ISSN 2475-5451

Review Article

International Journal of Diabetes & Metabolic Disorders

Effect of Food Additives on The Food Quality and Safety: A Review

Tolcha Techane Alemu[*1]

[1]*Department of Post-harvest Management, Jimma University College of Agriculture and veterinary medicine, Jimma, Ethiopia.*

[*]Corresponding author:
Tolcha Techane Alemu, Department of Post-harvest Management, Jimma University College of Agriculture and veterinary medicine, Jimma, Ethiopia.

Submitted: 14 Nov 2022; **Accepted**: 21 Nov 2022; **Published**: 26 Nov 2022

Citation: *Tolcha Techane Alemu. (2022). Effect of Food Additives on The Food Quality and Safety: A Review. Int J Diabetes MetabDisord, 7(2), 229-237.*

Abstract

This paper is aimed to review the effect of food Additives on the food quality and food safety. Food additives are any organic substances that are intentionally or unintentionally added to food in small quantities during production or processing to improve the organoleptic quality (colour, flavour, appearance, taste and texture) of the food. They contain functional classes, such as antioxidants, colorants, emulsifiers, preservatives, stabilizers, sweeteners, and thickeners. They also increase the shelf life of the food by maintaining product consistency. We may have problems with additives, substances deliberately added to foods, to add colour, to make them tastier, to make them sweeter, to make them last longer, or to break down big fat globules into little ones, so that the fat and water do not separate. Some people are sensitive to particular food additives and may have reactions like hives or diarrhoea. It is important to use food additives to improve the quality of a food. Food additive used as Preservative because of they act as antimicrobial and antioxidants used to prevent microbial spoilage. This Preservation is basically done for preserve the natural characteristics of food and preserves the appearance of food and increase the shelf value of food for some long-term storage. Food additives also give the food a smooth and consistent texture example emulsifier prevent liquid products from separating; Improve or preserve the nutrient value; Maintain the wholesomeness of foods; Control the acid-base balance of foods and provide leavening, provide color and enhance flavor. Therefore, Food additives are substances that food manufacturer's use in small quantity to maintain the quality properties or enhance their colour, flavour and texture at the same time also affects the original quality characterises of food including safety of foods.

Keywords: Food Additives, Preservatives, Antioxidants, Food Quality and Safety.

Introduction

Foods in the second half of the twentieth century, many more additives have been introduced, of both natural and artificial origin. Food Additives are defined by the United States food and drug Administration as any substance, the intended use of which results or may reasonably be expected to result, directly or indirectly, in its becoming a component or otherwise affecting the characteristics of any food (Alves et al., 2008).It is substance or mixture of substances other than a basic food stuff, which is present in a food as a result of any aspect of production, processing, storage, or packaging (Mirza et al., 2017).

They help to increase the shelf life of the food by maintaining product consistency, wholesomeness and freshness. They added to foods to preserve flavour or enhance its taste and appearance (Abdulmumeen et al., 2012). The food additives must be added in regulated quantities, concentration and should be within the acceptable daily intakes (ADIs) above which they can have some devastating effects on the consumer. They used for production, processing, treatment, packaging, transportation or storage of food (Femi Oloye et al., 2020). Food preservative is a class of food additive that help to prevent food spoilage and increase shelf life by disrupting the food of any pathogenic microorganisms like Clostridia spp, Bacillus cereus, Staphylococcus aureus and other microorganisms. Food preservatives preserve food by bringing down the pH and also stabilizing the redox potential of the food so as to make the environment unfavorable for microbes to strive.

Nowadays, most people tend to eat the ready-made foods available in the market, rather than preparing them at home (Inetianbor et al., 2015). Such foods contain some kind of additives and preservatives, so that their quality and flavour is maintained and they are not spoiled by bacteria and yeasts. More than 3000 additives and preservatives are available in the market, which are used as antioxidants and antimicrobial agents. Some of the commonly used food additives and preservatives are aluminum silicate, amino acid compounds, ammonium carbonates, sodium nitrate, propyl gallate, butylated hydrozyl toluene (BHT), butylated hydroxyanisole (BHA), monosodium glutamate, white sugar, salt, potassium bromate, potassium sorbate and sodium benzoate. Some of these colouring substances are erythrosine (red), cantaxanthin (orange), amaranth (Azoic red), tartrazine (Azoic yellow) and annatto bixine

(yellow orange) (Miller and Millstone,2010; Gurgel et al., 2015).

When the food is to be stored for a prolonged period, use of additives and preservatives is essential in order to maintain its quality, wholesomeness, taste, appearance and flavour. The excess water in the foods can cause the growth and proliferation of bacteria, fungi and yeasts and hence food spoilage. Use of additives and preservatives prevents spoiling of the foods due to the growth of bacteria and fungi. Additives and preservatives maintain the quality and consistency of the foods. They also maintain palatability and wholesomeness of the food, improve or maintain its nutritional value, control appropriate pH, provide leavening and colour, and enhance its flavour red for cherry, green for lime.

Therefore, food additive maintains quality and safety of food characteristics through reduce water activity and reduce growth and multiplication microorganism, reduce chemical and biochemical reaction. The terms food safety and food quality can sometimes be confusing. Food safety refers to all those hazards, whether chronic or acute, that may make food injurious to the health of the consumer. Quality includes all other attributes that influence a product's value to the consumer. Food quality is the quality characteristics of food that is acceptable to consumers. However, food additives affect the quality attributes and safety foods. Therefore, this review, reviews study made by numerous researchers and reviewers on effect of food additive on food quality and safety.

