

Food Additives and Health Risks

***Dr. Sushmita Nair**

Food additives have been used by man since ancient times .

Food additives are substances that are not normally consumed as food itself but are added to food intentionally for one or more technological purposes.

The reasons for their use are to protect food from chemical and microbiological attack, to even out seasonal supplies, to improve their eating quality and to improve their nutritional value.

Conclusion

Food additives preserve the freshness and appeal of food between the times it is manufactured and when it finally reaches the market. Additives may improve their taste, texture, consistency or color. All food additives approved for use are carefully regulated by federal authorities to ensure that foods are safe to eat and are accurately labeled. (Neltner et.al. 2011)

Food additives are classified into many functional classes,

A. Substances added to improve the quality of food

- (1) Colouring agents
- (2) Flavouring agents
- (3) Texture improving agents
 - (a) Emulsifying agents
 - (b) Stabilizers and thickener
 - (C) Miscellaneous agents

(4) Sweetening Agents

B. Preserving agents

- (1) Anti-microbial substances.
- (2) Anti-oxidants.

Accumulating evidence from nonhuman laboratory and human epidemiologic studies suggests that colorings, flavorings, chemicals deliberately added to food during processing (direct food additives), and substances in food contact materials (including adhesives, dyes, coatings, paper, paperboard, plastic, and other polymers) that may come into contact with food as part of packaging or processing equipment but are not intended to be added directly to food (indirect food additives) may contribute to disease and disability in the population (Honorato et. al. 2013)

(1) Colouring agents

Food color is important, because humans have evolved to notice it. Colour is an extremely important characteristic of food as it directly influences the perception of both flavor, taste of a food product and reaction as it enhances flavors and stimulates the appetite. Food coloring agents may be natural-extracted from plants, animals, or mineral resource; or synthetic- derived from petroleum based compounds. Examples of natural colorants are anthocyanins(red, blue), betacyanins(red), carotenoids (orange ,yellow , red) used in various beverages , desserts , soups etc. However, manufacturers prefer artificial food dyes to natural options because they get more vibrant colors, last longer shelf life and are of low cost.

Synthetic artificial food colors (AFCs) are added to foods and beverages for aesthetic reasons, and the resulting brightly colored products are appealing to the consumers , young children in particular. AFCs serve as best substitutes in fruit juice drinks that contain little or no actual fruit. Although dyes may make drinks, candy and other foods look better, many are associated with adverse side effects .

Over the last several decades, studies have raised concerns regarding the effect of artificial food colors (AFCs) on child behavior and their role in exacerbating attention deficit/hyperactivity disorder symptoms. Analysis has shown that some synthetic colorants like Brilliant Blue FCF, Indigo Carmine, Fast Green FCF, and Erythrosine are poorly absorbed, and show little toxicity. However, consumption of foods containing artificial dyes can cause an inflammatory response in the body, causing activation and disruptions of the immune system and toxicological effects in the gut. (Feng et. Al 2012) Studies have indicated that Tartrazine induces hypersensitive reactions in some persons, while a very high concentration of Allura Red AC, greater than 10 percent, causes psychological toxicity.(Kleinman 2011)

(2) Flavoring Agents

A flavor additive is a single chemical or blend of chemicals of natural or synthetic origin added to food to enhance natural flavor; introduce a new flavor, or to replace flavor that may be lost during processing of a food product. These substances are used in a wide variety of foods from confectionery and soft drinks to cereals, cakes and yoghurts, in comparatively small amounts.

Natural flavorings are extracted from plants, spices, herbs, animals, or microbial fermentations, but artificial flavorings are derived from synthetic compounds chemically formulated to act as natural flavorings. Artificial flavorings are preferred for commercial purposes, because of the scarcity, higher cost, and insufficient potency of natural flavorings.

