

# Chemical Food Preservatives and Their Impact on Health

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**ABSTRACT:** Every living organism needs food to live. The food has limited shelf life, in order to increase the shelf life and maintain the quality certain preservatives are used, these preservatives may have some harmful effect so if possible, and food without preservatives may be used. This additive is a sodium salt which is commonly used as chemical preservative in foods and it is found mainly in industrialized drinks. Sodium benzoate is considered safe by measurability agencies but there is still controversy over its effect on human health. Many effects like food allergy, food intolerance, cancer, multiple sclerosis, attention deficit, hyperactivity disorder, brain damage, nausea, cardiac disease among others have been reported.

**KEYWORDS:** chemical, food preservatives, impact, health, shelf life, allergy, disease, additive

## I. INTRODUCTION

As sustainability and food waste reduction becomes an ever-more important part of our food systems, we believe it's essential to explore the ways we reduce food waste and increase food safety and freshness through the use of preservatives. Preservatives are crucial to the preservation, safety, and freshness of the foods in our global food supply system. Many of the foods we enjoy are possible because of modern (and ancient) preservation techniques. Preservatives and preservation techniques prevent foods from spoiling and oxidizing quickly, allowing grocery manufacturers to distribute foods across the country and the globe without impacting food safety or quality.[1,2] Two significant factors that cause foods to go bad quickly are microbes and oxidation. Microbes that cause spoiling are undesirable bacteria, fungi, and yeasts that can grow in our food products. These microorganisms feed off the foods' nutrients and can cause serious harm to humans if consumed. Without preservatives, bacteria such as listeria and botulism can invade our foods and if consumed by humans, can cause us to become critically ill. Less harmful bacteria, fungi, and yeasts will grow on foods making them inedible. Oxidation, which is a term for certain types of chemical reactions, can impact food safety and flavor by cause an undesirable chemical change that can turn fats rancid and can cause vegetables and fruits, such as cut potatoes and apples, to brown. Enzymes and other chemical breakdown processes are responsible for the oxidation that transforms foods into an unpalatable, and at times, unsafe product. Preservatives are the ingredients and processes we apply to our foods to keep them safe and shelf-stable. There are two key ways we preserve our foods: chemical preservation and physical preservation.[3,4]

Chemical preservation involves adding specific ingredients to foods and food packaging that allows the food to remain safe and fresh. Humans have been using chemical preservation for thousands of years and familiar food products such as yogurt, sauerkraut, and kimchi are examples of foods that have undergone chemical preservation.

Physical preservation involves different techniques such as salt curing, refrigeration, smoking, drying, and more to protect food quality. As with chemical preservation, humans have been using physical means to preserve foods since ancient times. One such example is drying and smoking meats, veggies, and more. These techniques are not mutually exclusive; oftentimes we need to use both chemical and physical preservation approaches together to provide the safest food products with the fewest additional ingredients and processes. Canned foods are a great example of the hybrid preservation approach.[5,6]

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To can food safely, one must ensure:

- the food contents reach a specific acidity level; this usually requires the addition of a chemical such as ascorbic acid (Vitamin C) or salt.
- the canning jar and lid are sterile; this involves boiling the jar or another physical sterilization process.
- a completely sealed lid; this limits the oxygen needed for microbial organisms to live and prevents unwanted microbes from contaminating food, this typically requires the physical technique of heating the sealed jars.

A form of the above outlined thought process is applied across our food systems, so we get the highest quality, safest product with the fewest additions and preservation procedures. According to the U.S. FDA, all of the chemical and physical preservation techniques we currently use are safe for most individuals. As will all things in life, moderation is key when consuming foods and food products. Exclusively consuming high fat, high sugar products that contain preservatives will have negative long-term health consequences. However, we have not yet determined that these health impacts are related to the use of chemical preservatives within recommended quantities or are the consequences of an overall unhealthy lifestyle. Research is ongoing regarding specific preservative ingredients and their health impacts. Researchers and the U.S. FDA take food safety seriously and strive to ensure all foods and food products are safe for everyone to consume. Thus, researchers work with food regulatory agencies to share essential preservative discoveries so agencies can modify preservation regulations and guidelines based on science. Common antimicrobial preservatives used to reduce the microbial spoilage of foods by inhibiting the growth of bacteria, yeasts, and molds. Below you will find the ingredient and the products it typically preserves. [7,8]