LITERATURE REVIEW

Food Additives

Food additive are any substance not normally consumed as a food in itself and not normally used as a characteristic ingredient of food, whether or not it has nutritive value, the intentional addition of which to food for a technological purpose in the manufacture, processing, preparation, treatment, packaging, transport or storage of such food results, or may be reasonable expected to result, in it or its by-products becoming directly or indirectly a component of such food (Joint et al., 2016). Because food additives have become essential in the food industry, the EFSA Panel in 1988 introduced the regulation of labeling and numbering of food additives, such as food colorings, flavors, taste enhancers and preservatives, to promote a free and fair market of safe food products within the European Community (Haen, 2014).

Food Additives contain Preservative and Antioxidant (McCann, 2007). Preservative is any substance which is capable of inhibiting, retarding or arresting the process of fermentation, acidification or other deterioration of food of masking any of the evidence of putrefaction Antioxidant is any substance which delays, retards or prevent the development in food of rancidity or other flavour deterioration due to oxidation.Food additives are substances that food manufacturers intentionally add to food in small quantity during production or processing to improve the organoleptic of the food.

Current research also suggests that consumers are worried and would like to be better informed about the potential health risks of food additive use and consumption (Bearth et al. 2014). food additives are claimed by many nutritionists to be an essential element in the spread of snaking culture as well as the commercial success of so-called junk foods, which are often held responsible, at least in part, in the increased prevalence of non-communicable diseases (Mepham ,2011).

Effect of Food Additives on Food Quality and Safety

The effects of food additives may be immediate or may be harmful in the long run if one has constant exposure or accumulations. Immediate effects may include headaches, change in energy level, and alterations in mental concentration, behavior, or immune response (Patil et la.,2017). Long-term effects may increase one's risk of cancer, cardiovascular disease and other degenerative conditions. Some modern synthetic preservatives have become controversial because they have been shown to cause respiratory or other health problems (Upadhyay et al.,2012) Some studies point to synthetic preservatives and artificial colouring agents aggravating ADD & ADHD symptoms in those affected (Gottschalk, and Nowack, 2011).

Chemical additives in food and drinks have been linked to temper tantrums and other bad behaviour (Patil et al., 2014). It also affects some chemical properties like pH, titrable acidity, total soluble solid, texture, color, taste and flavour etc.A food additive is anything that affects food (directly or indirectly) or is a component of food. Legally, a food additive is anything added to food, or used in food preparation, that is not on the Generally Recognized as Safe (GRAS) list. The GRAS list includes products such as flour, sugar, and salt - any ingredient that has been used for a long time and has shown no adverse effects; so, food additives are ingredients that need government approval before they can be added to food (Fois, 2016).

Effect of different chemical additives on total soluble solids (T.S.S.)

Chemical additives affect TSS content of the foods. Example tomatoes juice prepared with Na-benzoate contained 13% TSS on the day of preparation and 12.8% TSS content after 60 days storage period. On the other hand, juice prepared with sorbic acid contained 13% TSS content on the day of preparation and 12% TSS content after 60 days storage period (Hough, W.L. and Rogers, R.D., 2007).

Effect of Different Chemical Additives on pH

Some researches show that chemical additives have differential effect on pH of food products. Products like tomato Juice prepared with Na-benzoate had pH value 3.615 on the day of preparation and 3.610 after 60 days storage period. On the other hand, Juice prepared with sorbic acid had pH value 3.65 on the day of preparation and 3.58 after 60 days storage period (Hasanuzzaman et al., 2011). One important risk posed by additives is the loss of the nutritional value of foods, which can result in inappropriate diets and subclinical malnutrition. The wide use of food additives can contribute to malnutrition in the following ways; the common fac-

tor in most foods containing additives is high salt, sucrose and fat content. Pure sucrose, by definition, contains literally no nutrients, only calories; fat, on the other hand, contains few nutrients and is very high in calories. In addition, foods containing additives are mainly processed foods, which have lost a substantial proportion of their nutritional value through the processing procedure (Tuormaa, 1994).

Tartrazine

Tartrazine (trisodium 5-hydroxy-1-(4- sulfonatophenyl)-4-(4-sulfonatophenylazo)-H-pyrazol-3-carboxylate) is also known as FD&C Yellow no. 5. It is an artificially synthesized azo pigment and 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. However long-term and excessive
ingestion of atrazine may cause a variety of adverse effects (Amin et al., 2010).

Curcumin

Clinical trials in human have been used to study the effects of curcumin on various, including multiple myeloma, pancreatic cancer, myelodysplastic syndromes, colon cancer, psoriasis and Alzheimer's disease (Hough et al., 2007). In vitro and in vivo studies suggest that curcumin can have carcinogenic effect (Burgos-Moron et al., 2010). Clinical studies in humans with high doses (2-12grams) of curcumin. have shown few side effects, with some subjects reporting mild nausea or diarrhea (Hsu and Cheng, 2007). Curcumin have been found to alter iron metabolism by chelating iron and suppressing the protein hepcidin, potentially causing iron deficiency in susceptible patients (Jiao et al., 2009). Curcumin also has embryotoxic and teratogenic effects on zebra fishes (Tfouni, and Toledo,2002).

