

An Attempt to Understand the Food in Packages: Food Additive Chemicals

Subhrajit Banerjee

Department of Physiology, Surendranath College, University of Calcutta, Kolkata, West Bengal, India

Corresponding Author's Email: subhrajitphysiology@gmail.com

Abstract

The presence of food additive chemicals in packaged foods has become a significant concern for consumers and researchers alike. This chapter aims to explore the various aspects of food additives, including their types, uses, and potential impacts on human health. Food additives are substances added to processed and packaged foods to enhance shelf life, texture, flavour, and appearance. While some additives are derived from natural sources, others are synthesized chemically. This chapter delves into the different categories, purposes, and specific chemical natures of food additives, such as preservatives, flavour enhancers, emulsifiers, and stabilizers, among others. Additionally, the regulations and safety measures surrounding the use of food additives, as well as exploring the role of governmental agencies and international organizations in establishing guidelines and tolerable limits, are envisaged.

Keywords: *Chemicals; Food Additives; Health; Preservatives; Toxic Effects*

Introduction

In an era of packed and packaged ready-to-eat fast foods and processed and semi-processed food, it's always a good idea to read food labels carefully and to choose products that are made by reputable brands and manufacturers. To foster a better understanding of the topic, the study highlights the necessity of accurate labelling and transparency in the food industry. The importance of informed consumer choices is to encourage individuals to be aware of the additives present in packaged foods we consume. Alternative and traditional strategies that can be employed to reduce reliance on synthetic additives and promote healthier and more sustainable food products are explored. Detailed analysis and referral of norms with regard to food categories and levels of use are required nowadays. Packaged products are approved by regulatory authorities. In India, local products like bread and different munching and snacking items of local bakery products like biscuits, chips, and other fried ready-to-eat items like *Chanachur* are devoid of any labelling in packaging. This chapter aims to introduce the readers to the various groups of food additives and their categorization according to safety norms issued by regulatory agencies like the FDA and other international bodies,

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as well as national bodies like FSSAI in India. Food adulteration refers to the addition of harmful or inferior-quality substances to food products in order to increase their quantity or enhance their appearance, which is not dealt with here and is not to be confused with food additives.

An Introduction to Different Classes of Food Additives

Food additives are substances that are numerous and fall into different classes. The most important to start with are preservatives, which are chemicals that increase shelf life; similarly, taste enhancers increase tastes like sweet, sour, salty, and umami. Examples include monosodium glutamate (MSG) and yeast extracts. Sweeteners can be either natural (e.g., sucrose, honey) or artificial (e.g., aspartame, saccharin). Additives that enhance or intensify the aroma of food products are called flavour enhancers and are discussed in detail in this chapter. Colorants are additives that provide or enhance the colour of food products. They can be natural (e.g., beet juice, turmeric) or artificial (e.g., FD&C dyes). Emulsifiers, stabilizers, and thickeners are added to food products to improve their texture and appearance. Acidity regulators help control and adjust the acidity or pH levels of food products, enhancing flavour and improving preservation. Antioxidants inhibit or delay the oxidation process in food, preventing rancidity and extending shelf life. Examples include ascorbic acid (vitamin C) and tocopherols (vitamin E). Bulking agents add bulk or volume to food products without significantly contributing to their caloric content. Examples include cellulose and maltodextrin. Humectants retain moisture in food products, preventing drying out or staleness. Examples include maltitol, glycerol and propylene glycol. Leavening agents help dough or batter rise by releasing gases. Examples include baking powder, yeast, and ammonium bicarbonate. Firming agents help maintain or enhance the texture and firmness of fruits and vegetables during processing. Examples include calcium citrate, calcium chloride and calcium lactate. Enzymes are proteins that catalyse specific biochemical reactions in food products, aiding in processes like fermentation, tenderization, and flavour development. Stabilizers and Thickeners enhance the texture, consistency, and stability of food products. Examples include agar, carrageenan, and xanthan gum. Anticaking agents prevent the formation of lumps or clumps in powdered food products, improving flowability. Examples include silicon dioxide and calcium silicate. Foaming agents can reduce the surface tension of water to form foam. Examples include quillaja extract and Polysorbate (20, 40 and 60). Bulking agents increase the bulk of a food without affecting its nutritional value. Examples include starch and potassium tartrates. Glazing agents provide a shiny appearance and give foods a protective coating. Examples include Beeswax, carrageenan, carnauba wax, and shellac. Sequestrants enhance the quality and stability of foods. Examples include Calcium disodium and ethylene diamine tetraacetate (Inetianbor, Yakubu & Ezeonu, 2015; O'Brien-Nabors, 2012)

