



ORIGINAL ARTICLE

**Some Artificial Food Preservative and Their Hazardous Effects on Human Health:
A Review**

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ABSTRACT

Food preservative is a class of food additive that help to prevent the growth and proliferation of pathogenic microorganisms like *Clostridium spp*, *Bacillus cereus* and *Staphylococcus aureus*. This can be achieved by bringing down the pH of the food so as to make the environment unfavourable for these microbes. Preservatives slow or stop the breakdown of fats and oils in food materials. Preservatives extend the shelf-life of food, cosmetics and pharmaceuticals by preventing their spoilage. Antimicrobials such as nitrites, nitrates, benzoates and sulfur dioxide destroy or delay the growth of bacteria, yeast and molds. Anti-oxidants such as butylated hydroxy toluene (BHT), butylated hydroxy anisole (BHA), and propyl gallate protects. Natural substances like salt, sugar, vinegar and spices have been used as preservatives. The most of preservatives used nowadays are artificial rather than natural and their constituents such as nitrates, benzoates, sulfites, sorbates, parabens, formaldehyde, BHT, BHA and several others can cause serious health hazards such as hypersensitivity, allergy, asthma, hyperactivity, neurological damage and cancer. Several natural preservatives obtained from plants, animals, microbes and minerals contain antioxidant, antimicrobial and antienzymatic properties. This article aims at escalating alertness about the harmful effects of non-natural preservatives and recommends the practice of natural preservatives for better therapeutic value, safety.

Key words: Preservatives, antimicrobial, Antioxidant, Antienzymatic, Hypersensitivity, Carcinogen

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INTRODUCTION

Food additives are substances that food manufacturers intentionally add to food in small quantity during production or processing to improve the organoleptics of the food (Winter, 1994). Preservatives are natural or synthetic substances that are added to prepared food items and in other products in order to increase their ridge life and preserve their quality. Food storage can be traced back to all ancient civilizations such as Egyptian, Greek, Roman, Sumerian and Chinese.

Drying food was a popular preserving method, as most bacteria and fungi require moisture to grow. Natural techniques of protection usually purpose to exclude air, moisture, and microorganisms, or to offer environments in which organisms that might cause spoilage cannot survive (Daniel, 2007). Natural manner of meals upkeep can be accomplished by Boiling, freezing (Heldman, 1994), pasteurizing, dehydrating, smoking, pickling. Adding Sugar ,every so often sugar is blended with alcohol for protection of luxurious merchandise inclusive of fruit in brandy or different spirits (Saulo, 1994), salt, alcohol, vinegar are also often used as food preservatives. They very effectively drop the increase of bacteria in meals. Espresso powder and soup are dehydrated, dried for renovation.

Artificial way of food preservation may be accomplished by means of nuclear radiation (Anon, 1991), vacuum packing and hypobaric packing nowadays sure artificial Chemical are used as food preservatives (Kinderlere, 1990).



Fig. 1: Different food products contains preservatives

Foods such as fruits, vegetables and meats were frequently dried for preservation. Jams and jellies are preserved as solutions of high sugar content, and plenty of meats (e.g., hams) and fish are nonetheless preserved through salting. The Eastern Civilizations of India and China extensively utilized spices to preserve their meals. Pickling with salt, vinegar, lemon juice or mustard oil become a famous approach to hold greens. Canning along with pasteurization revolutionized the upkeep of food inside the early part of the 19th century. Modern-day methods of maintenance contain sterilization such as irradiation, filtration and addition of preservatives such as sodium benzoate and propyl gallate.

CLASSIFICATION OF PRESERVATIVES

(Sharma, 2015; Seetaramaiah, 2011; Hugo, 2004; Kulkarni, 2010; Russell, 1999; Block, 1991)-

1. NATURAL PRESERVATIVES: In This Class Included Those Food Preservatives Which Are Obtained From Nature For Example Salt, Sugar, Vinegar, Spices, Honey, Edible Oil Etc.