Butylated Hydroxytoluene (BHT) and Butylated Hydroxyanisole (BHA)

Butylated Hydroxytoluene (BHT) and butylated Hydroxyanisole (BHA) are synthetic monocyclic phenolic compounds. They are commonly used in many food formulations as food preservatives for their antioxidant properties (Hamzah et al., 2013). BHA and BHT have been suspected of inducing health risks such as child hyperactivity, damage to the lungs, liver, and kidneys, and most importantly, cancer (Tran, 2013).

Artificial Sweeteners

These contribute to one of the several side effects of food additives because of their sweet nature which make them to be used indiscriminately by food producers and individual as well. Artificial sweeteners considered in this review include Saccharin, Aspartame, Sucralose and Neotame. Saccharin: The safety concerns of consuming products with saccharin remain even with the removal of the warning. According to a report written in 1997 by the Center for the Cheung 2007 in response to the National Toxicology Program (NTP) removing saccharin from the list of potential carcinogens, it would be highly imprudent for the
NTP to delist saccharin. Doing so would give the public a false sense of security, remove any incentive for further testing, and result in greater exposure to this probable carcinogen in tens of millions of people, including children (indeed, fetuses). If saccharin is even a weak carcinogen, this unnecessary additive would pose an intolerable risk to the public. Thus, we urge the NTP on the basis of currently available data to conclude that saccharin is reasonably anticipated to be a human carcinogen because there is sufficient evidence of carcinogenicity in animals (multiple sites in rats and mice) and 'limited' or 'sufficient' evidence of carcinogenicity in humans (bladder cancer) (Kroger, 2006).

Classifications of Food Additives

According to the Food Protection Committee of the Food and Nutrition Board, food additives may be defined as a substance or mixture of substances, other than a basic foodstuff, which is present in a food as a result of any aspect of production, processing, storage, or packaging. Additives can be divided into six major categories: preservatives, nutritional additives, flavouring agents, colouring agents, texturizing agents and miscellaneous additives. Several additives commonly serve more than one function in foods. Additives are classified into several ways depend on occurrence, source and their function in food. Some of these additives are natural, like the colourings annatto and curcumin, and the sweetener agave.

Intentional Food Additives

Those additives are deliberately by adding to the food. Direct additives are those that are intentionally added to foods for a specific purpose while indirect additives are those to which the food is exposed during processing, packaging, or storing (Boca Raton and Smoley, 1993).

E.g. Preservatives are Substances that inhibit growth of mo. Antioxidants are used for Prevents oxidation of fats. Stabilizers, emulsifiers.

Unintentional Food Additives

These classifications of food additives Cause health hazard and may also spoil the food. E.g. pesticides, toxins, heavy metals, etc.

Food additives are also classified based their sources. They are natural and synthetic food additives.

Natural food additives are substances, such as spices, herbs, roots, and essential oils, have been used in the past as flavour additives. Some examples of natural food additives are; soybeans and corn which are used to maintain food consistency; beets which provide beet powder is used sometimes as a colouring agents and caramel that is derived from caramelized sugar is used as a colouring agent. They are derived from natural sources. Animals, plants, micro-organisms etc.

Synthetic food additives are chemically synthesized. The synthetic food additives are those that are manufactured from one or several chemical substances through synthetic methods. Some of the synthetics food additives are; aspartame which is derived from

aspartic acid (C4H5O4NH2) is used in food preservation, Erythrosine which is the disodium salt of 2, 4, 5, 7-tetraiodofluorescein is used as a colouringagentandTartarzine which is Trisodium (4E)-5- oxo-1-(4-sulfonatophenyl)-4-[(4-sulfonatophenyl) hydrazono]-3-Pyrazolecarboxylate is used as a colouring agent (Lindernann, 2002; Yang et al.,2001).

Table 1: Functional Classes of Food Additives in International Numbering System (INS)

Functional Classes Definition (For labelling purposes
Acid Increases the acidity and/or imparts a sour taste to a food
Anticaking agent Reduces the tendency of particles of food to adhere to one another
Antifoaming agent Prevents or reduces foaming Antioxidant Prolongs the shelf-life of foods by protecting against deterioration caused by oxidation, such as fat rancidity and colour changes
Color Adds or restores color in a food.
Flavor enhancer Enhances the existing taste and/or odor of a food
Preservative Prolongs the shelf-life of a food by protecting against deterioration caused by microorganisms

Source: (Furukawa, 2003)

Functional Classification of Food Additives

Preservatives

They Are antimicrobial and antioxidants. They are used to prevent microbial spoilage. Some of them are, sugar, salt, nitrates (Kumar et al., 2011). A preservative is defined as any substance which is capable of inhibiting, retarding, or arresting, the growth of micro-organisms, of any deterioration of food due to micro-organisms, or of masking the evidence of any such deterioration. There are two types of preservatives. Those are class I and class II.

Class I preservatives refer to those preservative which are naturally occurring, everyday substances, examples include salt, honey and wood smokes.

Class II preservatives refer to preservative which are synthetically manufactured. It is estimated that nearly one fifth of the world's food is lost by microbial spoilage. Preservatives protect foods, such as cured meats, from developing dangerous toxins, such as botulism, a food poisoning illness (Sultanbawa, and Sultanbawa,2016).