- sorbic acid, sodium sorbate, sorbates: cheese, wine, baked goods, and more
- benzoic acid, sodium benzoate, benzoates: jams, salad dressing, juices, pickles, carbonated drinks, soy sauce, and more
- sulfur dioxide, sulfites: fruits, wines, and more
- nitrites, nitrates: meats
- lactic acid: yogurt, kefir, cottage cheeses, and more
- propionic acid, sodium propionate: baked goods, and more

Common antioxidants used to prevent oxidation. Below you will find the ingredient and the products it typically preserves.

- ascorbic acid, sodium ascorbate: cheese, chips, and more
- butylated hydroxytoluene, butylated hydroxyanisole: oils, packaging, and more
- gallic acid, sodium gallate: wines and more
- sulfur dioxide, sulfites: beverages, wines, and more
- tocopherols (Vitamin E): oils, cereals, and more

Our foods spoil and lose palatability quickly without preservatives. By using preservatives and preservation techniques responsibly, we can reduce food waste, increase food shelf-life, and help feed people with limited access to a safe, consistent food supply. [9,10]

## II. DISCUSSION

There are some food preservatives that are harmful if consumed above the prescribed limits. Some of the harmful or unhealthy food preservatives are caramel, butyrates, and benzoates. Studies show that nitrites and nitrates are carcinogenic and very harmful for the health. Sodium nitrites. Nitrites add color and flavor to preserved meat. The problem comes when nitrites are heated or mix with stomach acid. They produce nitrosamines, which are linked to an increased risk of colon and pancreatic cancer. Sulfites can trigger asthma. Sulfites are banned on fresh fruits and vegetables in the U.S. but are used in other foods. Sulfites may be present when the label says sulfur dioxide, potassium bisulfite, sodium bisulfite or sodium sulfite, so it's best to avoid these ingredients. Trans fats or partially hydrogenated

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oils. These are banned in the U.S. because of their link to heart disease. BHA (butylated hydroxyanisole) is a solid used to preserve butter, lard and meat. Berkeley Wellness says this common ingredient is found in bags of chips, vegetable oils, cereal and cookies. Its role is to prevent food from becoming rancid. The National Toxicology Program says BHA may be a human carcinogen. Berkeley Wellness says other research is mixed but suggests limiting BHA. Certain preservatives, including sulfites and sodium benzoate, may cause adverse reactions in a small percentage of the population. Sulfites help limit the growth of bacteria in wine and the discoloration of dried fruit, but can cause potentially deadly allergic reactions in sensitive individuals, including rashes, low blood pressure, diarrhea, flushing, abdominal pain, asthmatic reactions and anaphylactic shock. Sodium benzoate, also called benzoic acid, is used in acidic foods to keep microorganisms from growing. In sensitive individuals, it can cause asthma, hives and other allergic reactions.[11,12]

Although sodium benzoate is usually considered safe for people who aren't sensitive to it, when combined with ascorbic acid in acidic foods it can produce benzene, which may slightly increase your risk for leukemia and other types of cancer, according to the Center for Science in the Public Interest. Nitrates and nitrites, which are often used to preserve cured meats, such as lunch meat and hot dogs, may also increase your risk for certain types of cancers, according to the U.S. Environmental Protection Agency. Some other preservatives have been linked to a potential increase in cancer risk, although so far the evidence for this is preliminary and conflicted. These include propyl gallate, butylated hydroxyanisole, or BHA, butylated hydroxytoluene, or BHT, and tert-butylhydroquinone, or TBHQ. Bromates are known to destroy nutrients and cause stomach problems such as diarrhea. Sulfites are known to cause joint pain and heart palpitations. Butylated hydroxytoluene is known to cause cancer in rats. Sodium nitrate is said to cause stomach cancer, and artificially produced citric acid is said to cause asthma and allergic reactions. To avoid the dangerous chemical concoctions preservatives might bring, preserve foods naturally using salt, sugar, onions or rosemary extract.