2. CHEMICAL PRESERVATIVES: In this class included those food preservatives which are chemical semi synthetic or synthetic in nature such as benzoates, sorbates, nitrites and nitrates of potassium sulphites, glutamates, glycerides etc. Chemically Preservatives are categorised as antimicrobial, antioxidant, and antienzymatics.

a. ANTIMICROBIALS: They can damage or hinder the boom of micro organism yeast and moulds e.g. Nitrites and nitrates save you food poisoning by way of bacteria in meat merchandise. Sulphur dioxide prevents for the degradation in fruits, wine and beer. Benzoates and sorbates are antifungal dealers utilized in jams, salads, cheese and pickles (Abdulummeen, 2012).

b. ANTIOXIDANTS: These slow or stop the ruin down of fats and oils in food that happens in presence of oxygen proceed to rancidity (Sunitha, 2000). There are three styles of antioxidants: true antioxidants which includes Butylated hydroxytoluene (BHT) and Butylated hydroxyanisole (BHA) block chain reactions by reacting with unfastened radicals; lowering dealers such as ascorbic acid have decrease redox ability than the drug or excipients they're shielding, and Antioxidant synergists which includes Sodium edetate enhance the outcomes of different antioxidants.

c. ANTI-ENZYMATIC PRESERVATIVES: These prevent enzymatic processes like ripening from occurring in food products even after harvest. For instance, citric and erythorbic acids limit the action of the phenology enzyme, which causes the exposed surface of sliced fruits to turn brown (Kulkarni, 2010).

The majority of additives fall into the artificial flavour and flavour enhancer category, which are used to improve the flavour of food or give it a particular flavour. Salt, sugar, and vanilla are a few examples of flavours that are added to dishes to enhance their flavour. To mimic natural flavours, synthetic flavouring compounds can be employed, such as benzaldehyde for cherry or almond flavour. Monosodium glutamate (MSG), for example, is a flavour enhancer that brings out the flavours of other ingredients in meals. e) Foods like wheat flour and cheese are bleached using peroxides as the bleaching agent (U.S. Food and Drug Administration, 1993).

Chelating agents are used to stop flavour alterations, rancidity, and colour changes that could happen during food preparation. Citric acid, malic acid, and tartaric acid are among examples.

Vitamins, minerals, and other nutrient additions are added to meals during fortification or enrichment. For instance, rice is supplemented with thiamin, riboflavin, and niacin, while milk is fortified with vitamin D.

Agents that thicken and stabilise foods in order to change their texture Examples include carrageen, which is used as a thickener in ice creams and low-calorie jellies and the emulsifier lecithin, which keeps oil and vinegar blended in salad dressings.

Table 1: Food Preservative (Sharif, 2017)

Preservative	Class	Maximum Possible limit	Product used
Sodium and Potassium Benzoate, Benzoic Acid	Antimicrobial	200ppm	Pickles, Margarine, Fruit Juices, Jams, Cheese, Baked Goods, Snacks
Methyl And Propyl Paraben	Antimicrobial	0.1%	Baked Goods, Beverages, Dressings, Relishes
Sorbic Acid, Sodium, Potassium and Calcium Sorbates	Antimicrobial	200ppm	Dairy Products, Bakery Goods, Sweets, Syrups, Fruit Juices, Jams, Jellies, Beverages
Sulfites and Sulfur Dioxide	Antimicrobial	100-200ppm	Dry Fruits and Fruits, Molasses, Fried or Frozen Potatoes, Shrimp And Lobster
Propionates	Antimicrobial	0.32%	Bakery Products, Cheese, Fruits
Nitrites and Nitrates	Antimicrobial	100-200ppm	Meat Products
Propyl Gallate	Antioxidant	200ppm	Baked Foods, Meats
Bha (Butylated Hydroxy-Anisole) and Bht (Butylated Hydroxytoluene)	Antioxidant	100ppm For Meat Products, 50ppm For Breakfast Cereals and Potato Products	Baked Foods and Snacks, Meats, Breakfast Cereals, Potato Products
Tert-Butylhydro-Quinone (TbHQ)	Antioxidant	100ppm	Baked Foods and Snacks, Meats
Erythorbic Acid (Iso-Ascorbic Acid) and Citric Acid	Antienzymatic	200-350ppm	Soft Drinks, Juices, Wines and Cured Meats

E-NUMBERING

The "E numbers" used in Europe for all authorised additives are allocated to each food additive in order to regulate them. All E-numbers begin with the letter "E," however nations outside of Europe only use the number, whether or not the addition is permitted in Europe. Acetic acid, for instance, is labelled as E260 on goods sold in Europe but is referred to as additives 260 in some other nations. Every food additive must be given a name or number. The prefix "E" is not present, but the numerals are the same as in Europe. Tartrazine (E102), Quinoline Yellow (E104), Carmosine (E122) and Amaranth are some E numbers for food additives (E123).