Here in this text, a detailed listing of emulsifiers, flavouring agents, and preservatives is done and readers are directed to further refer sites for further analysis of the other heads from referred sites, take careful note of food labels, store packets for further reading and also refer to Table 1. The deleterious effects of food chemicals or additives can vary depending on several factors, such as the type of additive, dosage, individual sensitivity, and overall dietary intake. While many food chemicals have been deemed safe for consumption by regulatory bodies such as the FDA and FSSAI when used within approved limits, excessive or inappropriate use of additives can potentially have negative health implications. It's important to note that the majority of these additives are considered safe for consumption when used in appropriate amounts as determined by regulatory authorities (FDA, n.d.; Zhou *et al.*, 2023).

Emulsifiers

In the United States, emulsifiers are generally identified on food labels by their common names or by their International Numbering System (INS) codes. The INS is a system developed by the United Nations Food and Agriculture Organization (FAO) and the World Health Organization (WHO) to provide a global standard for food additives, including emulsifiers. The INS code consists of a three-digit number, where the first digit indicates the functional category of the additive (such as emulsifiers), and the second and third digits indicate the specific additive within that category. For example, the INS code for lecithin, a common emulsifier derived from soybeans, is E322. The use of emulsifiers in food products in India is regulated by the Food Safety and Standards Authority of India (FSSAI), the regulatory authority responsible for regulating food additives, and only those emulsifiers that are approved by the FSSAI can be used in food products. Food manufacturers in India are required to list all food additives, including emulsifiers, on product labels, along with their common names, chemical names, or ISI codes. Emulsifiers used in India may be identified on food labels using their common names, chemical names, or Indian Standards Institution (ISI) codes. FSSAI has established a list of approved food additives, which includes emulsifiers and has assigned codes to these additives. Emulsifiers are food additives that help to stabilize and homogenize mixtures of water and oil. The additives are coded "Food Additive Numbers" or FANs. The FANs for emulsifiers are listed under the functional class "Emulsifying, Gelling, Stabilizing, and Thickening Agents. Emulsifiers used in India are Lecithin: FAN - 322, Mono- and diglycerides of fatty acids: FAN - 471, Polysorbate 80: FAN - 433, Sodium stearoyl lactylate: FAN - 481, Similar ISI codes for Lecithin are: IS: 400, Mono- and diglycerides of fatty acids: ISI code - IS: 322, Polysorbate 80: ISI code - IS: 1430, Sodium stearoyl lactylate: ISI code - IS: 11193. An exhaustive list of Food Additive Numbers (FANs) approved for use in India is present on the official website of the Food Safety and Standards Authority of India (FSSAI) (<https://www.fssai.gov.in/>).

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Some FDA-approved common emulsifiers are Lecithin, Mono- and Diglycerides, Polysorbates, Carrageenan, and Sodium Stearoyl Lactylate. It is important to note that (while these emulsifiers are FDA-approved) some studies have suggested that they may have negative health effects if consumed in large quantities. The use of non-FDA-approved emulsifiers in food products is illegal in the United States. However, some manufacturers may use these additives in their products without proper labelling or regulatory oversight. Consuming food products that contain non-FDA-approved emulsifiers can pose health risks, including allergic reactions, digestive problems, and chronic diseases. It's important to note that some of these emulsifiers may be considered safe by regulatory agencies in other countries, or may be used in small amounts that are considered safe for consumption.

