers use a multi-step process to extract mostly the sweet mogrosides.



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 react to large amounts of MSG. Reactions include headache, nausea, weakness, and a burning sensation on the back of the neck and forearms. Some people complain of wheezing, changes in heart rate, and difficulty breathing. Some claim to be sensitive to very small amounts of MSG,



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but no good studies demonstrate that. To protect the public's health, manufacturers and restaurateurs should use less or no MSG. People who believe they are sensitive to MSG should be aware that other ingredients, such as natural flavoring, Torula yeast, and hydrolyzed vegetable protein, also contain glutamate. Also, foods such as Parmesan cheese and tomatoes naturally contain glutamate, 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*), and **can cause serious and even fatal allergic reactions**. 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, Scandinavia, and Australia. Quorn foods have been marketed in the United States since 2002 and in Scandinavia, Australia, and New Zealand more recently. 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. Some people suffer adverse effects the first time they eat Quorn foods, while others suffer adverse effects only after eating the products several times. Many people have gone to emergency rooms for treatment of Quorn-related reactions. In 2013, an 11-year-old boy who had asthma died after eating a Quorn Turk'y Burger.

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 people are allergic or intolerant to Quorn foods, but so far have rejected CSPI's recommendations to bar the use of mycoprotein or require Quorn foods to bear a label warning of possible severe adverse reactions. (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.)

Consumers who believe they have been sickened by Quorn foods **may file an adverse-reaction report** (go to <http://www.cspinet.org/cgi-bin/quorn/quorn.cgi>) with the Center for Science in the Public Interest.



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N



Natamycin (pimaricin)

Antimicrobial: Cheese.

This antimicrobial agent is produced by bacteria and used to prevent mold growth in cheese.



Neotame

Artificial sweetener: "Diet," "no-sugar added," "sugar-free" and other products, including soft drinks, dairy products, frozen desserts, and baked goods.

Neotame (brand name Newtame), produced by NutraSweet Co., is a remarkable 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, and it is handled differently by the body. It likely will be used mostly in low-calorie foods, but may also be used to adjust the flavor of other foods. To compensate for taste flaws, you will probably find neotame mixed with sugar or with other artificial sweeteners. It was approved by the U.S. FDA in 2002 and the European Union in 2010, but is still rarely used.



Niacin (Vitamin B3)

Nutrient: Enriched flour, breakfast cereals, and other fortified foods.

Niacin, or vitamin B3, is safe. Niacin deficiency causes pellagra, which is characterized by mental disturbances and potentially death.



Nisin

Preservative: meat and poultry products, cheese, liquid eggs, salad dressings

Nisin is a short polypeptide (small protein molecule) that is produced by lactic acid bacteria and has anti-bacterial properties. It is unclear how widely this preservative is used.



Nitrous Oxide

Propellant.

Nitrous oxide, also known as laughing gas, is often used as a propellant to drive foods out of pressurized containers.



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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. Finally, isolated fibers don’t contain the micronutrients and phytochemicals that foods with naturally occurring fiber contain.



Olestra (Olean)

Fat substitute: Lay’s Light chips, Pringles Light chips.

Olestra is a synthetic fat that is not absorbed as it passes through the digestive system, so it has no calories. Procter & Gamble, the developer, suggests that replacing regular fat with olestra will help people lose weight and lower the risk of heart disease. Originally envisioned as a replacement for fat in everything from cheese to ice cream, the ingredient is now only used in a couple of brands of snack chips.

Olestra can cause diarrhea and loose stools, abdominal cramps, flatulence, and other adverse effects, sometimes severe. Afflicted consumers can file reports with the Center for Science in the Public Interest at www.cspi.net/olestra.

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, but an occasional serving wouldn’t be a problem. 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 better off with baked snacks, which are 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.



Oligofructose

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



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calories per gram as fructose or other sugar. Oligofructose promotes the growth of “good” bifidus bacteria.



Orange B

See ARTIFICIAL COLORINGS, PAGE 13

P



Pantothenic Acid (And Sodium Pantothenate)

Nutrient.

Pantothenic acid is one of the water-soluble B vitamins. Human deficiencies have never been observed.



Papain

Meat tenderizer.

Papain is a harmless enzyme obtained from papaya that is used to break down tough muscle protein in meat.



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. That finding encouraged a few food manufacturers to begin replacing hydrogenated shortening with less-harmful ingredients. Similarly, the Institute of Medicine 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).



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Beginning in 2006, Nutrition Facts labels have had to list the amount of trans fat in a serving. That spurred many more companies, including Frito-Lay, Kraft, ConAgra, and others, to replace most or all of the partially hydrogenated oil in almost all their products. The substitutes are invariably more healthful, and the total of saturated plus trans fat (which both boost the “bad” LDL cholesterol when replaced by polyunsaturated vegetable oils) is generally no higher than it was before companies switched. Confusing label reading, though, is that foods labeled “0g trans fat” are permitted to contain 0.5g of trans fat per serving, while “no trans fat” means none at all. Consumers need to read labels carefully for another reason: foods labeled “0g trans” or “no trans” may still have large amounts of saturated fat.

Restaurants, which do not provide nutrition information, were 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. By 2016, McDonald’s, Wendy’s, KFC, Taco Bell, Ruby Tuesday, Red Lobster, and other large chains, and most smaller restaurants, eliminated trans fat.