Table 2: Codes assigned by commission of European Union for various preservatives (Anandand, 2013)

E-Number	Name of Preservatives	E-Number	Name of Preservatives
E 200	Sorbic acid	E 228	Potassium hydrogen sulphite
E 202	Potassium sorbate	E 230	Biphenyl, diphenyl
E 203	Calcium sorbate	E 231	Orthophenyl phenol
E 210	Benzoic acid	E 232	Sodium orthophenyl phenol
E 211	Sodium benzoate	E 233	Thiabendazole
E 212	Potassium benzoate	E 234	Nisin
E 213	Calcium benzoate	E 235	Natamycin
E 214	Ethyl p-hydroxybenzoate	E 239	Hexamethylene tetramine
E 215	Sodium ethyl p-hydroxybenzoate	E 242	Dimethyl dicarbonate
E 216	Propyl p-hydroxybenzoate	E 249	Potassium nitrite
E 217	Sodium propyl p-hydroxybenzoate	E 250	Sodium nitrite
E 218	Methyl p-hydroxybenzoate	E 251	Sodium nitrate
E 219	Sodium methyl p-hydroxybenzoate	E 252	Potassium nitrate
E 220	Sulphur dioxide	E 281	Sodium propionate
E 221	Sodium sulphite	E 282	Calcium propionate
E 222	Sodium hydrogen sulphite	E 283	Potassium propionate
E 223	Sodium metabisulphite	E 284	Boric acid
E 224	Potassium metabisulphite	E 285	Sodium tetraborate (borax)
E 226	Calcium sulphite	E 1105	Lysozyme
E 227	Calcium hydrogen sulphite		

Table 3: Adverse Effects of Artificial Preservatives

Chemical Food Preservatives	Used	Adverse Effect
Sodium Benzoate (E211)*	Carbonated Drinks, Pickles, Sauces, Certain Medicines.	Aggravates asthma and suspected to be a neurotoxin and carcinogen may cause fetal abnormalities
Sulphur Dioxide (E220)*	Carbonated drinks, dried fruits, juices, potato products	May induce gastric irritation nausea, diarrhea, asthma attacks, skin rashes.
Potassium Nitrate (E249)	Cured meats, canned meat products.	May lower oxygen carrying capacity of blood, may combine with other substances to form nitrosamins that are carcinogens.
Calcium Benzoate (E213)	Drinks, low sugar products, cereals, meat products	May temporarily inhibit digestive enzyme function and may deplete levels of the aminoacid glycine.
Aspartame (E951)	200 times sweeter than sugar.	May cause neurological damage
Calcium Sulphite	In a vast array of foods from burgers to biscuits, from frozen mushrooms to horseradish. Used to make old produce look fresh.	May cause bronchial problems, flushing, low blood pressure, tingling and anaphylactic shock. Avoid them if you suffer from bronchial asthma, respiratory problem.
Tartrazine	Its use is permitted as a colorant in food products, cosmetics and pharmaceuticals, with a recommended acceptable daily intake (ADI) of 7.5 mg/kgbw.	tartrazine had genotoxic potential towards human lymphocytes

Table 4: Preservatives used in different Formulation

Pharmaceutical Products	Preservatives
Oral	Methyl, ethyl, propyl parabens and their combinations, sodium benzoate, benzoic acid, calcium lactate, sorbates of calcium, sodium and potassium, sorbic acid.
Dermal	Benzalkonium chloride, cetrimide, EDTA, benzoic acid, thiomersal, imidurea, chlorhexidine, chlorocresol, phenyl salicylate.
Dental	Sodium benzoate, benzoic acid, potassium sorbate, sodium phosphate, triclosan, cetylpyridinium chloride, methyl and ethyl parabens.
Ophthalmic	Benzalkonium chloride, EDTA, benzoic acid, thiomersal, imidurea, chlorhexidine, polyamino propylbiguanide, sodium perborate, boric acid.
Nasal	Benzalkonium chloride, phenylcarbinol, potassium sorbate, chlorobutanol, chlorocresol, EDTA
Rectal	Benzyl alcohol, benzoic acid, sodium benzoate, methyl hydroxybenzoate, chlorhexidine gluconate
Parenteral	Methyl, ethyl, propyl, butyl parabens and their combinations, benzyl alcohol, chlorbutanol, chlorhexidine, thiomersal, formaldehyde

