

ASSESSMENT OF POTENTIAL HARMFUL EFFECTS ON HUMAN HEALTH FOR FOOD ADDITIVE FROM NATURAL RESOURCES

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ABSTRACT

Many different food additives have been developed over time to meet the needs of large-scale food processing. Additives are added to ensure processed food remains safe and in good condition throughout its journey from factories or industrial kitchens, to warehouses and shops, and finally to consumers. Food additive, any of various chemical substances added to foods to produce specific desirable effects. Additives such as salt, spices, and sulfites have been used since ancient times to preserve foods and make them more palatable. In a time where the public is more aware and interested with what they eat, natural additives have been gaining interest both from the food industries and the consumers.

Keywords: Natural Food Additives, Colorants, Preservatives, Effects, Spices.

I. INTRODUCTION

Today, globally, hundreds of additives are added to food, while many others have been banned over the years [1]. Over the years, several ingredients have performed useful functions in a diversity of foods, providing an affordable, nutritious, tasty, colorful, and safe food supply, with food additives and technology developments playing crucial roles [2]. Their use in the food industry is fundamental, allowing loss reduction, quality increase, shelf-life extension, new formulations development, and standardization, thus meeting the increasingly challenging market demands [3]. Used in all types of foods, additives are becoming increasingly prevalent and important in human nutrition, being subjected to strict regulation, despite the controversy caused by conflicting results obtained in a large number of studies involving these compounds, along with different governments interpretations [4].

Food as a basic need

The importance of food for mankind is undeniable; there is still no way of living without eating, therefore, this commodity is of utmost importance for the well-being of every man, woman and child across the world. Although the need to feed has maintained itself immutable across the ages, the way we consume foodstuffs has seen deep changes. From the local gatherers in the Paleolithic to the domestications of animals and vegetables there was a huge leap, only surpassed by the commercial trading.

Some additives have been used for centuries as part of an effort to preserve food, for example vinegar (pickling), salt (salting), smoke (smoking), sugar (crystallization), etc. This allows for longer-lasting foods such as bacon, sweets or wines. With the advent of ultra-processed foods in the second half of the twentieth century, many additives have been introduced, of both natural and artificial origin. Food additives also include substances that may be introduced to food indirectly (called "indirect additives") in the manufacturing process, through packaging, or during storage or transport[5-6].

The United States Food and Drug Administration (FDA) lists these items as "generally recognized as safe" (GRAS)[7]; they are listed under both their Chemical Abstracts Service number and FDA regulation under the United States Code of Federal Regulations.

There are four general categories of food additives: nutritional additives, processing agents, preservatives, and sensory agents. These are not strict classifications, as many additives fall into more than one category. For more information on additives, see emulsifier; food colouring; nutritional supplement; and preservative.

Nutritional additives

Nutritional additives are used for the purpose of restoring nutrients lost or degraded during production, fortifying or enriching certain foods in order to correct dietary deficiencies, or adding nutrients to food substitutes. The fortification of foods began in 1924 when iodine was added to table salt for the prevention of goitre. Vitamins are commonly added to many foods in order to enrich their nutritional value. For example, vitamins A and D are added to dairy and cereal products, several of the B vitamins are added to flour, cereals, baked goods, and pasta, and vitamin C is added to fruit beverages, cereals, dairy products, and confectioneries. Other nutritional additives include the essential fatty acid linoleic acid, minerals such as calcium and iron, and dietary fibre.

Processing agents

A number of agents are added to foods in order to aid in processing or to maintain the desired consistency of the product.

Processing additives and their uses		
function	typical chemical agent	typical product
anticaking	sodium aluminosilicate	Salt
bleaching	benzoyl peroxide	Flour
chelating	ethylenediaminetetraacetic acid (EDTA)	dressings, mayonnaise, sauces, dried bananas
clarifying	bentonite, proteins	fruit juices, wines
conditioning	potassium bromate	flour
emulsifying	lecithin	ice cream, mayonnaise, bakery products
leavening	yeast, baking powder, baking soda	bakery products
moisture control (humectants)	glycerol	marshmallows, soft candies, chewing gum
pH control	citric acid, lactic acid	certain cheeses, confections, jams and jellies
stabilizing and thickening	pectin, gelatin, carrageenan, gums (arabic, guar, locust bean)	dressings, frozen desserts, confections, pudding mixes, jams and jellies

Preservatives

Food preservatives are classified into two main groups: antioxidants and antimicrobials. Antioxidants are compounds that delay or prevent the deterioration of foods by oxidative mechanisms. Antimicrobial agents inhibit the growth of spoilage and pathogenic microorganisms in food.

Food preservatives	
chemical agent	mechanism of action
Antioxidants	
ascorbic acid	oxygen scavenger
butylated hydroxyanisole (BHA)	free radical scavenger
butylated hydroxytoluene (BHT)	free radical scavenger
citric acid	enzyme inhibitor/metal chelator
sulfites	enzyme inhibitor/oxygen scavenger
tertiary butylhydroquinone (TBHQ)	free radical scavenger
tocopherols	free radical scavenger
Antimicrobials	
acetic acid	disrupts cell membrane function (bacteria, yeasts, some molds)
benzoic acid	disrupts cell membrane function/inhibits enzymes (molds, yeasts, some bacteria)
natamycin	binds sterol groups in fungal cell membrane (molds, yeasts)
nisin	disrupts cell membrane function (gram-positive bacteria, lactic acid-producing bacteria)
nitrites, nitrites	inhibits enzymes/disrupts cell membrane function (bacteria, primarily Clostridium botulinum)
propionic acid	disrupts cell membrane function (molds, some bacteria)
sorbic acid	disrupts cell membrane function/inhibits enzymes/inhibits bacterial spore germination (yeasts, molds, some bacteria)
sulfites and sulfur dioxide	inhibits enzymes/forms addition compounds (bacteria, yeasts, molds)

Sensory agents**Colorants****Soft drink**

Many soft drinks, including colas, contain colorants.