Food additives that are classified as emulsifiers or stabilizers in the European Union's numbering system for food additives fall within the range of E400 to E499 (Food-Info.net, 2021). The website lists the emulsifiers and stabilizers within this range, along with their chemical names, functions, and examples of foods in which they are commonly used. Regulations and classifications of food additives can vary between different countries and regions, so it's always a beneficial idea to refer to the specific regulations and labelling requirements in your own country or region. Here are some websites that provide information on food additives and their regulations in India: Food Safety and Standards Authority of India (FSSAI) The website is <https://www.fssai.gov.in/>

Indian Standards Institution (ISI) - The ISI is a national standards body in India that develops standards for various products, including food additives. Their website provides information on Indian standards for food additives, including emulsifiers, along with their codes and specifications. The website is <https://www.bis.gov.in/index.php/en/>.

Central Food Technological Research Institute (CFTRI) (2024)- The CFTRI is a research institution in India that conducts research on various aspects of food science and technology. Their website provides information on food additives, including emulsifiers, along with their functions and applications in food products. The website is <http://www.cftri.com>.

Surveys conducted by the Food Safety and Standards Authority of India (FSSAI)(2024) include the National Milk Quality Survey, the National Food Safety and Quality Survey, and the National Survey on Milk Adulteration (<https://www.fssai.gov.in/cms/national-surveys.php>).

Natural Emulsifier

Lecithin is derived from soybeans, eggs, or sunflower seeds. It is commonly used in food products such as chocolate, baked goods, and margarine. Carrageenan, derived from seaweed, is commonly used in dairy products such as ice cream, chocolate milk, and

yogurt, almond milk. Xanthan gum is derived from bacteria used in salad dressings, sauces, and other food products. Though natural, some studies revealed digestive problems and other health issues (Blekas, 2016).

Synthetic Emulsifier

These additives as emulsifiers have not been evaluated (or not adequately evaluated) for safety or because they have been found to be unsafe. Examples and uses of emulsifiers are as follows. Mono- and diglycerides are commonly used in baked goods, ice cream, and peanut butter. Health effects include weight gain. Polysorbates are commonly used in ice cream, salad dressings, baked goods, and mayonnaise. It has been linked to inflammation, gut dysbiosis (Food and Agriculture Organization of the United Nations, 2023). Sodium stearoyl lactylate is used in bread, pastries, and other baked goods. DATEM is a synthetic emulsifier that is commonly used in baked goods and other food products. It has been banned in some countries due to safety concerns (Bakerpedia, 2024a).

PVA is a synthetic emulsifier that is commonly used in instant noodles and other food products. It has been found to be unsafe for consumption and has been banned in some countries (Saxena, 2004). Azodicarbonamide (ADA) is a synthetic emulsifier that is commonly used in bread and other baked goods. It has been banned in some countries due to safety concerns (Bakerpedia, 2024b). SLS is a synthetic emulsifier that is commonly used in personal care products such as toothpaste and shampoo. It has been found to be unsafe for consumption and is not approved for use in food products (Chemical Safety Facts, 2022). Propylene glycol is used in baked goods, frosting, and other food products. Health effects include allergic reactions and skin irritation. Ethoxylated mono- and diglycerides are used in baked goods and other food products. Health effects include allergic reactions. Sodium carboxymethylcellulose used in processed foods and ice cream causes gut irritation and inflammation (Partridge *et al.*, 2019). Glycerol ester of wood rosin (GEWR) is used in citrus-flavoured drinks and other beverages. Health effects include allergic reactions and skin irritation. PGEs are used in baked goods and confectionery. Health effects include allergic reactions and digestive problems. Calcium stearoyl lactylate (CSL) used in baked goods, margarine allergic reactions, skin irritation. Butylated hydroxyanisole (BHA) used in snack foods, baked goods, and cereal. Health effects include cancer. Butylated hydroxytoluene (BHT) is used in food products such as potato chips, cereal, and baked goods. Health effects include cancer and liver damage. Titanium dioxide is used as a whitening agent in food products such as candy, gum, and frosting. Health effects are inflammation and DNA damage (denotes FDA non-approved).