Denmark virtually banned partially hydrogenated oil as of January 1, 2004. Later that year, the Center for Science in the Public Interest petitioned the FDA to 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, Austria, Hungary, Iceland, Norway, and Switzerland adopted Denmark-like restrictions.

In 2013 the FDA responded to CSPI’s petition to revoke the legal status of partially hydrogenated oil (the FDA considered that oil to be “generally recognized as safe,” even though it and everyone else considers it to be “generally recognized as dangerous”) by proposing that that oil be eliminated from the food supply. In 2015 the FDA finally concluded that partially hydrogenated oil was no longer safe and gave the food industry three years to eliminate it from its products. Already the industry has replaced about seven billion pounds of the manufactured oil, and FDA’s action will spur companies to eliminate the remaining billion pounds. Still, the Grocery Manufacturers Association, the industry’s largest trade association, has petitioned the FDA to approve numerous small uses of partially hydrogenated oil.



Pectin (And Sodium Pectinate)

Gelling agent: Jams, jellies.

Pectin is a safe carbohydrate that strengthens cell walls in citrus fruits, apples, beets, carrots, and other fruits and vegetables. Pectin forms gels that are the basis of fruit jellies, and may be used to thicken barbeque sauce, cranberry sauce, canned frosting, and yogurt.



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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; the acidity erodes tooth enamel. 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 reduces levels of the carcinogen acrylamide in French fries, prevents discoloration in potatoes and sugar syrups, and prevents the formation of harmless mineral (struvite) crystals in canned seafood. Sodium phosphates help retain moisture in processed meats and prevent struvite crystals from forming in canned tuna. Most people consume far more phosphorus than they need, which may have adverse effects on kidney, bone, and cardiovascular health, especially for people suffering from kidney disease.



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 might 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, a sugar alcohol. 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.”



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Polyglycerol Polyricinoleate (PGPR)

Emulsifier: Chocolate candy, margarine.

PGPR is one of those mysterious chemicals that manufacturers use in food production. It stabilizes low-fat, high-water margarines and helps the “flow properties” in candy production.



Polysorbate 60, 65, And 80

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. A 2015 study of polysorbate 80 and another emulsifier (carboxymethylcellulose) in mice found that both affected gut bacteria and triggered inflammation and other changes in the gut, as well as obesity and metabolic syndrome. In mice that were predisposed to colitis, the emulsifiers promoted the disease. It is possible that polysorbates and other emulsifiers act like detergents to disrupt the mucous layer that lines the gut, and that the results of this study may apply to other emulsifiers as well. Research needs to be done to determine long-term effects of these and other emulsifiers at levels that people consume.



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. (Calcium bromate, which likely is toxicologically similar to potassium bromate, occasionally may be used.)



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Potassium Chloride

Salt substitute.

Potassium chloride, also called potassium salt, is used in some foods as a means of lowering sodium levels. The typical American diet contains too much sodium, increasing the risk of high blood pressure, heart disease, and strokes.

More and more people are filling their salt shakers with potassium chloride or with “lite salts” that are half potassium chloride and half sodium chloride. The amount of potassium chloride used in foods is almost self-limiting, because most people perceive excessive amounts of potassium chloride to taste extremely bitter.

Potassium chloride is not just safe, but positively healthful. However, people with kidney disease and certain heart conditions need to talk to their doctors about avoiding large amounts.



POTASSIUM IODATE

Dough strengthener: Bread, rolls.

Potassium iodate is sometimes used as a dough strengthener in bread and rolls. Some bakers may switch to this ingredient when they stop using its chemical cousin potassium bromate, which poses a small cancer risk. However, potassium iodate, too, is not well tested and may also pose a slight cancer risk. It conceivably could lead to excessive iodine intake.

Potassium iodate is a source of iodine, an essential trace element, necessary for the body to make thyroid hormones. That’s the good news. But too little or too much iodine can be harmful. A committee of the World Health Organization concluded that use of potassium iodate as a flour treatment agent was unacceptable because it could result in an excessive intake of iodine. At the same time, the committee endorsed the use of potassium iodate to fortify salt, since use in salt results in a lower intake of iodine than widespread use in bread and rolls and is used to prevent iodine deficiency disorders such as goiter and mental retardation, to name a few.

In the United States, potassium iodide, not potassium iodate, is used in iodized salt, but in other countries, especially tropical countries, potassium iodate is favored because it is more stable in warm, humid conditions. Iodized salt has virtually eliminated iodine deficiency in the United States, Canada, and several other countries.

Some people, such as those with thyroid disease, are especially sensitive to iodine intake and should make a special effort to avoid potassium iodate in bread and rolls. One other possible concern is that iodate breaks down in dough and in the body to form iodide. In a study conducted by Japanese government scientists, high doses of



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potassium iodide caused cancer in rats, suggesting it may be a weak carcinogen. The same research found that it also increased the potency of a known carcinogen.

As a sidelight, both potassium iodate and potassium iodide can also be used to prevent damage to the thyroid in the event of an accident at a nuclear reactor, although the iodide form is generally recommended.

Bottom line: Potassium iodate is not widely used in baked goods, and any risk is small. Still, it may be worth choosing baked goods without this ill-tested additive, and bakers should stop using it.



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 together with two other antioxidants, BHA and BHT, because of the synergistic effects those preservatives have with one another. The best safety studies, which were published by the U.S. government, yielded unusual results. Propyl gallate appeared to cause more cancers (in several organs) in rats treated with a low dose than with either a zero dose (the controls) or a high dose. That finding (and others) suggest it may be an "endocrine disruptor," as well as a carcinogen. This additive needs to be better studied.