Additives also used for preserve (cure) meats. They give them desirable colours and flavours, discourage the growth of microorganisms, and prevent toxin formation. Sodium nitrite has been used for centuries as a preservative and colour stabilizer in meat and fish products. The nitrite, when added to meat, gets converted to nitric oxide, which combines with myoglobin to form nitric oxide myoglobin (nitrosyl myoglobin), which is a heat-stable pigment. The curing also contributes flavour to the meat. In addition, nitrite curing inhibits the growth of Clostridium and Streptococcus, and also lowers the temperature required to kill Clostridium botulinum (Abdulmumeen et al., 2012).

Antimicrobial agents

Inhibiting the growth and toxin production of Clostridium botulin and other bacteria in cured meat products Antioxidants such as vitamin C act as preservatives by inhibiting the effects of oxygen on food, and can be beneficial to health. Substance used to preserve food by preventing growth of microorganisms and subsequent spoilage, including fungistats, mold andrope inhibitors. Also includes, antimitotic agents, preservatives and mold preventing agents (indirect additives).

Tables 2: Types and properties of antimicrobial substances used in the food processing industry

Antimicrobial Compound Effective against Some Food Applications
Acetic acid salt bacteria, molds bread;
Na and Ca propionate bacteria, molds bread, cake, cheese foods
Potassium sorbate bacteria, molds breads
Sodium nitrite Clostridium cured meat products
Sodium benzoate molds and yeasts condiments, fruit juices
Sugar (sucrose) bacteria, yeast, mold baked products, fruit preserves, meats
Sulfite, sulfur dioxide (SO2) bacteria, yeast, mold dried fruit, lemon juice,

Sources: (Ming Pao, 2004; Barrett;2004)

Antioxidants

An anti-oxidant is a substance added to fats and fat-containing substances to retard oxidation and thereby prolong their wholesomeness, palatability, and, sometimes, keeping time. An anti-oxidant should not contribute an objectionable odour, flavour, or colour, to the fat or to the food in which it is present. Substance used to preserve food by retarding deterioration, rancidity, or discoloration due to oxidation. It prolongs the shelf life of food by protecting against deterioration caused by oxidation, such as fat rancidity and colour change. Vitamins and minerals are added to many common foods such as milk, flour, cereal and margarine to make up for those likely to be lacking in a person's diet or lost in processing. Such fortification and enrichment have helped reduce malnutrition (Sunitha and Preethi, 2000).

Table 3: Antioxidant Action/Characteristics Applications

Antioxidant Action/Characteristics Applications
Tocopherols Can add with vitamin C Foods containing animal fats
Honey Darker is more effective Ground turkey
Dried plums Retard lipid oxidation Sausage and other ground
meat
Citric acid Chelate metals in meat Meats
Phosphates Complexes with metal ions Meats
Rosemary Delay free radical formation Meats, irradiated ground beef

Source: (Cheung et al., 2015; Robichaud et al,.2021)

Nutritive additives

Nutritive additives are nutrients added to food during manufacture. Those additives are called fortified foods. their function is Functions Replace nutrients lost in processing e.g. flour skimmed milk to increase nutritional value e.g. breakfast cereal (Yamahara et al.,2009). Colorings are added to food to replace colors lost during preparation or to make food look more attractive.

Flavours and Flavour enhancers

Flavouring agents are added to food to improve aroma or taste make up the greatest number of additives used in foods. Natural flavouring agents include nut, fruit and spice blends, as well as those derived from vegetables and wine. In addition, there are flavourings that imitate natural flavours. Flavors are additives that give food a particular taste or smell, and may be derived from natural ingredients or created artificially. Substance added to supplement, enhance, or modify the original taste and/or aroma of a food, without imparting a characteristic taste or aroma of its own. It enhances the existing taste and/or odour of a food.Flavouring additives are the ingredients, both naturally occurring that when added, gives the characteristic flavour to almost all the foods in our diet. Flavour and flavour enhancers like monosodium glutamate (MSG). constitute the largest class of food additives. Natural flavours are substances, such as spices, herbs, roots, and essential oils, have been used in the past as flavour additives. MSG is generally recognized as safe. However, it was reported some time back that MSG injected to young mice resulted in brain damage. Typical of the synthetic flavour additives are amyl acetate for banana, methyl anthranilate for grapes, ethyl butyrate for pineapple, (Nishioka et al., 2009).

MSG is made up of sodium and glutamic acid. Glutamic acid is an amino acid found naturally in high protein foods such as meats and dairy products like Camembert cheese. MSG is also a flavour enhancer used in prepared meals, some Chinese food, certain sauces and soups. MSG has been blamed for a variety of side effects including headaches and body tingling, however scientific studies show no link between MSG and these reactions suggesting that some other component of the meal, or even psychological responses, may be responsible for any adverse effects. They may be extracted from natural sources (through distillation, solvent extraction, maceration, among other methods) or created artificially (Sunitha and Preethi, 2000).

Taste plays a major role in determining food palatability, which promotes selection, intake, absorption and digestion of foods. Umami is a characteristic taste imparted by glutamate, which is naturally present in many foods and play important roles in the taste, palatability and acceptability of foods increasing the flavour characteristics, mouth fullness, impact, mildness and thickness or enjoyment of the food around the world (Gronemeyer et al., 2004). Monosodium glutamate (MSG) is flavour enhancer, additive which enhances the existing taste and/or odour of a foodstuff. The agent that is used only for flour bleaching is benzoyl peroxide ((C6H-5CO) 2O2). This does not influence the quality of dough. Materials used both for bleaching and improving are chlorine gas, (Cl2); chlorine dioxide, (CIO2); nitrosyl chloride, (NOCI); and nitrogen di and tetra oxides, (NO2 and N2O4). Oxidizing agents used only for dough improvement are potassium bromate, (KBrO3); potassium iodate, (KIO3); Calcium iodate, [Ca (IO3)2]; and calcium peroxide, (CaO2) (Sunitha and Preethi, 2000).