Food Preservative

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Salt has been used as a natural preservative for centuries. It can be used to preserve vegetables, meats, and fish by drawing out moisture and inhibiting the growth of bacteria. There are several healthy preservatives that can be used at home without causing harm, like vinegar, honey, alcohol, and citric acid. Sugar is a natural preservative that can be used to preserve fruits, jams, and jellies. Citric acid is used to preserve canned fruits and vegetables, and as a flavour enhancer. Sorbic acid is used to preserve cheese, wine, and baked goods. Tocopherols, natural forms of vitamin E, used to preserve oils, dressings, and baked goods. Carrageenan, a natural preservative used in dairy products, salad dressings, and other foods. Some examples of organic preservatives include rosemary extract, clove oil, and grapefruit seed extract. Rosemary is a natural antioxidant that can be used to preserve meats and other food products. It can also be used to prevent the oxidation of oils and fats. Ginger has antibacterial properties and can be used to preserve food. It's particularly effective in preserving pickles and other fermented foods. Tea tree oil has antibacterial and antifungal properties and can be used to preserve food. It's particularly effective in preserving fruits and vegetables. Oregano oil has antibacterial and antifungal properties and can be used to preserve food. It's particularly effective in preserving meats and other animal products. Cloves have antibacterial properties and can be used to preserve food. They're particularly effective at preserving fruits and vegetables. These ingredients have been used for centuries to preserve food, and are generally considered safe when used in appropriate amounts. Several spices have natural antimicrobial properties that can act as preservatives in food. Some of these spices are cinnamon, cloves, oregano, thyme, rosemary, sage, ginger, mustard, black pepper, and turmeric. Some other natural preservatives are nisin- a natural preservative used in cheese and other dairy products and natamycin- a natural preservative used in cheese and other dairy products.

There are several preservatives approved for use in food in India, each with its own chemical code. The preservatives listed are identified by their respective international numbering system, which is widely used across the globe, including India. The Indian food regulatory body (FSSAI), recognizes and approves the use of these preservatives based on their respective international codes. FSSAI has set maximum limits for certain preservatives in different food categories to ensure that the levels of these substances in the final product do not exceed the safe limits. Therefore, food manufacturers in India are required to comply with the FSSAI regulations related to the use of preservatives in food products, in addition to following the international codes for preservatives.:

Table 1: *Chemical synthetic preservatives used in food that are approved in India are mentioned below*

Sodium Benzoate (E211)	This preservative is commonly used in acidic foods, such as pickles, chutneys, and sauces, to prevent spoilage. and is a commonly used preservative in Indian street food. Some studies suggest that high levels of sodium benzoate in the diet may increase the risk of hyperactivity and behavioural problems in children. In addition, when combined with ascorbic acid (vitamin C), sodium benzoate may form benzene, a carcinogenic substance.
Potassium Sorbate (E202)	Some studies have linked potassium sorbate to skin irritation, allergic reactions, and digestive issues.
Calcium Propionate (E282)	High levels of calcium propionate may cause skin irritation, digestive issues, and headaches. In addition, some studies suggest that calcium propionate may have a negative impact on gut health.
Ascorbic Acid (Vitamin C) (E300)	Used as an antioxidant and preservative in a wide range of foods, including fruit juices, canned fruits and vegetables, and processed meats. A synthetic Vitamin C, it is also commonly used in jams, and other products to prevent oxidation and spoilage. While ascorbic acid is generally considered safe, high levels of vitamin C may cause digestive issues, such as diarrhoea and nausea.
Butylated Hydroxy anisole (BHA) (E320) and Butylated Hydroxytoluene (BHT) (E321)	Used as an antioxidant in many processed foods, including cereals, snack foods, and baked goods, to prevent the oxidation of fats and oils and extend the shelf life of the product. Some studies have linked BHA/BHT to cancer in animals. However, the evidence is not yet conclusive in humans. BHA/BHT is also used in cosmetics, pharmaceuticals, and rubber products to prevent oxidation.
Propyl Gallate (E310)	Some studies suggest that high levels of propyl gallate may be carcinogenic in animals. In addition to its use as a preservative in food products, propyl gallate is also used in cosmetics, pharmaceuticals, and toiletries as an antioxidant.
Ethylenediaminetetraacetic Acid (EDTA) (E385) -While EDTA	Generally considered safe, some studies have suggested that high levels of EDTA may have negative impacts on kidney function in some individuals. Used as a chelating agent to bind metal ions, such as calcium and iron, in canned and bottled foods to prevent spoilage and maintain the quality of the product.
Sodium Metabisulphite (E223)	This preservative is commonly used in dried fruits, such as raisins and apricots, to prevent spoilage and to maintain their colour and flavour. Used in juices and other beverages to prevent spoilage and to maintain their colour and flavour. Sulphites (sulphur dioxide, sodium sulphite, sodium bisulphite) – are often used to preserve wine and beer.
Sodium Nitrite/ Nitrate (E250/E251)	A fertilizer and a component in gunpowder; used in cured meats, such as bacon, ham, and sausages, to prevent the growth of bacteria, preserve color and flavour, and prevent spoilage. High levels of sodium nitrite may increase the risk of cancer, particularly colon cancer. Sodium nitrate is not tasteless. In fact, it has a slightly salty and bitter taste, and carcinogenic compounds called nitrosamines are formed in the body from nitrite.
Ethylenediaminetetraacetic Acid (EDTA) (E385)	In addition to its use as a preservative in canned and bottled foods, EDTA is also used in the cosmetics industry as a chelating agent and in the medical field as a treatment for heavy metal poisoning.
Methylcellulose	Synthetic preservative used to preserve processed meats and cheese.