Propylene Glycol

Maintains moisture, thickener, emulsifier, antioxidant, anticaking agent: ice cream, cake mixes, creamers, frozen meals, frosting, baked goods, snacks, candy, nuts, pickles, dressings, condiments.

Propylene glycol is used in a wide range of food products, often to maintain moisture, as well as thicken, emulsify, and preserve foods. It can also lower the freezing point of water, like its more toxic chemical cousin, ethylene glycol, used in anti-freeze. Some people are allergic to propylene glycol in foods, as well as in personal care products and topical cortisone creams, and should avoid it.



Pyridoxine (Vitamin B6)

Nutrient: Breakfast cereals, instant breakfasts, health-food bars.

Pyridoxine, or vitamin B6, serves a variety of functions in the body and performs a central role in amino acid metabolism. Wheat germ, brown rice, and yeast are rich sources of pyridoxine. It is safe.



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Q



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. In 1994, the U.S. Food and Drug Administration banned quinine from over-the-counter drugs used to treat leg cramps, saying it was not safe and effective for that use. Then in 2006 FDA ordered companies to stop marketing unapproved products containing quinine. And in 2010 and 2012 FDA warned against using the only approved quinine-containing anti-malaria drug for any purpose other than to treat malaria. The higher levels used in drugs are more likely to cause adverse reactions than the low levels used in food, but to be on the safe side, pregnant women and the elderly should avoid quinine-containing beverages.



Quorn

See MYCOPROTEIN, PAGE 42

The Center for Science in the Public Interest has received well over 2,000 reports of adverse reactions. If you have experienced a reaction to Quorn foods, please report it at www.cspi.net/quorn.

R



Riboflavin (Vitamin B2)

Nutrient: Enriched flour, breakfast cereals, and other vitamin-fortified foods.

Riboflavin is simply vitamin B2. Riboflavin plays a crucial role in activating numerous enzymes. It is safe.



Red 3

See ARTIFICIAL COLORINGS, PAGE 13



Red 40

See ARTIFICIAL COLORINGS, PAGE 13



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S

**Saccharin**

Artificial sweetener: "Diet," "no-sugar-added," "sugar-free" soft drinks and packaged (tabletop) sweeteners.

Saccharin (one brand is Sweet 'N Low) is about 350 times sweeter than sugar and is used in diet foods and as a packaged (tabletop) sugar substitute. Saccharin is the original artificial sweetener, having been discovered accidentally in 1879 at Johns Hopkins University. Many studies on rodents have shown that saccharin can cause cancer of the urinary bladder, especially in males. In some animal studies, saccharin also caused cancer of the uterus, ovaries, skin, blood vessels, and other organs. Additional studies have shown that saccharin increases the potency of other cancer-causing chemicals. And the best epidemiology (human) study, which was conducted by the National Cancer Institute, found that the use of artificial sweeteners (saccharin and cyclamate) was associated with a higher incidence of bladder cancer. That said, other animal and human studies did not identify a cancer risk.

In 1977, the FDA proposed that saccharin be banned because of the studies showing that it causes cancer in animals. However, Congress intervened and permitted it to be used, provided that foods carried a warning notice. 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 large amounts of saccharin cause bladder cancer in male rats, but argues that those tumors are caused by a mechanism that would not occur in humans. Some public health experts respond by stating that, even if that still-unproved mechanism was 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.

Saccharin has been replaced in almost all foods by aspartame and other better-tasting sweeteners. Coca-Cola Company's Tab, one of the first diet sodas, still contains saccharin, but now also contains aspartame. In 2014, Health Canada lifted its decades-long ban on saccharin in foods, allowing it to be added to some beverages, canned fruits, frozen desserts, and other foods. Saccharin passes into the breast milk of nursing mothers.

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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 a desirable texture or other property.

A diet high in sodium increases blood pressure in most people, thereby increasing the risk of heart attack and stroke. Hypertension experts and epidemiologists have estimated that cutting sodium in packaged and restaurant foods by half would save as many as 100,000 deaths per year. Everyone should avoid salty processed foods and restaurant meals, use salt sparingly in cooking and at the table, and enjoy other seasonings. Potassium chloride—either from natural foods or a shaker—helps counteract the adverse effects of high-sodium diets.



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The Food and Drug Administration (FDA) 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. Then in 2010 the Institute of Medicine concluded that voluntary efforts over the previous 40 years to reduce sodium were worthless and that the FDA should phase in mandatory restrictions. As a result of a lawsuit filed by CSPI, in mid-2016 the FDA may propose voluntary targets for sodium in various categories of food.

In response to the scientific evidence and public pressure, numerous major companies like General Mills, Sara Lee, Walmart, and McDonald’s have begun making moderate reductions in sodium. As a result, sodium consumption from packaged foods has declined by about 15 percent since 2010, but sodium levels in most restaurant foods have barely changed. That’s important progress that should save thousands of lives each year.

Indeed, major companies like General Mills and McDonald’s have begun making moderate reductions. As a result, sodium consumption from packaged goods has declined by another 15 percent since 2010, but sodium levels in most restaurant foods have barely changed. Meanwhile, the British government 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 cut salt (or other sodium-containing ingredients) to the levels used by competitors and still have perfectly marketable products.



Sea Salt (Sodium Chloride)

Flavoring, preservative: Seasoning, soup, snack chips, crackers, and other processed foods.