Colour is an extremely important sensory characteristic of foods; it directly influences the perception of both the flavour and quality of a product. The processing of food can cause degradation or loss of natural pigments in the raw materials. In addition, some formulated products, such as soft drinks, confections, ice cream, and snack foods, require the addition of colouring agents. Colorants are often necessary to produce a uniform product from raw materials that vary in colour intensity. Colorants used as food additives are classified as natural or synthetic. Natural colorants are derived from plant, animal, and mineral sources, while synthetic colorants are primarily petroleum-based chemical compounds.

Natural colorants

Most natural colorants are extracts derived from plant tissues. The use of these extracts in the food industry has certain problems associated with it, including the lack of consistent colour intensities, instability upon exposure to light and heat, variability of supply, reactivity with other food components, and addition of secondary flavours and odours. In addition, many are insoluble in water and therefore must be added with an emulsifier in order to achieve an even distribution throughout the food product.

See list of food additives for a complete list of all the names.

Categories

Food additives can be divided into several groups, although there is some overlap because some additives exert more than one effect. For example, salt is both a preservative as well as a flavor [8].

Acidulants

Acidulants confer sour or acid taste. Common acidulants include vinegar, citric acid, tartaric acid, malic acid, fumaric acid, and lactic acid.

Acidity regulators

Acidity regulators are used for controlling the pH of foods for stability or to affect activity of enzymes.

Anticaking agents

Anticaking agents keep powders such as milk powder from caking or sticking.

Antifoaming and foaming agents

Antifoaming agents reduce or prevent foaming in foods. Foaming agents do the reverse.

Antioxidants

Antioxidants such as vitamin C are preservatives by inhibiting the degradation of food by oxygen.

Bulking agents

Bulking agents such as starch are additives that increase the bulk of a food without affecting its taste.

Food coloring

Colorings are added to food to replace colors lost during preparation or to make food look more attractive.

Fortifying agents

Vitamins, minerals, and dietary supplements to increase the nutritional value.

Color retention agents

In contrast to colorings, color retention agents are used to preserve a food's existing color.

Emulsifiers

Emulsifiers allow water and oils to remain mixed together in an emulsion, as in mayonnaise, ice cream, and homogenized milk.

Flavorings*

Flavorings are additives that give food a particular taste or smell, and may be derived from natural ingredients or created artificially.

*In EU, flavorings do not have an E-code and they are not considered as food additives.

Flavor enhancers

Flavor enhancers enhance a food's existing flavors. A popular example is monosodium glutamate. Some flavor enhancers have their own flavors that are independent of the food.

Flour treatment agents

Flour treatment agents are added to flour to improve its color or its use in baking.

Glazing agents

Glazing agents provide a shiny appearance or protective coating to foods.

Humectants

Humectants prevent foods from drying out.

Tracer gas

Tracer gas allows for package integrity testing to prevent foods from being exposed to atmosphere, thus guaranteeing shelf life.

Preservatives

Preservatives prevent or inhibit spoilage of food due to fungi, bacteria and other microorganisms.

Stabilizers

Stabilizers, thickeners and gelling agents, like agar or pectin (used in jam for example) give foods a firmer texture. While they are not true emulsifiers, they help to stabilize emulsions.

Sweeteners

Sweeteners are added to foods for flavoring. Sweeteners other than sugar are added to keep the food energy (calories) low, or because they have beneficial effects regarding diabetes mellitus, tooth decay, or diarrhea.

Thickeners

Thickening agents are substances which, when added to the mixture, increase its viscosity without substantially modifying its other properties.

Packaging

Bisphenols, phthalates, and perfluoroalkyl chemicals (PFCs) are indirect additives used in manufacturing or packaging. In July 2018 the American Academy of Pediatrics called for more careful study of those three substances, along with nitrates and food coloring, as they might harm children during development [9].

Key facts

- Food additives are substances primarily added to processed foods, or other foods produced on an industrial scale, for technical purposes, e.g. to improve safety, increase the amount of time a food can be stored, or modify sensory properties of food.
- Food additives are substances not normally consumed as a food by themselves and not normally used as typical ingredients in foods. Most minimally processed and unprocessed foods do not contain food additives.

- Food additives are assessed for potential harmful effects on human health before they are approved for use.
- Authoritative bodies at the national, regional and international levels are responsible for evaluating the safety of food additives.
- The Joint FAO/WHO Expert Committee on Food Additives (JECFA) is the international body responsible for evaluating the safety of food additives for use in foods that are traded internationally.

Safety assessments

Food additives are assessed for potential harmful effects on human health before they are approved for use. Authoritative bodies at the national, regional and international levels are responsible for evaluating the safety of food additives. The Joint FAO/WHO Expert Committee on Food Additives (JECFA) is the international body responsible for evaluating the safety of food additives for use in foods that are traded internationally.

WHO response

Evaluating the health risk of food additives

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 assessments 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 internationally. This applies whether food additives come from natural sources 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.

International standards for the safe use of food additives

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.

How do I know which additives are in my food?

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.

II. CONCLUSION

Enhancing the attributes of the food product to make it more appealing and sustainable with the addition of food additives is an ancient concept. In the modern world, processed food is higher in demand which involves the growing use of food additives of chemical origin, which could impose detrimental health effects. Hence, while using food additives it is important for the manufacturer to check the guidelines of the authorities and relevant regulations should be taken into consideration. Although adding these food additives help in bringing a plethora of innovative and value-added products, it is of prime importance to see the justified usage and the levels of food additives in which they are used.

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