Potential health risks associated with preservatives are often related to high levels of exposure over long periods of time, which is why regulatory bodies have set maximum

limits for the use of these substances in food products. Additionally, individual sensitivity to preservatives may vary, and some individuals may experience adverse effects at lower levels of exposure. Therefore, it's always a good idea to consume processed foods in moderation and read labels carefully. It's important to note that all food additives, including preservatives, have been thoroughly tested and approved for use by regulatory bodies such as the US Food and Drug Administration (FDA) and the European Food Safety Authority (EFSA). Studies have suggested that long-term exposure to high levels of certain preservatives may pose health risks to individuals (Mirza, Asema & Kasim, 2017).

The most common easily available preservatives in India that are used in roadside stalls and street food hawkers include sodium nitrate, sodium benzoate, sodium meta bisulphite, sodium citrate, EDTA (chelating agents are used to remove metal ions from food, which can cause spoilage and degradation), sodium lignosulphonate, citric acid, propionic acid, polyethylene glycol, 1,4 butane diols. Potassium sorbate, citric acid, calcium propionate are commonly used in carbonated drinks, fruit juices, and candies to add tartness and prevent spoilage. Calcium propionate - is commonly used in bread and baked goods and also in dairy products, and processed meats.

Examples of some other synthetic preservatives are sodium propionate - commonly used in bread and baked goods to prevent mould growth, butyrate - used in meat products to prevent the growth of bacteria and fungi, sodium erythorbate - used in meat products to help preserve the colour and prevent the growth of bacteria, potassium bromates - used in flour and baked goods to improve dough strength and shelf life. TBHQ (tertiary butylhydroquinone) – is used in oils, fats, and fried foods to prevent oxidation and extend shelf life. Antioxidants are a type of preservative that prevents food from becoming rancid or spoiled due to exposure to oxygen. Some common antioxidants used in food include ascorbic acid (vitamin C) and alpha-tocopherol (vitamin E).

Flavouring Chemicals

Flavouring chemicals can be found in various food products and beverages. A brief explanation of the flavours associated with some of the chemicals is provided here. It's worth noting that these flavours can be highly subjective and can vary depending on the concentration and context in which they are used. Additionally, some of these chemicals can have negative effects on health at high levels, so they are typically used in small amounts and regulated by food safety agencies. Flavouring chemicals are often used to create a more consistent and cost-effective flavour profile.