Sea salt is obtained from the evaporation of sea water, unlike most table salt, which is mined from salt deposits, and then further processed to remove impurities. Many sea salts have slightly different flavors than regular salt—due to their slightly different mineral content—but the typical variety used in processed foods does not.

Sales of sea salt and sea-salted products are booming, and marketers would have you believe sea salt is a healthier, more natural form of salt. Although a majority of people surveyed by the American Heart Association believed sea salt was a lower-sodium alternative to table salt, sea salt has just as much sodium as table salt. (You



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can find lower-sodium sea salt and other salts; these are made by mixing the salt (sodium chloride) with potassium chloride and other ingredients.) The trace amounts of magnesium, potassium, calcium, and other minerals in sea salt are so minor as to be insignificant to health. However, some sea salts, as well as kosher salt (which sometimes is from the sea), have larger crystal sizes with irregular shapes so they do not pack as tightly as table salt and therefore they have less sodium per teaspoon.

Most people should consume less salt (be it regular or sea salt), because diets high in sodium increase blood pressure and the risk of heart attacks, strokes, and kidney disease.

See SALT (Sodium Chloride) and POTASSIUM CHLORIDE



Silicon Dioxide, Silica, Calcium Silicate

Anti-caking agent: salt, soups, coffee creamer, and other dry, powdery foods.

This chemical is just sand. Silicon dioxide occurs naturally in foods, especially foods derived from plants. Breathed in, silica dust can cause lung disease, even cancer. For use in food, it is finely ground and added to salt and other foods to help powders flow more easily. Aluminium calcium silicate and tricalcium silicate are also used in foods, and calcium silicate is used in some dietary supplements.



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 and they appear to be safe for most people, though they cause hives, asthma, or other allergic reactions in sensitive individuals.

Another problem occurs when sodium benzoate is used in beverages that also contain ascorbic acid (vitamin C) or erythorbic acid (also known as d-ascorbic acid). 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 urged companies not to use benzoate in products that also contain ascorbic acid, but in the early 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 United States to reformulate affected beverages, typically fruit-flavored products.



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Sodium Carboxymethyl Cellulose (CMC)

See CARBOXYMETHYL CELLULOSE, PAGE 24



Sodium Diacetate

Preservative, acidulant, flavor: baked goods, snack foods, fats and oils, meat products, candy, gravies, sauces, soups, soup mixes.

A salt of ACETIC ACID, the main ingredient (other than water) of vinegar. It has a vinegar flavor and can prevent the growth of mold and bacteria.



Sodium Erythorbate, Erythorbic Acid, Sodium Isoascorbate

Antioxidant, color retainer: Processed meat, beverages, baked goods, potato salad.

Chemically, sodium erythorbate is a stereoisomer of vitamin C (ascorbic acid), but it itself has no nutritional value. (Stereoisomers have the same atoms linked in an identical manner, but differ only in their spatial arrangement.) It is used most commonly in processed meats, where it retards nitrosamine (a carcinogen) formation and color fading.



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. In 2015 the International Agency for Research on Cancer, part of the World Health Organization, concluded that processed meat is carcinogenic to humans. In 2016 CSPI petitioned the USDA to require a warning label on packages of bacon, ham, hot dogs, and other processed meat products to inform consumers that eating those foods can increase the risk of colorectal cancer. All consumers, including in particular pregnant women, would be



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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.

The labels on some "natural" hot dogs and other cured meats brag about "no added nitrite." Be skeptical. While those products may not contain added sodium nitrite, they sometimes are made with celery powder or celery juice, which are naturally high in nitrite. Indeed in 2011 The New York Times revealed that the "natural" cured meats could have 10 times as much nitrite as conventional products. The bottom line: nitrite aside, those "no added nitrites" products typically are high in salt and sometimes saturated fat, so they'd be worth eating only occasionally or avoiding entirely.



Sodium Stearoyl Fumarate, Sodium Stearoyl Lactylate

See CALCIUM (or SODIUM) STEAROYL FUMARATE, CALCIUM (or SODIUM) STEAROYL LACTYLATE, PAGE 23



Sorbic Acid, Potassium Sorbate

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

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



Sorbitan Monostearate

Emulsifier: Cakes, candy, frozen pudding, icing.

Like mono- and diglycerides and polysorbates, sorbitan monostearate 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

Sugar-free sweetener, thickening agent, maintains moisture: Frozen desserts, candy, shredded coconut, chewing gum, other sugar-free foods.

Sorbitol, a sugar alcohol and close relative of sugar, occurs naturally in fruits and berries. It is half as sweet as sugar and does not cause tooth decay. Moderate amounts of



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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 that problem by reacting starch with various chemicals to create MODIFIED STARCHES (see next entry).

Starch made from breeds of high-amylose corn is relatively resistant to digestion. That “resistant starch” has some of the same benefits of naturally occurring dietary fiber.

Starch is made up of two different kinds of large carbohydrate molecules. Amylose is insoluble carbohydrate made up of long chains of glucose molecules. Amylopectin is a large, water-soluble, branched-chain polysaccharide.



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. The starches were eliminated when the Center for Science in the Public Interest charged that some baby foods contained only about 30 percent food (such as strained bananas), with the rest being water, modified starch, and sugar.



Stearic Acid

Antioxidant, chewing gum base, flavoring, anti-caking agent (calcium stearate).

Stearic acid is a fatty acid that occurs in virtually all fats. Though it is a saturated fat, it does not appear to affect blood cholesterol levels. The trivial amounts used as an additive are harmless.