Sulfa drugs can cause allergic reactions in some people, including hives, swelling and difficulty breathing. If you've ever experienced a reaction to a sulfa drug, your doctor may have diagnosed you with a sulfa allergy. Inform other treating physicians of this allergy and your medical chart will be flagged with this information. If you're ever hospitalized, you may wear a bracelet that informs hospital personnel that you have a sulfa allergy. But sulfa drugs and foods that contain sulfites or sulfates aren't chemically related, so you don't have to worry about sulfa in your diet. Antibiotics such as Co-Trimoxazole, sold under the brand name Septrin; Sulfamethoxazole, brand-name Gantanol; and Trimethoprim-Sulfamethoxazole, brand name Bactrim; are classed as sulfonamides. These drugs may be used to treat bacterial infections of the digestive or reproductive tracts. They're effective for many people, but some people develop an immune system response to sulfonamides that produces an allergic reaction. The sulfonamide bonds to human protein, producing large molecules that can cause you to break out in hives, or swelling of the lips and other mucous membranes, or even difficulty breathing. Sulfonamides are not the same as sulfites such as sulfur dioxide or sulfate salts. These chemical compounds are sometimes used to preserve foods. Your body metabolizes sulfites and sulfates differently than it does sulfa drugs. Being allergic to sulfa drugs doesn't predispose you to a sulfite allergy and vice-versa. Your body converts the sulfa compounds used as food preservatives to sulfur dioxide. People with asthma are particularly susceptible to bronchospasms when they're exposed to these preservatives.

Sulfonamides are used in medications, not foods. If you have a sulfa allergy, you don't have to avoid any particular foods. Though some people with sulfa allergies may also be sensitive to sulfites in food, the two allergies are not related. Inform your doctor and your pharmacist if you've been previously diagnosed with a sulfa allergy. If you experience a reaction such as this after taking any antibiotic or other medication, contact your doctor immediately and seek emergency help.[13,14]

### III. RESULTS

Many brands of breakfast cereal contain BHA (Butylated hydroxyanisole) to help preserve the grains and help them last longer before going rancid or stale. Other oil-containing foods, such as potato chips and dry drink mixes, also contain BHA, as do actual oils, including vegetable oil and shortening. In addition, commercially prepared bread, chewing gum and dehydrated potato products can contain the food additive. Though the FDA continues to approve BHA as an acceptable food additive, certain research studies show that BHA might do more harm than good. Kylie Floate, author of "The Undeniable Truth about Food," notes that BHA can accumulate in your body. There is a reasonable amount of research to suggest that BHA is a human carcinogen, as well, according to the Department of Health and Human Services National Toxicology Program. Though the link between BHA and cancer has only been shown in animal studies, it stands to reason that similar risks might have a negative impact on humans, too.

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Monosodium glutamate, aka MSG, has been criticized for increasing appetite and causing uncomfortable side effects such as nausea and heart palpitations. But the salty flavor enhancer is GRAS by the FDA — and researchers haven't been able to find a definitive link between these symptoms and the food additive.

The three main categories of artificial preservatives are antimicrobials, antioxidants, and chelating agents. [15,16]

- **Antimicrobials:** They help to prevent the overgrowth of bacteria and molds. And include: 1) Benzoates (found in many beverages). 2) Sorbates (help to prevent mold, yeast and fungi growth in foods and beverages). 3) Propionates (mold inhibitors used in baked goods). 5) Nitrates and nitrites (help to prevent bacterial overgrowth, most notably *Clostridium botulinum*).
- **Synthetic Antioxidants:** They help to prevent discoloration and include sulfites, synthetic vitamin E, C, butylated hydroxyanisole (BHA), and butylated hydroxytoluene (BHT).
- **Chelating agents:** They include EDTA and polyphosphates. And help to bind metals, usually copper and iron to prevent the metals from oxidizing and speeding up spoilage.

The American Academy of Pediatrics warns about the harmful side effects of food preservatives and food additives in their policy statement. So as per this statement, preservatives are all the way more harmful for children. Children are smaller, so their “dose” of any given chemical ends up being higher. Moreover, they put their hands in their mouths more often than adults do, so they are likely to ingest more. Since their bodies are still developing, they can be at more risk.

### 1. Breathing problems:

One of the most harmful side effects of food preservatives is that they increase the chances of breathing problems like asthma. Some of the preservatives present in food items such as aspartame, sulfites, and benzoates aggravate breathing problems. Therefore, removing foods with preservatives from the diet can help in reducing the symptoms as well as the severity of breathing problems. (Which foods help to increase immunity in kids.)