Vanillin is a sweet, creamy, and vanilla-like flavour commonly found in vanilla extract, baked goods, and desserts. Ethyl vanillin is a more intense and stronger version of vanillin, often used in imitation vanilla flavouring. Acetaldehyde is a fruity and slightly sweet flavour commonly found in ripe fruits and alcoholic beverages. Maltol is a caramel-

like flavour often used in baked goods and caramel-flavoured products. 2-acetyl pyrazine is a nutty and roasted flavour commonly found in coffee, chocolate, and other roasted or toasted foods. Cinnamaldehyde is a spicy and warm flavour commonly found in spicy foods. Limonene is a citrusy and fruity flavour commonly found in citrus fruit juices such as lemons and oranges. Eugenol - spicy and warm flavour commonly found in (clove-like) spicy foods. Menthol is a cool and refreshing flavour commonly found in mint and other mint-flavoured products. Linalool - floral and slightly spicy flavour. Isoamyl acetate- fruity and banana-like flavour. Ethyl acetate fruity - sweet flavour commonly found in fruit juices and drinks such as apples, pears, and grapes. Butyric acid is a cheesy and rancid flavour commonly found in aged cheese and other fermented foods. Propionic acid - slightly sour and tangy flavour commonly found in cheese and other fermented foods. 4-hydroxy-2,5-dimethyl-3(2H)-furanone (HDMF) is a sweet and caramel-like flavour commonly found in strawberries. Citral- citrusy and lemon-like flavour commonly found in lemongrass. Geraniol- rose flavour, Furfural- nutty and slightly burnt flavour commonly found in baked goods and roasted coffee. 2-methylbutyric acid - cheesy and rancid flavour commonly found in cheese and other fermented foods. 2,3-pentanedione - buttery and creamy flavour commonly found in butter and other dairy products (Branen *et al.*, 2001).

Table 2: Different types of food additives with their effect on human health

Food Additive Types	Compounds	Deleterious Effect	Reference
Preservatives	Sorbic acid	Interactions with human serum albumins causing cytotoxicity, complication in immune balance, suppress immune function, hampering male reproductive system, gastric irritation, nausea, diarrhea, allergic reactions, asthma, skin rashes, dermatitis and allergies in the urticaria	Ambarwati, 2012; Herrero <i>et al.</i> , 2013; Anand & Sati, 2013; Silva & Lidon, 2016
	Benzoic acid		
	Propionic acid		
	Methyl-, ethyl-, butyl- and propyl-esters of p-hydroxybenzoic acid (PHB, parabens)		
	Sodium acetate		
	Sodium benzoate		
	Potassium sorbate		
Antimicrobials	Nitrates	Methemoglobinemia, allergies, palpitations, headaches, risk of tumorigenesis, and even carcinogenesis	Nair & Elmore, 2003; Xie <i>et al.</i> , 2011; Crowe, Elliott & Green, 2019
	Nitrites		
	Sulfites		
Antioxidants	Butylated hydroxyanisole (BHA)	Carcinogenic effect on liver and stomach tissues, immunotoxic effects like hypersensitivity, chronic inflammation, high toxicity and mutagenicity	Dolatabadi & Kashanian, 2010; Eskandani, Hamishehkar & Dolatabadi, 2014; Naidenko <i>et al.</i> , 2021
	Butylated hydroxytoluene (BHT)		
	Tertiary butyl hydroquinone (TBHQ)		
	NDGA (Nor dihydroguaiaretic acid)		
	DG (dodecyl gallate)		
	PG (propyl gallate),		
	OG (octyl gallate)		