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Monosodium glutamate is the most commonly used flavour enhancer in broths, soups, canned and frozen vegetables, spice blends, gravies, meats, poultry, seafood, and sauces. Extravagant use of MSG is not desirable as when ingested in large amounts it may produce negative physical reactions such as burning sensations, facial tightness or pressure, and a tingling sensation in some individuals. MSG may also cause increased sodium in blood, undesirable for salt sensitive hypertensive individuals. Further, monosodium glutamate reportedly elicits harmful effects of in children affecting brain development. Foods that contain salicylates have been proven to cause tinnitus, vertigo, insomnia, hearing loss, behavioral changes in children and others. Other effects of flavor enhancers are: migraines, asthma, fatigue, nausea, dizziness, numbness, heart palpitations, depression, shakes, skin irritation, hyperactivity, brain damage, nervous system damage, obesity and diabetes (Husarova 2007)

(3) Texture improving agents

This group of food additives include substances of various kinds may be classified as

- (a) Emulsifying agents
- (b) Stabilizers and thickeners.
- (c) Miscellaneous agents
- (d) Emulsifying agents :

An emulsifying agent is used to maintain homogeneity or uniform dispersion of one liquid in another and give foods a good texture. Emulsifiers give foods a good texture and homogeneity by making it possible for immiscible liquids, to mix well such as in ice-creams or mayonnaise.

Emulsifiers also act to prevent the formation of ice and sugar crystals in foods in case of temperature changes such as in ice cream with sugar; can be used to encapsulate flavor compounds; and improve volume, fineness and uniformity of processed baked products.. Silicone is identified as an antifoaming agent for beverages and lecithin is a common emulsifying agent. (Inetianbor et al 2015)

(b) Stabilizers and thickeners

Stabilizers and thickeners are used as gelling agents to increases the smoothness, viscosity or consistency of food products such as in dressings, frozen desserts, confectionaries, pudding mixes, jams and jellies by acting as stabilizing or thickening emulsions. Examples are pectin, gelatin, carrageenan, and gums (arabic, guar, locust bean). Gelatin with gums is commonly used to eliminate suspended particles in apple juice. In case of Vegans foods, Agar-agar is used as a substitute for gelatin. Most stabilizing and thickening agents are polysaccharides (starches or gums), or proteins such as gelatin.

(C) Miscellaneous agents

Anticaking agents. Anticaking agents stop powders and granulated ingredients from clumping. They can be derived from natural sources or manufactured from chemical or artificial ingredients.

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Humectants. Moisture in food can be controlled by dehydration or chemically binding it with humectants. Humectants are hygroscopic substances used for moisture control in foods to prevent foods from drying out, and also prevent crystallization of sugar contained in confectionaries.

Glycerol has a moisture control effect and is used as a humectant in confectionery such as marshmallows, soft candies, chocolates and chewing gum. Further, cookies do not dry out so quickly, and meat and fish products have a longer shelf life. Cellulose ground to fine powder is a raw material obtained from plant fibers such as wheat, oat and bamboo and is used as a natural humectant. Some individuals show sensitivity to humectants, especially when ingested in large amounts. Symptoms are nausea or diarrhea and large doses of sugar alcohols may have a laxative effect.

Chelating agents. Chelating agents, also known as sequestering agents are used in processing to protect food products from specific enzymatic reactions that cause deterioration during processing and storage. The mode of actions is mainly the binding of any minerals that may be present in food, such as calcium and Magnesium, which are necessary as cofactors for the enzymatic activity. Ethylenediaminetetraacetic acid (EDTA) is used as a chelating agent in dressings, mayonnaise, sauces, dried bananas; and potassium bromate used for conditioning flour.

pH control agents. Chemical and biological reactions are optimized within certain PH ranges. Citric acid, and lactic acid are used for either controlling or changing the acid–base balance of foods or to get specific flavors or colors. The acids are commonly used in cheese making, confectionaries, jams and jellies.

(4) Sweetening Agents

Sweetening agents are classified into nutritive sweeteners and non-nutritive sweeteners. Sucrose commonly known as “table sugar”, is the most popular nutritive sweetener in foods and plays an important role in some body functions. Sucrose contains calories which give energy to the body when consumed, It can be harmful when consumed in high quantities. Too much sugar can induce undesirable changes in osmotic pressure in body cells, insulin rush and intolerance reactions in diabetic patients. High fructose consumption as contained in soft drinks and its exclusive hepatic metabolism, has been associated with excessive hepatic energy, simple steatosis and hepatic fat accumulation known as Non-alcoholic fatty liver disease (NAFLD).

Artificial sweeteners are non-nutritive low-calorie or calorie-free chemical substances used as substitutes for table sugar to sweeten foods and drinks. A sugar substitute is a food additive that provides a sweet taste like that of table sugar or more intense. Artificial sweeteners are not carbohydrates, and are referred as ‘intense sweeteners’ because they are many times sweeter than table sugar. Examples are: Aspartame, Acesulfame K, Saccharine, Sucralose, Sorbitol, Stevia and Xylitol.