Humectants

They prevent foods from drying out. Humectants are moisture retention agents. Their functions in foods include control of viscosity and texture, bulking, retention of moisture, reduction of water activity, control of crystallization, and improvement or retention of softness. They also help improve the rehydration of dehydrated food and solubilization of flavour compounds. Polyhydroxy alcohols are water soluble, hygroscopic materials which exhibit moderate viscosities at high concentrations in water and are used as humectants in foods. Some of them are propylene glycol (CH3. CHOH.CH2OH), glycerol, and sorbitol and mannitol [CH2OH (CHOH) 4CH2OH]. Polyhydric alcohols are sugar derivatives and most of them, except propylene (Sunitha and Preethi, 2000).

Stabilizers and Thickeners

These compounds function to improve and stabilize the texture of foods, inhibit crystallization (sugar, ice), stabilize emulsions and foams, reduce the stickiness of icings on baked products, and encapsulate flavours. Substances used as stabilizers and thickeners are polysaccharides, such as gum Arabic, carrageenan, agar-agar, alginic acids, starch and its derivatives, carboxyl methylcellulose and pectin. Gelatin is one no carbohydrate material used extensively for this purpose. Stabilizers and thickeners are hydrophilic and are dispersed in solution as colloids. These swell in hot or even cold water and help thicken food.Thickeners are added to the mixture; increase its viscosity without substantially modifying its other properties (Czarra, 2009; Coppens,2006).

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 for diabetes mellitus and tooth decay and diarrhea (Sultanbawa, 2016). 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 for diabetes mellitus and tooth decay and diarrhea. Sweeteners are substance which imparts a sweet taste to a food. Sweeteners are added to foods for flavouring. Sweeteners other than sugar are added to keep the food energy (calories) low and they are usually recommended for diabetes mellitus, tooth decay and diarrhea patients so that the sugar levels in them will not be elevated.

Colorant

Colouring is added to food to replace colours lost during preparation, or to make food look more attractive. They consist of synthetic colours and those from natural sources. Even though most colours do not add any nutritive value to foods, without certain colours most consumers will not buy or eat some foods. Thus, colours are frequently added to restore the natural ones lost in food processing or to give the preparations the natural colour we expect. A number of natural foods colours extracted from seeds, flowers, insects, and foods, are also used as food additives. One of the best known and most widespread red pigments is bixin, derived from the seed coat of Bixa orellana, the lipstick pod plant of South American origin. Turmeric is a spice that gives the characteristic colour of curries and some meat products and salad dressings. A natural red colour, cochineal (or carnum) obtained by extraction from the female insect (Coccus cacti), grape skin extract, and caramel, the brown colour obtained from burnt sugar, are some natural colours that are used as food additives. These are intended to make food more appealing and to provide certain foods with a colour that humans associate with a particular flavour (e.g. red for cherry, green for lime). Some examples of food.colourants are; erythrosine, carmosine (McCann et al., 2007). Colour additives are recognized as an important part of many foods we eat (Hardy and Barrows,2003).

Importance of food additives

The also substances added to food to maintain or improve its safety, freshness, taste, texture, or appearance (Abdulmumeen et al., 2012). Food additives need to be checked for potential harmful effects on human health before they can be used. They are chemicals, or ingredients which are added to food products for maintaining their stability. Additives are artificial or natural chemicals, added to food, for microbial and chemical stability of foods or delay or even stop food rancidity.

Food Additive means any substance not normally consumed as a food by itself and not normally used as atypical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for technological purpose in the manufacture, processing, preparation, treatment, packing, or holding of such food results, or may be reasonably expected to result in it or its bye products becoming a component or otherwise affecting the characteristics of such foods (Murthy, and Naidu,2012).

Food additives play a vital role in today's food supply. Since most people no longer live on farms, additives help keep food wholesome and appealing while en route to markets sometimes thousands of miles away from where it is grown or manufactured. Additives also improve the nutritional value of certain foods and can make them more appealing by improving their taste, texture, consistency or colour.Therefore, Food additives play an important role in today's complex food supply. Food additives are chemical substances added to foods to improve flavour, texture, colour, appearance and consistency or as preservatives during manufacturing or processing. Food additives play a vital role in today's food supply. They allow our growing urban population to have a variety of foods year-round and, they make possible an array of foods without the inconvenience of daily shopping. Additives also improve the nutritional value of certain foods and can make them more appealing by improving their taste, texture, consistency or colour (Houghton, 2002).

The importance of preserving food is that, it lengthens the shelf life of a food and it slows down the spoilage of food which is caused by microorganisms present in the container or the hands that held it before putting it inside a container. The importance of food preservation is so that the food cannot be spoilt or can cause illness. Although preservatives are essential to maintain food safety, too much of a good thing is not healthy. Besides allergies, these foods may cause stomach pains, vomiting, breathing problems, hives and skin rashes. Some of the worst additives include benzoates, which can cause skin rashes, asthma and perhaps brain damage. Bromates can cause nausea and diarrhea. Saccharin may lead to toxic reactions that impact the gastrointestinal tract and heart, as well as cause tumors and bladder cancer. Red Dye 40 may result in certain birth defects. Sodium chloride can lead to high blood pressure, kidney failure, stroke and heart attack (Hoover and Milich, 1994).