Colorants	Tartrazine	Hyperactivity in children, allergies, cancer	Abiega-Franyutti & Freyre-Fonseca, 2021; Dey & Nagababu, 2022; Sultana <i>et al.</i> , 2023
	Titanium dioxide		
	Sunset Yellow FCF		
	Ponceau 4R		
	Allura Red AC		
	Quinoline yellow		
	Carmoisine		
	Greenplum Amaranth		
	Black PN		
	Cake Red 2G		
	Erythrosine		
	Green S		
	Brilliant Blue		
	Indigo carmine		
Flavour or Taste Enhancer	Monosodium glutamate (MSG)	Cytotoxic and genotoxic effects, potential DNA damage	Zanfirescu <i>et al.</i> , 2019; Xu <i>et al.</i> , 2022
	Monopotassium glutamate		
	Calcium Glutamate		
	Magnesium di-glutamate		
	Protein hydrolysate		
	Umami peptides		
	Dimethylpolysiloxane		
	Sodium Guanylate		
	Guanylic acid		
	Sodium Inosinate		
	Ethyl Maltol		
Maltol Sodium5-Ribonucleotide			
Acidity Regulator	Sodium lactate	Stinging, swelling, shortness of breath, a big weight gain, allergic reaction, skin burn, liver damage, hyperkalemia and NH ₃ toxicity	Cao <i>et al.</i> , 2020
	Citric acid		
Anticaking Agents	Calcium phosphate	nausea/vomiting, bone/muscle pain, headache, oxidative stress, respiratory distress, allergic reactions	Athinarayanan <i>et al.</i> , 2014
	Magnesium silicate		
	Sodium aluminosilicate		
	Potassium ferrocyanide		
Emulsifiers	Carboxymethylcellulose	Dysbiosis with overgrowth of mucus-degrading bacteria, deficiency in interleukin-10 or toll-like receptor 5, intestinal (small bowel) inflammation, food allergies, and risk of certain types of cancer, metabolic syndrome	Laudisi <i>et al.</i> , 2019b; Naimi <i>et al.</i> , 2021; De Siena <i>et al.</i> , 2022
	Lecithins		
	Mono- and diglycerides		
	Polysorbates		
	Carrageenans		
	Guar gums		
	Maltodextrin		
	Sodium stearyl lactylate		
Resistant starch			
Sorbitans			
Stabilizer	Xanthan gum	Altered gut bacteria, irritating the intestinal lining	EFSA Panel on Food Additives and
	Carageenan		

	Gum arabic		Nutrient Sources added to Food <i>et al.</i> , 2017
	Magnesium stearate		
Sweeteners	Acesulfame-K	Neurological damage, risk factor for cardiovascular disease prevention, gut dysbiosis, impaired glucose metabolism, glucose tolerance and support weight gain by negatively affecting microbiota	Cao <i>et al.</i> , 2020; Mahalak <i>et al.</i> , 2019; Debras <i>et al.</i> , 2022; Li <i>et al.</i> , 2022
	Aspartame		
	Saccharin		
	Sucralose		
	Cyclamate		
	Neotame		
	Sorbitol		
	Erythritol		
Thickeners	Dextrin	Altered mucus barrier, increased intestinal inflammation	Laudisi <i>et al.</i> , 2019a

Conclusion

The FDA follows a rigorous pre-market approval process for food additives, including food thickeners. Manufacturers must submit detailed safety data and evidence of the additive's safety and intended use before it can be approved for use. The FDA evaluates the safety of the additive and sets specific usage levels and conditions of use. Once approved, the FDA assigns a "Generally Recognized as Safe" (GRAS) status or issues a food additive regulation for the substance.

Food regulations as laid by authorities are binding across packaged foods from reputed industrial food manufacturers, while street foods and eateries all over India are flaunting these regulations and are mostly ignored by jurisdiction, surveillance, and regulatory authorities. Some commonly used preservatives (that are relatively inexpensive) and used in roadside stalls for storing curry, juices, and high-calorie products are sodium benzoate, potassium sorbate, nitrates (in curries), sodium metabisulfite for dried fruits, and ascorbic acid in fruit juice stalls. Some potential deleterious effects associated with food chemicals include allergic reactions in susceptible individuals and sensitivities or intolerances to specific food additives, resulting in digestive issues, headaches, or other adverse reactions. Individuals with specific health conditions, such as asthma, have sulfite sensitivity. Again, high doses or prolonged exposure due to overconsumption of packed meals and packaged foods with certain food additives may be consumed at higher than desirable levels, which will have toxic effects on the body. Additionally, different additives in combination with food can have complex effects that are not fully understood.

A balanced and varied diet that includes whole, minimally processed foods is generally recommended to minimize reliance on processed foods containing high levels of additives. Again, it's important to note that excessive or prolonged exposure to these substances may pose health risks, particularly for sensitive individuals. Readers are further advised to understand the health implications and current updated information like manufacturing practices, purity, and levels of use of these additives in different

categories of food and become aware as consumers. Therefore, it's always a beneficial idea to consume processed foods in moderation and be aware of the ingredients and additives.

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