HEALTH HAZARDS CAUSED BY ARTIFICIAL PRESERVATIVES

Although artificial preservatives are generally regarded as safe, some of them have negative side effects, including carcinogenic and toxic consequences. Food additives can have immediate impacts or have negative long-term effects if there is continuous exposure or accumulation. Headaches, a shift in energy level, and changes in mental focus, behaviour, or immunological response may all be immediate impacts. The chance of developing cancer, cardiovascular disease, and other degenerative diseases may rise as a result of long-term effects (Pandey, 2012). According to some studies, synthetic preservatives and artificial colouring agents make ADD/ADHD symptoms worse in people who are affected (Gustafsson, 2003). Clinical testing were not as reliable as parental reports for detecting the presence of additives (ANON, 2004). Preservatives in food or medicine that are allergen-causing can result in anaphylaxis.

Preservatives commonly found in most oral pharmaceutical products (Strickley, 2008) (such as tablets, capsules, suspensions and syrups), dental products (Steinberg, 1999) (such as toothpaste, mouthwash and gargles), dermal products (Esposito, 2003) (mostly cosmetic personal care products, such as cream, lotion, ointment, soap, bath gel, hair spray, shampoo and conditioner), nasal products (Marple, 2004) (such as nasal drops, sprays and aerosols) parenteral products (Myer, 2007) including vaccines, rectal products (such as suppositories and enema) and ophthalmic products (Baudouin, 2010 and Noecker, 2001).

ALTERNATIVES TO ARTIFICIAL PRESERVATIVES

The days of benzoates, sorbates, metabisulphites, poisonous gases and different artificial chemical preservatives seem like numbered.

Natural materials or extracts acquired from plants, animals or minerals, can serve as useful alternatives. Other than their use in food, cosmetics and prescribed drugs as flavoring, binding, disintegrating, gelling, thickening or postponing agents, or as vehicles, those can also be used as preservatives (Pawar, 2011; Jakoweinko, 2007; Dorman, 2000; Ranasinghe, 2002; Rajkumar, 2003; Friedman, 2004; Guynot, 2003; Lusby, 2005; Cavanagh, 2002; Petersen, 2003; Kalemba, 2003; Evans, 2009; Juntachote, 2005; Pai, 2004; Kahkonen, 2001; Mandal, 2011; Subbalakshmi, 2002).

REGULATIONS OF FOOD AND PRESERVATIVES (Mirza, 2017)

Food safety has emerged as an important global issue with international trade and public health implications (WHO, 2006). There are numerous regulating groups that determine what should be introduced to food and meals supplements and the quantities that they

ought to be introduced so they will now not have deleterious effects at the clients. These substances are termed as usually recognized as safe (GRAS). Each United States of America of the world has its personal guidelines even though there is probably a similarity among them.