They are technologically justified for food additives stand for, Maintaining the nutritional quality of the food Enhancing the keeping quality or stability of food thereby reducing food wastage; Making food attractive to consumers in a manner which precludes deception; Providing essentials aids in food processing.,Increase shelf life – preservatives, Reduce risk of food poisoning preservatives Prevent waste – preservatives, Make food more appetising – colouring, Improve taste, flavouring, Improve texture, physical conditioning agents, Increase nutritive value, Provide wider variety of foods and Ensure consistency of quality (Brooks et al., 2004). Additives also improve the nutritional value of certain foods and can make them more appealing by improving their taste, texture, consistency or color (Deshpande and Deshpande, 2017.).

Source of additives

Food additives can be derived from plants, animals, or minerals or they can be synthetic. They are added intentionally to food to perform certain technological purposes which consumers often take for granted. There are several thousand food additives used, all of which are designed to do a specific job in making food safer or more appealing. WHO, together with FAO, groups food additives into 3 broad categories based on their function. Products of vegetable origin thickening agents extracted from seeds, fruit and

seaweeds. Colours isolated from seeds, fruit and vegetables acidulants such as tartaric acid from fruit (Khodjaeva,2021).

Safety Evaluation of Food Additives

Under Food additives Amendment two groups of ingredients are exempted from regulation.

Group I: Prior sanctioned substances that FDA or USDA has determined safe for use in food prior to 1958 amendment. E.g., Sodium nitrate and Potassium nitrate

Group II: It includes GRAS, all the substances approved by experts as safe based on their extensive history of use in food before 1958 or based on published scientific evidence. Eg: Salt, sugar, MSG.In 1969, President Nixon directed the FDA to update safety aspects of all GRAS substances on the basis of current scientific investigations (Haley, and Lyn, 2010; Knechtges, 2011; Dupont, L. and Guillon, E., 2003).

Regulations of Food and Preservatives

There are several regulating agencies that determine what must be added to food and food supplements and the quantities that they must be added so they will not have deleterious effects on the consumers. These substances are termed as generally recognized as safe (GRAS). In Nigeria, for instance, before anything can be added to food, it must be approved by the National Agency for Food and Drug Administration and Control (NAFDAC) in conjunction with the Standard Organization on Nigeria (SON). These regulations are; Label declaration for substances used as food additives, Labeling of synthetic colour and mixture of colours in food, Food additives not to be described falsely, Food additives to bear certain information, Processing aids and carry-over of food additives, Prohibition against sale of food containing non-permitted food additive, Conditions for a request to add to or change food additive, Restriction on sale, of baby foods containing food additive, Conditions for allowing more than one preservative, Ionizing radiation. Some of the penalties. In the U.S., food ingredients may either be FDA-approved food additives or generally recognized as safe (GRAS). Food packaging manufacturers must prove to the U.S. Food and Drug Administration (FDA, 1993) that all materials coming in tact with food are safe, before they are permitted for use in such a manner. Food additives were first subjected to regulation in the United States under the Food and Drug Act of1906 (Haley, and Lyn, 2010; Badenhorst 2014).

The 1958 Food Additives Amendment forbids the use of any food additive not approved by FDA, and the agency may only approve additives shown to be safe. The act outlines the requirements for requesting approval for a food additive (i.e., Petition to establish safety) and details the action to be taken by FDA in dealing with such a petition. According to (Kubota and Ishizaki (2006), food supplements were nationally regulated in the EU until 2002, when the Food Supplements Directive 2002/46/EC came into effect. This directive provides a list of the vitamins and minerals that can be used in the manufacture of food supplements [1-55].

Summary

This review work has examined the various effects of food additives on food quality and safety. A food additive is anything that affects food quality (directly or indirectly) or is a component of food. Additives help to assure the availability of wholesome, appetizing and affordable foods that meet consumer's demands from season to season while also helping to preserve food from spoilage from microorganism. The GRAS list includes products such as flour, sugar, and salt - any ingredient that has been used for a long time and has shown no adverse effects; so, food additives are ingredients that need government approval before they can be added to food. Generally, Food additive can be preserved by chemical preservatives for long period with minimum overall quality and some chemical properties change. But selection of appropriate food additives is important to insure safety and quality of the food.