Stevia Leaf Extract (Rebiana)

“Natural” high-potency sweetener: “Diet,” “no-sugar,” “sugar-free” and other products, including beverages, packaged sweeteners, and various foods. Also called by the names of the individual sweet substances (steviol glycosides) that



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can be extracted from the stevia leaf, including rebiana (also called rebaudioside A or reb A), reb D, reb F, reb M (same as reb X), stevioside; sold under such brand names as Truvia, Pure Via, and Sweet Leaf.

Stevia rebaudiana is a shrub (yerba dulce) that traditionally grew in Brazil, Paraguay, and even parts of Arizona. It is now grown commercially in California, China, southeast Asia, and elsewhere. Stevia leaves, which are about 30 times as sweet as sugar, contain sweet substances called steviol glycosides, which are 200–300 times sweeter than sugar. Among the sweetest ones are rebaudioside A, also called reb A or rebiana, and stevioside.

The food industry and many consumers who are trying to avoid sugar and artificial sweeteners have high hopes for stevia leaf extracts. Crude stevia leaf extracts have long been used as a sweetener in Japan and several other countries. One flaw, though, is that many people perceive stevia leaf and its sweet derivatives to have an unpleasant aftertaste. Companies are racing to develop better-tasting extracts, which have been dubbed rebaudioside D, F, M, X, “enzymatically modified steviol glycosides,” and others. Companies are also seeking to mask the aftertaste of rebiana with various ingredients, including ERYTHRITOL, substances that block some of the bitterness receptors in taste buds, or modest amounts of sugar.

In the 1990s, the FDA (and Canada and the European Union) rejected whole-leaf stevia and crude stevia extracts for use as a food ingredient. High dosages fed to rats reduced sperm production and increased cell proliferation in their testicles, which, at least at those dosages, could cause infertility or other problems. FDA also was concerned that stevia might interfere with the absorption of carbohydrates and the conversion of food into energy within cells, as well as with effects on kidney function and the cardiovascular system.

In the early 2000s, Cargill and Merisant (a marketer of sugar substitutes) developed highly purified extracts of stevia that are 95 percent pure rebaudioside A and 200 times as sweet as sugar. Since then, other companies have also developed highly purified extracts of stevia, some containing rebaudioside A, some containing stevioside, and some containing a combination of those or related substances. Truvia and Pure Via are the brand names for packaged or tabletop sweeteners containing rebiana, and SweetLeaf is the brand name of a packaged sweeteners containing both rebiana and stevioside. Like other packaged sugar substitutes, packets of those products contain mostly a carrier ingredient, since the tiny bits of sweetener would otherwise get lost in the packets. Thus, Truvia packets are mostly erythritol, Pure Via mostly dextrose and cellulose powder, and SweetLeaf mostly inulin.

The one nagging concern (other than taste) about stevia leaf extracts is that they have not been adequately tested for cancer. Several (but not most) genotoxicity tests found that some stevia-related substances caused mutations and other changes to DNA or chromosomes. Because such findings may indicate a cancer risk, FDA should have required additional cancer studies in animals. Testing guidelines for



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widely used food additives generally call for two-year feeding studies in both rats and mice, but both studies of a stevia leaf extract (stevioside) were in rats.

Despite the incomplete testing, in late 2008 the FDA did not object to rebaudioside A as “generally recognized as safe” (GRAS) and since then has raised no objections to extracts containing stevioside and other steviol glycosides (rebaudiosides D, F, M) as GRAS. Companies quickly started marketing a wide range of lower-calorie products sweetened with stevia leaf extracts, replacing some or all of the sugar or other high-potency sweeteners. Eventually, substances derived from stevia leaf—and possibly other natural non-caloric sweeteners might play an important role in reducing the harm caused by artificial sweeteners like ASPARTAME and the huge amounts of SUGAR and HIGH-FRUCTOSE CORN SYRUP that so many people are consuming.



Sucralose

Artificial sweetener: “No sugar added,” “sugar-free,” “diet” and other products, including baked goods, kettle corn, frozen desserts, ice cream, soft drinks, prepared meals, packaged (tabletop) sweeteners (Splenda).

Approved in the United States in 1998, sucralose—sometimes marketed as Splenda—is used in soft drinks, baked goods, ice cream, and other products, including ones you might not expect, such as frozen dinners and English muffins. It is widely used around the world. Unlike aspartame, sucralose does not break down at high temperatures and so can be used in baked goods.

In 2016 an independent Italian laboratory published a large study on mice. The study found that sucralose caused leukemia and related blood cancers in male mice that were exposed to it throughout their lives starting from before birth. The study is superior to previous industry-sponsored studies that did not find a link with cancer, since those tested fewer animals, started exposing the animals much later, and terminated the study earlier. In addition, treated animals in the industry-sponsored studies had significantly decreased body weight compared to controls, which can decrease cancer rates. This Italian lab is the same one that several years earlier published studies that found that aspartame caused cancers in rats and mice.

When sucralose was first being considered for approval by the FDA, CSPI 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.