### 2. Obesity:

Preservatives could be the reason for excessive weight gain and obesity in kids who are mostly consuming processed foods. Also, artificial preservatives used in many processed foods could increase the risk of inflammatory bowel diseases and metabolic disorders. (How to prevent obesity in kids.)

### 3. Hyperactivity:

Most of the packaged food companies are adding artificial preservatives to delay spoilage and contamination in foods. Artificial preservatives such as nitrates, benzoates, sulfites, sorbates, parabens, formaldehyde, BHT, BHA and several others can cause serious health hazards such as hyperactivity, neurological damage and hypersensitivity. (How some foods can help to manage hyperactivity in kids.)

### 4. Serious diseases:

Recently, cardiovascular diseases have become quite common and the presence of preservatives on food items is one of the main causes of increasing heart problems. Studies also suggest that food preservatives can weaken the heart tissues over time. Another harmful side effects of food preservatives is that they can result in forming cancer cells. For example, some food items consist of nitrosamines, a preservative which has nitrites and nitrates. When this is mixed with the gastric acids, it forms cancer-causing agents. That is primarily why it is best to avoid snacks or meals that are loaded with nitrites and nitrates. (What are some foods to add daily nutrition for kids.)

### 5. Hormones:

Another side effect of food preservatives are that they can affect your child's neurological development and the endocrine system, which regulates hormones. The endocrine system is involved in growth and hormones, so if additives affect estrogen or testosterone, it can also affect development during puberty. Since food choices have a direct effect on hormone levels in the body, it becomes extremely important to make sure that each and every bite that goes into your kid's mouth is adding nutrition and not causing any harm in any way. Moreover, hormonal imbalance is very common nowadays amongst the teenagers and one of the major reason for this is excessive consumption of processed foods, ready to eat and packaged foods. (How foods can help to improve your hormonal health.)[17]

#### IV. CONCLUSIONS

WHO, in cooperation with the Food and Agriculture Organization of the United Nations (FAO), is responsible for assessing the risks to human health from food additives. Risk assessment of food additives are conducted by an independent, international expert scientific group – the Joint FAO/WHO Expert Committee on Food Additives (JECFA). Only food additives that have undergone a JECFA safety assessment, and are found not to present an appreciable health risk to consumers, can be used. This applies whether food additives come from a natural source or they are synthetic. National authorities, either based on the JECFA assessment or a national assessment, can then authorize the use of food additives at specified levels for specific foods. JECFA evaluations are based on scientific reviews of all available biochemical, toxicological, and other relevant data on a given additive – mandatory tests in animals, research studies and observations in humans are considered. The toxicological tests required by JECFA include acute, short-term, and long-term studies that determine how the food additive is absorbed, distributed, and excreted, and possible harmful effects of the additive or its by-products at certain exposure levels. The starting point for determining whether a food additive can be used without having harmful effects is to establish the acceptable daily intake (ADI). The ADI is an estimate of the amount of an additive in food or drinking water that can be safely consumed daily over a lifetime without adverse health effects.

The safety assessments completed by JECFA are used by the joint intergovernmental food standard-setting body of FAO and WHO, the Codex Alimentarius Commission, to establish levels for maximum use of additives in food and drinks. Codex standards are the reference for national standards for consumer protection, and for the international trade in food, so that consumers everywhere can be confident that the food they eat meets the agreed standards for safety and quality, no matter where it was produced. Once a food additive has been found to be safe for use by JECFA and maximum use levels have been established in the Codex General Standard for Food Additives, national food regulations need to be implemented permitting the actual use of a food additive. The Codex Alimentarius Commission also establishes standards and guidelines on food labelling. These standards are implemented in most countries, and food manufacturers are obliged to indicate which additives are in their products. In the European Union, for example, there is legislation governing labelling of food additives according to a set of pre-defined “E-numbers”. People who have allergies or sensitivities to certain food additives should check labels carefully. WHO encourages national authorities to monitor and ensure that food additives in food and drinks produced in their countries comply with permitted uses, conditions and legislation. National authorities should oversee the food business, which carries the primary responsibility for ensuring that the use of a food additive is safe and complies with legislation. [18]

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