References

1. Alves, S. P., Brum, D. M., de Andrade, É. C. B., & Netto, A. D. P. (2008). Determination of synthetic dyes in selected foodstuffs by high performance liquid chromatography with UV-DAD detection. Food chemistry, 107(1), 489-496.
2. Mirza, S. K., Asema, U. K., & Kasim, S. S. (2017). To study the harmful effects of food preservatives on human health. J. Med. Chem. Drug Discovery, 2, 610-616.
3. Abdulmumeen, H. A., Risikat, A. N., & Sururah, A. R. (2012). Food: Its preservatives, additives and applications. International Journal of Chemical and Biochemical Sciences, 1(2012), 36-47.
4. Femi-Oloye, O. P., Owoloye, A., Olatunji-Ojo, A. M., Abiodun, A. C., Adewumi, B., Ibitoye, B. O., ... & Akinwumi, F. O. (2020). Effects of commonly used food additives on haematological parameters of Wistar rats. Heliyon, 6(10), e05221.
5. Inetianbor, J. E., Yakubu, J. M., & Ezeonu, S. C. (2015). Effects of food additives and preservatives on man-a review. Asian Journal of Science and Technology, 6(2), 1118-1135.
6. Miller, M., & Millstone, E. (1987). Food Additives Campaign Team: Report on Colour Additives. FACT, London.
7. Fernandes, A. G., Pinheiro, A. M., Prado, G. M. D., Fai, A. E. C., Sousa, P. H. M. D., & Maia, G. A. (2006). Sucos tropicais de acerola, goiaba e manga: avaliação dos padrões de identidade e qualidade.
8. Joint, F.A.O. (2016). World Health Organization and WHO Expert Committee on Food Additives, 1987. Principles for the safety assessment of food additives and contaminants in food Otles, S. Handbook of food analysis instruments. CRC Press.
9. Haen, D. (2014). The paradox of E-numbers: ethical, aesthetic, and cultural concerns in the Dutch discourse on food additives. Journal of agricultural and environmental ethics, 27(1), 27-42.
10. McCann, D., Barrett, A., Cooper, A., Crumpler, D., Dalen, L., Grimshaw, K., ... & Stevenson, J. (2007). Food additives and hyperactive behaviour in 3-year-old and 8/9-year-old children in the community: a randomised, double-blinded, placebo-controlled trial. The lancet, 370(9598), 1560-1567.
11. Bearth, A., Cousin, M. E., & Siegrist, M. (2014). The con-

sumer's perception of artificial food additives: Influences on acceptance, risk and benefit perceptions. Food quality and preference, 38, 14-23.
12. Mepham, B. (2011). Food additives: an ethical evaluation. British Medical Bulletin, 99(1), 7-23.
13. Patil, S. R., Arnold, B. F., Salvatore, A. L., Briceno, B., Ganguly, S., Colford Jr, J. M., & Gertler, P. J. (2014). The effect of India's total sanitation campaign on defecation behaviors and child health in rural Madhya Pradesh: a cluster randomized controlled trial. PLoS medicine, 11(8), e1001709.
14. Upadhyay, R., Pandey, A. K., Upadhyay, S. K., Bassin, J. K., & Misra, S. M. (2012). Limnochemistry and nutrient dynamics in Upper Lake, Bhopal, India. Environmental monitoring and assessment, 184(11), 7065-7077.
15. Gottschalk, F., & Nowack, B. (2011). The release of engineered nanomaterials to the environment. Journal of Environmental Monitoring, 13(5), 1145-1155.
16. Foist, L. (2016). Antioxidant power of wild edible Wyoming plants. University of Wyoming.
17. Hough, W. L., & Rogers, R. D. (2007). Ionic liquids then and now: from solvents to materials to active pharmaceutical ingredients. Bulletin of the Chemical Society of Japan, 80(12), 2262-2269.
18. Hasanuzzaman, M., Hossain, M. A., & Fujita, M. (2011). Nitric oxide modulates antioxidant defense and the methylglyoxal detoxification system and reduces salinity-induced damage of wheat seedlings. Plant Biotechnology Reports, 5(4), 353-365.
19. Tuormaa, T. E. (1994). The adverse effects of food additives on health: a review of the literature with a special emphasis on childhood hyperactivity. Journal of Orthomolecular Medicine, 9, 225-225.
20. Amin, K. A., Hameid II, H. A., & Abd Elsttar, A. H. (2010). Effect of food azo dyes tartrazine and carmoisine on biochemical parameters related to renal, hepatic function and oxidative stress biomarkers in young male rats. Food and Chemical Toxicology, 48(10), 2994-2999.
21. Hough, W. L., Smiglak, M., Rodríguez, H., Swatloski, R. P., Spear, S. K., Daly, D. T., ... & Rogers, R. D. (2007). The third evolution of ionic liquids: active pharmaceutical ingredients. New Journal of Chemistry, 31(8), 1429-1436.
22. Burgos-Morón, E., Calderón-Montaño, J. M., Salvador, J., Robles, A., & López-Lázaro, M. (2010). The dark side of curcumin. International journal of cancer, 126(7), 1771-1775.
23. Hsu, C. H., & Cheng, A. L. (2007). Clinical studies with curcumin. The molecular targets and therapeutic uses of curcumin in health and disease, 471-480.
24. Jiao, Y., Wilkinson, J., Di, X., Wang, W. and Hatcher, H. (2009). Curcumin, a cancer chemo preventive and chemotherapeutic agent is a biological active iron chelator.Blood 113 (2): 462-469.
25. Tfouni, S. A. V., & Toledo, M. C. F. (2002). Determination of benzoic and sorbic acids in Brazilian food. Food control, 13(2), 117-123.
26. Hamzah, R. U., Jigam, A. A., Makun, H. A., & Egwim, E. C. (2013). Antioxidant properties of selected African vegetables, fruits and mushrooms: A review. Mycotoxin and food safety in developing countries, (London), 203-249.
27. Tran, A. V. (2013). Do BHA and BHT Induce Morphological Changes and DNA Double-Strand Breaks in Schizosaccharomyces pombe?.
28. Kroger, M., Meister, K., & Kava, R. (2006). Low-calorie sweeteners and other sugar substitutes: a review of the safety issues. Comprehensive reviews in food science and food safety, 5(2), 35-47.
29. Smoley, C. K. (1993). Everything added to Food in the United States. US Food and Drug Administration, 31.
30. Lindemann-Matthies, P. (2002). The influence of an educational program on children's perception of biodiversity. The Journal of Environmental Education, 33(2), 22-31.
31. Yang, S., Leong, K. F., Du, Z., & Chua, C. K. (2001). The design of scaffolds for use in tissue engineering. Part I. Traditional factors. Tissue engineering, 7(6), 679-689.
32. Furukawa, S., Saita, K., Ogihara, H., Shimoda, M., & Hayakawa, I. (2003). Effect of food additives on the inactivation of bacterial spores by reciprocal pressurization treatment. Biocontrol Science, 8(1), 19-24.
33. Kumar, P., Chatli, M. K., Verma, A. K., Mehta, N., Malav, O. P., Kumar, D., & Sharma, N. (2017). Quality, functionality, and shelf life of fermented meat and meat products: A review. Critical reviews in food science and nutrition, 57(13), 2844-2856.
34. Sultanbawa, Y. and Sultanbawa, F. (2016). Australian native plants: cultivation and uses in the health and food industries. CRC Press.
35. Barrett, D. M., Somogyi, L., & Ramaswamy, H. S. (2004). Processing fruits: science and technology. CRC press.
36. Sunitha, J., and R. Preethi. (2000). "Food Additives." Ranga Agricultural University.
37. Cheung, P.C. and Mehta, B.M. eds. (2015). Handbook of Food Chemistry. Springer Berlin Heidelberg.
38. Robichaud, V., Bagheri, L., Salmieri, S., Aguilar-Uscanga, B. R., Millette, M., & Lacroix, M. (2021). Effect of γ-irradiation and food additives on the microbial inactivation of foodborne pathogens in infant formula. LWT, 139, 110547.
39. Yamahara, K. M., Walters, S. P., & Boehm, A. B. (2009). Growth of enterococci in unaltered, unseeded beach sands subjected to tidal wetting. Applied and environmental microbiology, 75(6), 1517-1524.
40. Nishioka, N., Inoue, K. I., Adachi, K., Kiyonari, H., Ota, M., Ralston, A., ... & Sasaki, H. (2009). The Hippo signaling pathway components Lats and Yap pattern Tead4 activity to distinguish mouse trophectoderm from inner cell mass. Developmental cell, 16(3), 398-410.
41. Gronemeyer, H., Gustafsson, J. Å., & Laudet, V. (2004). Principles for modulation of the nuclear receptor superfamily. Nature reviews Drug discovery, 3(11), 950-964.
42. Coppens, P., Da Silva, M. F. and Pettman, S. (2006). European Regulations on Nutraceuticals, Cox, C., 2004. Boric acid and borates. J. Pesticide Reform,24:10-15.