There is rising concern over high consumption of sweeteners commonly associated with overweight, obesity, diabetes, hypertension, hypercholesterolemia and cardiovascular disease. Some studies have correlated saccharin, acesulfame-K (Ace-K) and aspartame to negative health effects. They induce

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DNA damage in human peripheral lymphocytes. The toxicity symptoms of Ace-K are headache, depression, nausea, mental confusion, liver and kidney malfunction effects. Although low consumption of artificial sweeteners causes mild symptoms, at high concentrations can induce threatening brain damage. Aspartame causes gastrointestinal problems and is toxic to humans at high levels (Chaudhary 2010)

(B) Preserving agents

Preserving agents are substances that are added to a food to prevent or delay undesirable changes caused by the action of microorganisms, enzymes and/or physical agents in contact with food. Food preservation is one of the oldest technologies used by humans. Food preservatives are classified into two main groups: antimicrobials and antioxidants.

Anti-microbial preservatives are chemical substances which are added to food to prevent microbial spoilage. This includes traditional preservatives like salt, sugar, vinegar. Nitrates and nitrites are used in curing of meat which helps to improve the colour, texture and flavour. Acetic acid is used in Pickle and sauce manufacture. Sorbic acid is used in baked goods. Propionic acid prevents bread and cakes from moulds and ropes. Benzoic acid is the most common preservative used. Sulphur dioxide and metabisulphite are extensively used in the preservation of fruit, pulp and juices to prevent enzymatic and non-enzymatic browning. Sodium benzoate, a widely used food preservative has great effect on glucose homeostasis and metabolic profile of humans (Lennerz et al 2015)

Studies have indicated elevated antibiotic resistance in bacteria associated with animals fed on feed containing antimicrobials, which spreads to other animals and humans either directly or indirectly via the food chain, water, air, and manure and sludge-fertilized soils. Diet quality including broad use of food additives can perturb gut homeostasis, thereby promoting tissue-damaging inflammatory responses and increases susceptibility to infections (Marshall and Levy 2011)

Antioxidants are chemical compounds that delay or prevent the deterioration of foods by oxidative mechanisms. They act as free radical scavengers, metal chelators, and enzyme inhibitors. Examples are ascorbic acid, butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), citric acid, sulfites, tertiary butylhydroquinone (TBHQ) and tocopherols. Tocopherols are used in processed meats as an alternative to using nitrites, potatoes and some baked products. TBHQ acts as an antioxidant and is added to processed foods to extend the shelf life, prevent iron-containing foods from discoloration and rancidity of fats and oils. However, recently TBHQ has gained a controversial reputation. Recent studies on TBHQ have linked it to development of tumors, vision disturbances, liver enlargement, neurotoxic effects, convulsions, and paralysis in laboratory animals. BHA and TBHQ are both suspected to affect human behavior, Attention Deficit Hyperactivity Behavior (ADHD). (Morteza et al (2014))

High molecular-weight Phthalate esters are used in a wide range of consumer items and in industrial food processing like clear food wrap, plastic tubing etc. Metabolites of phthalates are associated with oxidative stress, which appears to reduce insulin-dependent stimulation of insulin-signaling elements and glucose transport activity, as well as endothelial relaxant nitric oxide (Ted 2006)

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Although use of additives is inevitable in food industry- tailor made for specific needs, low cost, functional foods and low calorie and extended shelf life . Before an additive is permitted in any food, they must be a critical evaluation in animals and human beings of its physiological and biochemical behaviour. A safe level should be allowed which is free from all possible toxic effects. They should not be used to disguise the use of faulty processing and handling techniques and to deceive the customer. Several food additives have been linked to certain types of health risks including allergies, asthma and cancer, irritable bowel syndrome, mood swings, skin irritations or reactions, constipation, migraines, autism, sleep disturbance, and nasal congestion, which calls for further research and stricter regulation for their use in industry. Some food additives disrupt endocrine system of children, causing hormonal imbalance, which affects normal growth and development children (Landrigan et al 2011) Food safety monitoring authorities should continuously monitor and guide the control and regulate the use of food additives to prevent adverse effects. A lasting solution has been to turn to organic foods to stop or reverse these effects, where feasible.

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