Table 5: Some Alternatives of Artificial preservatives

Alternative preservatives	Sources	Used
Algin	A compound extracted from seaweed, including the giant kelp <i>Macrocystis pyrifera</i> , <i>Ascophyllum nodosum</i> and various types of Laminaria,	Algin used to make puddings, milkshakes, ice cream creamier and thicker, is also used to extend shelf life of food products
Basil extract	It is derived form the culinary herb <i>Ocimum basilicum</i> .	it is popularly used for its medicinal properties in Ayurveda and Siddha medicines. It is a useful antioxidant and anti-microbial agent.
Grapefruit Seed Extract	It is also known as citrus seed extract, is a liquid derived from the seeds, pulp and white membranes of grapefruit <i>Citrus paradise</i> .	It is used to kill or inhibit the growth of bacteria, viruses, fungi and other microbes. It should be used in conjunction with others broad spectrum preservatives to be effective. It can be used in quantities of up to 1% of the recipe.
Rosemary Extract	It is obtained from <i>Rosmarinus officinalis</i> .	Rosemary extract has been shown to improve the shelf life and heat stability of omega 3-rich oils, which are prone to rancidity. It can be used up to 0.5% in pharmaceutical formulations.
Vitamin E Oil	It is found most abundantly in wheat germ oil, sunflower, and safflower oils.	It is used in cosmetics, pharmaceuticals and anhydrous products.
Erythorbic acid	It is also known as iso-ascorbic acid. It is a vegetable-derived food additive produced from sucrose	It is widely used in processed foods as an antioxidant preservative. Along with sodium erythorbate, it is also used in hair and nail products.
Citric Acid	It occurs naturally in fruits such as lemon and lime	It is used in canned fruit juices, cheese, margarine, pickle and salad dressings as flavoring and acidifying agent
Carrageenan	It is extracted from Irish Moss <i>Chondrus crispus</i>	It is used to make puddings, ice-cream and milkshakes. It makes foods jell and stabilizes food to keep color and flavor even.
Guar Gum	It is a substance made from seeds of the guar plant <i>Cyamopsis tetragonoloba</i> , a legume grown in India	It is used as a stabilizer in pharmaceutical preparations and food products such as processed cheese, ice cream, jelly and dressings
Sodium Aluminosilicate	It is a naturally-occurring mineral.	It is used in dried milk substitutes, egg mixes and grated cheeses, keeps food from caking and clumping up. It is also an acidity regulator used in concentrations below 2%.
Honey	It is a sweet food made by bees using nectar from flowers.	it is a rich source of nutrients and is self-preserving. It is a natural energy-booster, builds immunity and is a natural remedy for many ailments.
Neem Oil	It is a vegetable oil pressed from the fruits and seeds of the neem tree <i>Azadirachta indica</i> . It has rejuvenating as well as its detoxifying effects.	It is a popular anti-fungal, anti-bacterial as well as anti-protozoal agent. It is used for preparing cosmetics such as soap, hair products, body hygiene creams, hand creams, and in Ayurvedic, Unani and folklore traditional medicine, in the treatment of a wide range of afflictions.

In 1972 a committee from Federation of yankee societies for experimental biology reviewed the protection of all GRAS substances on the premise of posted and other available statistics. The committee located all reviewed substances in five classes.

Category I: Includes all those additives whose GRAS popularity became reaffirmed. Which means that the to be had facts provided no proof of toxic risks of the substance in query. Those substances are typically used in keeping with GMP.

Class II: It includes the ones materials whose GRAS reputation turned into reaffirmed at present day degree of use. Which means that the available records presented no evidence of poisonous hazard at the level of current use and exercise.

Category III: Substances whose safety is reaffirmed at the extent of modern-day use and exercise. But positive uncertainties exist so that extra researches are required.

Class IV: Include the ones substances for which statistics is incomplete to “reaffirm safety”. This means evidence of toxicity has been reported, however the level and way of modern use the records is insufficient to determine the impact on public health.

In developing countries, the concerns about food safety are increasing due to a variety of factors including increase in the age of human populations, unplanned urbanization and migration and mass production of food due to population growth and changed food habits.

This likely explains why the Indian food law lays greater emphasis on meals adulteration. The Prevention of food Adulteration Act (PFA) is the primary food protection act regulated through the Ministry of fitness and own family Welfare, authorities of India and its implementation has been entrusted to kingdom Governments/Union Territories. Each nation Government has created its very own company for implementation of the Act. The existing infra structure for the enforcement consists of food health Authority on the nation level, nearby (fitness) government on the village/municipality stage and food/Sanitary Inspectors at the grassroots level. Those inspectors who're appointed below the PFA Act are given the authority to look at establishments, acquire samples and send for analysis, check out any proceedings made to them (Chandha, 2004 and Vermula, 2008).

CONCLUSION

Chemicals used as artificial preservatives can have negative health effects. There is growing awareness of the negative consequences of these substances in food, cosmetics, and medications. Due to their non-toxic nature and several health advantages, natural preservatives are superior to their artificial counterparts in terms of advantages. Basil, neem, citrus, and rosemary extracts are superior substitutes for preservatives such benzoic acid, nitrates, MSG, BHA, and BHT. People should choose items with natural preservatives in order to achieve and preserve excellent health, and they should carefully read the labels on food, cosmetics, and medication products.

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