Several researchers contend that sucralose negatively impacts the gut, including changes in the microbiome and enzymes. That could have a range of consequences, including effects on blood sugar, regulation of body weight, inflammatory bowel disease, and how drugs and other chemicals are absorbed and metabolized by the body. For example, a 2008 study (funded by the sugar industry) reported that Splenda significantly



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reduced beneficial bacteria and had other effects in the gastrointestinal tract of rats that could affect the bioavailability of drugs. Unfortunately, the study was small and had other significant shortcomings. A 2012 study found a close correlation between the use of sucralose and saccharin and changes in the incidence of inflammatory bowel disease (IBD) in different regions around the world. However, finding a correlation is a long way from demonstrating a cause–effect relationship. Meanwhile, people experiencing IBD or other GI symptoms could see if avoiding sucralose provides any relief.

Even setting aside these concerns, young children could exceed the FDA’s “acceptable daily intake” for sucralose (5 mg/kg), especially given sucralose’s popularity (more products containing sugar substitutes use sucralose than any other sweetener). For example, a 6-year old child weighing 45 pounds would exceed the FDA limit by drinking two or three 12-ounce sodas containing the typical 40-60 mg of sucralose per can. In addition, sucralose passes into breast milk at levels high enough to make the milk sweeter.

A final point: 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. (The mere fact that sucralose is synthetic does not make it unsafe.) The lawsuit was settled without any announcement of the terms, but McNeil has dropped that “made from sugar” slogan.



Sucrose Acetate Isobutyrate (SAIB)

Emulsifier: Citrus-flavored beverages, including “energy,” “sport,” and “electrolyte” drinks, as well as such alcoholic beverages as wine coolers, malt beverage coolers, and premixed cocktail products.

Sucrose acetate isobutyrate (SAIB), like brominated vegetable oil, is used primarily in citrus-flavored drinks to keep the flavor oils in suspension, giving them a cloudy appearance. In January 2013 it was announced as a replacement for brominated vegetable oil (BVO) in Gatorade, following widespread consumer protest over BVO.

FDA has approved its use in non-alcoholic and alcoholic beverages up to 300 ppm. SAIB has been subjected to short- and long-term studies in laboratory animals and people, at high doses, with little, if any, evidence of harm. It is also approved for use in Europe.



Sugar (Sucrose)

Sweetener: Table sugar, sweetened foods.

Sucrose, ordinary table sugar, occurs naturally in fruit, sugar cane, and sugar beets. Industry produced 68 pounds of sugar per person in 2013. That figure was down from 102 pounds per year in 1970, but the decrease has been more than made up



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for by increased use of high-fructose corn syrup and dextrose. In 2013, industry produced a total of about 128 pounds of total refined sugars per person, though because of waste and spoilage the average American actually consumed only about 76 pounds of all refined sugars (about 1.5 pounds per week). That represents a 15-percent reduction from the 1999 high of 89 pounds. That historic decline resulted largely from declining soft drink consumption (due partly to increased health concerns and to the popularity of bottled water).

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 13 percent of the average diet, but provide no vitamins, minerals, or protein. That means a person would have to get 100 percent of his or her nutrients from only 87 percent of his or her food. And, of course, some people, especially teen-aged boys, consume as much as 25 percent of their calories from refined sugars.

When sugar is digested, it breaks down into one fructose and one glucose (dextrose) molecule. Small amounts of fructose and glucose from fruits, vegetables, sugar, HFCS, or other sources are safe. However, large amounts of refined sugars promote tooth decay and displace nutrient-rich foods with empty calories. Furthermore, large amounts of glucose boost blood sugar levels and large amounts of fructose increase triglyceride (fat) levels and small, dense LDL (“bad”) cholesterol levels in blood, and may thereby increase the risk of heart disease. Also, recent studies show that consuming 25 percent of calories from fructose or HFCS (which is about half fructose) leads to more visceral (deep belly) fat or liver fat. Those changes may increase the risk of diabetes and heart disease. Finally, preliminary research suggests that large amounts of fructose may upset levels of such hormones as leptin and ghrelin, which regulate appetite, thereby contributing to weight gain and obesity.

The Dietary Guidelines for Americans (America’s basic nutrition policy) recommends that people consume no more than about 10 percent of calories (12 teaspoons in a 2,000-calorie diet) in the form of refined sugars. The American Heart Association has a stricter recommendation: six teaspoons of refined sugars per day for women and nine teaspoons for men. That’s far less than the current average of 13 percent of calories. The bottom line: the less added sugars—fructose, glucose, sucrose, or HFCS—one consumes the better (though small amounts are safe).

Some companies have been replacing high-fructose corn syrup with sugar, pretending that that makes their products more healthful. In fact, there’s essentially no nutritional difference between sugar and high-fructose corn syrup, so just ignore the marketing hype.



Sulfites (Sulfur Dioxide, Sodium Bisulfite,



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Sodium Metabisulfite)

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 B1 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.

T



Tagatose

Sugar substitute: breakfast cereals, cereal bars, diet and non-diet soft drinks, jelly, pudding, meal replacement drink mix, coffee mix powder, candy, chewing gum.

This relatively new additive is the mirror image of 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. It is 92 percent as sweet as sugar. It is found at low levels in apples, oranges, raisins, heated cow’s milk, and other foods.



Tartaric Acid, Potassium Acid Tartrate, Sodium Potassium Tartrate, Sodium Tartrate

Antioxidant: Beverages, candy, ice cream, baked goods, yogurt, gelatin desserts, baking powder.

Tartaric acid occurs naturally in grapes, other fruits, and coffee beans. It has an extremely tart, acidic taste, which is useful in some foods. Most of the tartaric acid we ingest is digested by bacteria in the intestines. The 20 percent that is absorbed is rapidly excreted in the urine.



