

### Food Additives








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

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

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

### Additives (Listed Alphabetically)

-  **SAFE.** The additive appears to be safe.
-  **CUT BACK.** Not toxic, but large amounts may be unsafe or promote bad nutrition.
-  **CAUTION.** May pose a risk and needs to be better tested. Try to avoid.
-  **CERTAIN PEOPLE SHOULD AVOID.**
-  **AVOID.** Unsafe in amounts consumed or is very poorly tested and *not worth any risk*.

### KEY

**ACESULFAME-K**

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

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

**ALGINATE, PROPYLENE GLYCOL ALGINATE**

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

**ALPHA TOCOPHEROL (Vitamin E)**

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

**ARTIFICIAL COLORINGS**

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

**ARTIFICIAL COLORINGS: BLUE 1**

Beverages, candy, baked goods. Inadequately tested; suggestions of a small cancer risk.

**ARTIFICIAL COLORINGS: BLUE 2**

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

**ARTIFICIAL COLORINGS: CITRUS RED 2**

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

**ARTIFICIAL COLORINGS: GREEN 3**

Candy, beverages. A 1981 industry-sponsored study gave hints of bladder cancer, but FDA re-analyzed the data using other statistical tests and concluded that the dye was safe. Fortunately,

this possibly carcinogenic dye is rarely used.



**ARTIFICIAL COLORINGS: RED 3**

Cherries in fruit cocktail, candy, baked goods.

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



**ARTIFICIAL COLORINGS: RED 40**

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

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



**ARTIFICIAL COLORINGS: YELLOW 5**

Gelatin dessert, candy, pet food, baked goods.

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



**ARTIFICIAL COLORINGS: YELLOW 6**

Beverages, sausage, baked goods, candy, gelatin.

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



**ARTIFICIAL AND NATURAL FLAVORING**

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

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



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

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

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



**ASPARTAME**

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

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

A 1970s study suggested that aspartame caused brain tumors in rats. However, the Food and Drug Administration persuaded an independent review panel to reverse its conclusion that aspartame was unsafe. The California Environmental Protection Agency and others have urged that independent scientists conduct new animal studies to resolve the cancer

question. In 2005, researchers at the Ramazzini Foundation in Bologna, Italy, conducted the first such study. It indicated that rats first exposed to aspartame at eight weeks of age caused lymphomas and leukemias in females. However, the European Food Safety Authority reviewed the study and concluded that the tumors probably occurred just by chance.

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

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

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



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



#### **BETA-CAROTENE**

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

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



#### **BROMINATED VEGETABLE OIL (BVO)**

Emulsifier, clouding agent: Soft drinks.

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



#### **BUTYLATED HYDROXYANISOLE (BHA)**

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

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

**BUTYLATED HYDROXYTOLUENE (BHT)**

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

**CAFFEINE**

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

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

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

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

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

**CALCIUM (or SODIUM) PROPIONATE**

Preservative: Bread, rolls, pies, cakes.

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

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

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

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

**CARMINE; COCHINEAL EXTRACT**

Artificial coloring.

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

**CARRAGEENAN**

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

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

safe.



#### **CASEIN, SODIUM CASEINATE**

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

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



#### **CITRIC ACID, SODIUM CITRATE**

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

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



#### **COCHINEAL EXTRACT:** see [CARMINE](#).



#### **CORN SYRUP**

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

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



#### **CYCLAMATE**

Artificial sweetener: Diet foods.

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



#### **DEXTROSE**

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

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



#### **DIACETYL**

Butter flavoring.

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



#### **DIACYLGLYCEROL**

Cooking oil.

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

**EDTA**

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

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

**ERYTHORBIC ACID:** see ASCORBIC ACID.

Antioxidant, color stabilizer: Cured meats.

**FERROUS GLUCONATE**

Coloring, nutrient: Black olives.

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

**FOOD-STARCH, MODIFIED:** see STARCH, MODIFIED.**FRUCTOSE**

Sweetener: "Health" drinks and other products.

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

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

**FUMARIC ACID**

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

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

**GELATIN**

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

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

**GLYCERIN (GLYCEROL)**

Maintains water content: Candy, fudge, baked goods.

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

**GUMS**

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

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

Gums are derived from natural sources (bushes, trees, seaweed, bacteria) and are poorly



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



#### **HEPTYL PARABEN**

Preservative: Beer, non-carbonated soft drinks.

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



#### **HIGH-FRUCTOSE CORN SYRUP**

Sweetener: Soft drinks, other processed foods.

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

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

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

See also [MALTODEXTRINE](#) and [HIGH MALTULOSE CORN SYRUP](#).



#### **HIGH MALTULOSE CORN SYRUP**

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

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

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



#### **HYDROGENATED STARCH HYDROLYSATE (HSH)**

Sweetener: Dietetic and reduced-calorie foods.

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



#### **HYDROLYZED VEGETABLE PROTEIN (HVP)**

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

HVP consists of vegetable (usually soybean) protein that has been chemically broken down to the amino acids of which it is composed. HVP is used to bring out the natural flavor of

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