43. Hardy, R. W., & Barrows, F. T. (2003). Diet formulation and manufacture. In Fish nutrition (pp. 505-600). Academic Press.
44. Murthy, P. S., & Naidu, M. M. (2012). Sustainable management of coffee industry by-products and value addition—A review. Resources, Conservation and recycling, 66, 45-58.
45. Hoover, D. W., & Milich, R. (1994). Effects of sugar ingestion expectancies on mother-child interactions. Journal of Abnormal Child Psychology, 22(4), 501-515.
46. Brooks, D. M., Hernández-Guzmán, G., Kloek, A. P., Alarcón-Chaidez, F., Sreedharan, A., Rangaswamy, V., ... & Kunkel, B. N. (2004). Identification and characterization of a well-defined series of coronatine biosynthetic mutants of Pseudomonas syringae pv. tomato DC3000. Molecular plant-microbe interactions, 17(2), 162-174.
47. Deshpande, A. And Deshpande, B. (2017). Food Additives and Preservation: A Review. Indian J. Sci. Res, 13(2), Pp.219-225.
48. Khodjaeva, U., Bojňanská, T., Vietoris, V., & Sytar, O. (2021). About food additives as important part of functional food. Journal of Microbiology, Biotechnology and Food Sciences, 2021, 2227-2237.
49. Larkin, A. C., Cahan, M. A., Whalen, G., Hatem, D., Starr, S., Haley, H. L., ... & Quirk, M. (2010). Human Emotion and Response in Surgery (HEARS): a simulation-based curriculum for communication skills, systems-based practice, and professionalism in surgical residency training. Journal of the American College of Surgeons, 211(2), 285-292.
50. Knechtges, P. L. (2011). Food Safety: Theory and Practice: Theory and Practice. Jones & Bartlett Publishers.
51. Dupont, L., & Guillon, E. (2003). Removal of hexavalent chromium with a lignocellulosic substrate extracted from wheat bran. Environmental science & technology, 37(18), 4235-4241.
52. Badenhorst, C. P. S., Erasmus, E., Van der Sluis, R., Nortje, C., & Van Dijk, A. A. (2014). A new perspective on the importance of glycine conjugation in the metabolism of aromatic acids. Drug metabolism reviews, 46(3), 343-361.
53. Kubota, K., & Ishizaki, T. (1991). Dose-dependent pharmacokinetics of benzoic acid following oral administration of sodium benzoate to humans. European journal of clinical pharmacology, 41(4), 363-368.
54. EFSA Panel on Plant Health (PLH). (2010). Guidance on a harmonized framework for pest risk assessment and the identification and evaluation of food additive options by EFSA. EFSA Journal, 8(2), p.1495.
55. Hoogma, R. (2015). The effect of using E-numbers or colloquial additive names on the consumption intention. Sl: sn.