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When tartaric acid is partially neutralized with potassium hydroxide, the result is potassium acid tartrate, or cream of tartar. That ingredient is used in baking powder and to stabilize egg whites.



Taurine

Pretend benefits: Energy drinks.

Taurine occurs naturally in shellfish, other seafood, and meat. Companies add large amounts to energy drinks because it's supposedly energizing, but no credible evidence exists for that claim.



TBHQ (Tert-Butylhydroquinone)

Antioxidant: vegetable oil, snack foods, cereals, other fat-containing foods.

This preservative prevents rancidity. It is sometimes used along with similar preservatives, including BHA, BHT, and propyl gallate, with which it has a synergistic effect. (TBHQ is chemically related to BHA and forms when BHA is metabolized by the body.) One benefit of TBHQ over those other preservatives is that it does not cause discoloration in the presence of iron.

In a government study which used a better design than other similar studies, TBHQ increased the incidence of tumors in rats.



Thaumatococin

Natural high-potency sweetener: used as a flavor modifier in a variety of foods and beverages.

This sweetener, which has the brand name Talin, consists of a couple of proteins extracted from the katemfe fruit grown in West Africa. It is about 2,000 times sweeter than sugar. Although approved as a sweetener in Europe, Australia/New Zealand, Canada, Mexico, and a number of other countries, you won't find it at the store or listed on food labels in the United States. That's because it has not been approved as a sweetener in the United States, although it has been designated "generally recognized as safe" (GRAS) as a flavor modifier. Like rebiana and mogrosides, other natural, high-potency sweeteners, it is said to have a "licorice-like" aftertaste, which consumers may find distasteful and might be the reason it is rarely used. As a protein it is presumably safe, but might cause occasional allergic reactions.



Thiamin Mononitrate (Vitamin B1)



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



Torula Yeast

Natural flavoring and flavor enhancer: snack foods, crackers, dips, seasoning blends, processed meats, soups and bouillons, gravies and sauces, salad dressings, rice and pasta dishes.

Torula yeast can be grown on wood sugars obtained as a byproduct of paper production, as well as other sources of sugar. It is inactivated and then used as a flavoring or taste enhancer, thanks to its monosodium glutamate (MSG) content and umami taste. People who believe they are sensitive to MSG might try to avoid foods containing Torula, but there have not been any studies testing Torula for MSG-type reactions. On food labels, Torula yeast may be listed by name or hidden under the term “natural flavorings.”

When Germany experienced food shortages in World War I, Torula yeast was used as a protein-rich food source.



Triacetin (Glycerol Triacetate)

Wetting agent: Beverages.

This 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, PAGE 45



Transglutaminase (“Meat Glue”)

Enzyme to bind proteins: Beef, poultry dairy, seafood, and other protein-rich products.

You’ll never see this ingredient listed on food labels, because it appears to be used primarily by restaurant chefs. Transglutaminase’s marketer (Ajinomoto) calls it “a revolutionary new way to improve existing food products or allow ‘out of the box’ thinking in making new food products.” What it does is enable a chef to “glue” together a bunch of scraps of meat and sell it as a steak, bind bacon to meat, improve the texture of cheese, and do other tricks. Transglutaminase is a naturally occurring enzyme that is presumably safe, but used to deceive consumers. Also, binding two pieces of food together puts into the protected center of meat or seafood any bacteria that were on the outside and, hence, easily killed in cooking. Inside the food, bacteria are protected from heat and could multiply and cause illnesses when consumed. It is for that reason that this ingredient is a potential safety risk.



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V

**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.

**Vegetable Oil Stanols And Sterols**

See PHYTOSTEROLS AND PHYTOSTANOLS, PAGE 47

**Vitamin D (D3)**

Nutrient: Fortified milk.

Vitamin D is an essential nutrient that is produced in the skin by sunlight and that occurs naturally in such animal foods as fatty fish, eggs, butter, and liver. Recent research indicates, but has not yet proven, that the great majority of people are not getting enough vitamin D from sunlight or consuming enough in the form of foods or dietary supplements (look for vitamin D3). Increasing vitamin D consumption might reduce the risks of colon cancer, high blood pressure, and heart disease. Though the official recommended intake of D is 400 IU per day, shoot for closer to 1,000. (Talk to your doctor about any special concerns related to your specific health situation.)

X

**Xylitol****Safe**

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**Cut Back**

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**Avoid**

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Sugar-free sweetener: Chewing gum, packaged sweeteners, other sugar-free foods.

The sweetest of the sugar alcohols, xylitol is about as sweet as sugar. Like most other sugar alcohols, xylitol is not well absorbed by the body, so it has fewer calories than table sugar (although slightly more than most other sugar alcohols). It does not promote tooth decay. Large amounts may have a laxative effect, leading to diarrhea.

While xylitol is harmless to humans, even small amounts (such as in several sticks of chewing gum) can kill dogs. Dogs quickly absorb xylitol into their bloodstream, which may trigger a potent release of insulin from the pancreas. The insulin, in turn, may cause a rapid, steep decrease in blood sugar (hypoglycemia), an effect that can occur within 10 to 60 minutes. Untreated, that can quickly be life-threatening. Xylitol also causes fatal liver disease in dogs.

Y



Yellow 5

See ARTIFICIAL COLORINGS, PAGE 13



Yellow 6

See ARTIFICIAL COLORINGS, PAGE 14



Yellow Prussiate Of Soda

Anticaking agent: Salt.

Some salt manufacturers add yellow prussiate of soda (sodium ferrocyanide) to salt when they crystallize it. The additive generates jagged and bulky crystals which resist caking. That mitigates the need for extra anticaking agents. Although this additive contains cyanide, it is not toxic because the cyanide is tightly bound to iron atoms.



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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 because of known risks or inadequate testing. 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.

ARTIFICIAL COLORINGS	FUNCTION	SOURCE	YEAR BANNED	PROBLEM
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 (<i>ban never finalized</i>)	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 (<i>it had been used to stamp the Department of Agriculture's inspection mark on beef carcasses</i>).
Yellow 1 & 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.
OTHER ADDITIVES	FUNCTION	SOURCE	YEAR BANNED	PROBLEM
agene (<i>nitrogen trichloride</i>)	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.
cinnamyl anthranilate	artificial flavoring	synthetic	1982	Liver cancer
cobalt salts	stabilize beer foam	synthetic	1966	Toxic effects on heart
coumarin	flavoring	tonka bean	1970	Liver poison
cyclamate	artificial sweetener	synthetic	1969	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 (<i>p-ethoxy-phenylurea</i>)	artificial sweetener	synthetic	1950	Liver cancer
ethylene glycol	solvent	synthetic	1998	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

More Loophole Than Law: The Food Additives Testing and Approval Process

Although consumers likely presume that a federal agency ensures the safety of ingredients in the food supply, in reality, this isn't the case.

First, many additives have not been thoroughly tested. And the vast majority of safety testing of food additives is done by manufacturers (or by people hired by them), not the government or independent laboratories. Second, because of a loophole in the law, companies can declare on their own that an additive is "Generally Recognized As Safe" (GRAS), and start adding it to food without even informing the government. Such ingredients are required to be listed on labels although in some cases they appear simply as "artificial flavorings."

Some additives do undergo a more formal government approval process, but even that is no guarantee of safety. There are approved additives that have been shown in subsequent independent studies to harm health, and are in the "Avoid" category in Chemical Cuisine. But the FDA rarely reviews the safety of additives (including GRAS substances) once they enter the food supply.

A Word about Cancer Testing

Chemicals usually are tested for their ability to cause cancer by feeding large dosages to rats and mice. Large dosages are used to compensate for the small number of animals 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, 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 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 study using low dosages and a small number of animals would be extraordinarily insensitive. It would also be nice if test-tube studies or computer models not using any animals could cheaply and accurately identify cancer-causing chemicals. While some progress has been made in that direction, current methods have not yet 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. Ideally, faster, cheaper, more reliable tests that don't involve animals will be developed in the next few years.

The Delaney Clause is an important part of the federal Food, Drug, and Cosmetic Act. It bans any additive "found to induce cancer when ingested by man or animal." The food and chemical industries have tried, but so far failed, to weaken or repeal that law, and the Food and Drug Administration rarely invokes it.

Glossary

ACIDULANTS are used to make foods more acidic for reasons of taste, preservation, or other purpose.

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 water, thereby making food thicker. They “stabilize” factory-made foods by keeping the complex mixtures of oils, water, acids, and solids well mixed.

EAT HEALTHY. STAY HEALTHY.



VEGGIE NICE! VEGETARIAN & VEGAN MAIN DISHES FROM THE HEALTHY COOK
NEW. Trying to eat more plant-based meals? Never know what to make for vegetarian dinner guests? *Veggie Nice* gives you more than a month's worth of meatless main dishes. Try the Yellow Split Pea & Spinach Stew. Or the Pepper, Onion, & Sweet Potato Frittata. All are from the kitchen of Healthy Cook Kate Sherwood. That means they're good for you...and their flavor will knock your socks off. (48 pages)



HEALTHY FOODS: YOUR GUIDE TO THE BEST BASIC FOODS
Which vegetables deliver the most potassium? Is the chicken thigh leaner than the drumstick? How can you tell when a papaya is at its peak? Discover how to make your food choices wiser with this practical guide to the best basic foods in the grocery store. (21 pages)



121 GOOD-EATING TIPS
Whether you're a seasoned cook or a kitchen novice, you'll find loads of helpful tips in this collection of food-prep secrets, safe-food-handling suggestions, recipes for quick and healthy sides, snacks, soups, dips, shakes, and desserts, and more. (21 pages)



FROM SUPERMARKET TO LEFTOVERS: A CONSUMER'S GUIDE TO BUYING, PREPARING, COOKING, AND STORING FOOD SAFELY
Buy your fish just before leaving the supermarket. Hard cheeses like cheddar and parmesan are much less likely to make you sick than soft cheeses like Brie and Camembert. Store your eggs on a refrigerator shelf, not in the door. Learn the 2-2-4 Rule for leftovers. If it has to do with shopping for, cooking, or storing food safely, you'll find it in this definitive guide. (91 pages)



FAST & FRESH SALADS
You've never eaten salads this good...and this good for you. The 10 quick and easy salad dressings alone are worth the price of admission. Each recipe was developed and taste-tested in the test kitchen of *Nutrition Action Healthletter*. (30 pages)



FOR WOMEN ONLY
NEW. The signs of a heart attack or a stroke are different in women than in men. Women have a higher risk of osteoporosis and, of course, breast cancer. And they're more likely to suffer from constipation and muscle loss. Here's what women need to know to stay strong and healthy. (62 pages)



FAST & FRESH MAIN COURSES
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FROM THE HEART: HEART-HEALTHY DISHES FROM THE HEALTHY COOK
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