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REVIEW ARTICLE

Effect of Some Food Additives on DNA: A Review

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ABSTRACT

Food additives have become more widely used in modern food technology; however, they have significant health consequences. Food additives are compounds used to protect the flavor of foods or improve their taste, appearance, or other properties. Mainly, food preservatives inside food additives are being used to protect the food against miniature life forms negative effect consequences. The danger evaluating from food additives to human health is assessed by WHO, in participation with FAO. However, the expanded utilization of food additives might result in poisonous reactions. Numerous studies showed that many food additives have genotoxic and cancer-causing impacts in various test organic entities, including plants, microbes, human lymphocytes, and multiple organs, mice, and rats. The expression "Food additive" is an administrative term that incorporates any helpful substance that is routinely neither eaten up as food itself yet is deliberately added to food (in tiny amounts mostly) to expand its processing or to enhance its odor, color, consistency, taste, surface, or period of usability. Additives are not thought of as "food" regardless of whether they have nutritive worth. Any substance in the food supply, even at a low degree of exposure, may appear carcinogenic or, in any case, harmful to some people sooner or later and under certain conditions. Because of the possibility of being carcinogenic, we should be more aware and careful in taking food additives into our lives. The purpose of this review is to provide an overview of the dangers of these substances to avoid excessive use of the foods they contain.

INTRODUCTION

Organisms have genomes that are constantly influenced by external or internal influences that can alter by altering the information contained in deoxyribonucleic acid's chemical integrity. A variety of alterations causes genetic instability, and these modifications play a key role in the development of cancer.[1] Food additives are used for a variety of reasons, including protection, coloring, and sweetening. Food additives are used to prevent or delay health problems caused by changes in food microbiologically, enzymatically, or chemically and to increase shelf life and fineness.[2] Food additives have recently gained much press as possible causes of various human ailments; they could be one of the factors causing cancer, renal and hepatic failure, and the likelihood of mutations.[3] Numerous studies have demonstrated the genotoxicity of numerous dietary additives in diverse cell lines.[4] Increased use of these compounds has increased health problems such as diarrhea, asthma, behavioral issues, sleeping problems, migraines, allergic irritation, dermatitis (especially among children), and poisonous, genotoxic, and carcinogenic effects.[5] Nonetheless, there is conflicting information on the genotoxicity and/or toxicity of these compounds. Because of their toxicity,

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several food additives have been banned. In vivo and in vitro tests," AF-2 (2-furyl]-3-[5-nitro-2-furyl]acrylamide)" has been discovered to be a source of DNA damage in microbes and human cells, as well as DNA alternations" in bacteria, insects, fungus, and mammalian body cells". On the other side in animal cells, it produces chromosomal defects, and it also affects human cells.[6]

Genotoxic Effect of Some Food Additives

Food additives are substances that are added to food to make it taste better, keep food fresh, improve flavor, replenish nutrients lost during processing, and make it more visually appealing. Some of the additives substances cause genetic changes, for examples:

- *Sodium Benzoate:* The results demonstrated that sodium benzoate SB could bind to DNA, and hydrophobic associations and hydrogen bonds assumed a fundamental role in the splicing process. In addition, Hyperactivity appeared on children who took excessive sodium benzoate,[7] and also it has additionally been significantly detrimental to the Deoxyribonucleic Acid (DNA).[8]
- *Citric acid:* In human peripheral blood cells, the clastogenic property of citric acid as a dietary additive, which is commonly employed as an antioxidant, was resolved. Citric acid caused a significant increase in chromosomal deviations or chromosomal aberrations (CAs) at every tested fixing and treatment time. The mitotic index was significantly reduced by citric acid (MI). It did not, however, completely diminish the replication index (RI). Furthermore, Citric acid dramatically increased sister chromatid alternations. When compared to the control group, this drug increases the frequency of micronuclei (MN). It also resulted in a reduced CBPI. However, this was not a statistically significant finding.[9]
- *Ester gum:* (EG) is a weighing or coloring agent used to flavor citrus oil-based beverages. The cytogenetic endpoints of sister chromatid reciprocation and chromosomal deformation were utilized to define dietary additives' genotoxicity and clastogenic activity. EG was not a potential health danger at the doses examined, despite its poor clastogenesis and the possibility of a slight increase in sister chromatid alternation frequencies.[10]
- *Acesulfame-K:* a sweetening factor whose genotoxic and proliferative effect has been tested in vivo. Gavage was used to present male albino mice to the chemical. Bone marrow cells were dissected for chromosomal abnormalities after being extracted from femurs. Due to recent findings of mammalian genotoxicity, acesulfame-K should be taken with caution.[11] Non-nutritive sweeteners aspartame and acesulfame-K are allowed in diets and beverages on their own. When these sweeteners of various types are used together, they have synergistic sweetening activity; however, it is unknown whether they also have a synergistic genotoxic effect. Aspartame, in conjunction with acesulfame-K, is not considerably genotoxic, according to the findings.[12]

Classification of Food Additives

From the general population and food producers. Mostly, the public will pick a food without any additives, yet if these are not accessible, a similar consumer will have picked, if conceivable, a food containing natural added material over manufactured ones. Food additives can be isolated into 6 categories: preservatives that could be divided into 3 subclasses, anti-caking factors, antimicrobials and antioxidants; nutritional additives; coloring factors additives that also include azo compounds, chenophthalone derivatives, triarylmethane complex, xanthine and indigos; flavoring factors include sweeteners, Flavors, both natural and artificial, as well as food enhancers Finally, emulsifiers and stabilizers are texturizing agents.[13]

Natural Additives

Natural food additives have piqued people's interest for several years now. Are the most often used mixtures in each category and the primary categories of food additives included? The inexhaustible supply of synthetic and natural additives added to the absence of information on the greater part of the populace regarding recognizing normal from manufactured mixtures, doesn't assist with explaining what's going on with everything in the name of most food items. The best way to beat this impediment is to give consumers significant data about such components deliberately added to food. Surprisingly, there is no meaning of normal additives, cell reinforcements, tones, or sugars. Just natural flavorings have legislation in the EU and the United States of America, then this is translated to different classes of added substances, prompting incorrect understandings and the disarray of what is normal or manufactured. There is a developing requirement for straightforward enactment concerning the normally added substances because they are a growing source of interest in developed countries.[14]

Natural Antioxidants

Antioxidant materials are primarily utilized in food to forestall off-flavors by oxidation of fats, ending their peroxidation in the commencement or engendering stages. There are five types of antioxidants: primary antioxidants, also known as radical scavengers or chain breaking antioxidants, e.g., chelators, which bind to metals and prevent them from initiating radical formation, quenchers, which deactivate high-energy oxidant species. Oxygen scavengers, which remove oxygen from systems to prevent them from becoming unstable; antioxidant regenerators, which help other antioxidants regenerate when they become radicals. Meats, oils, fried meals, dressings, dairy products, baked items, and extruded snacks are the most common foods that contain antioxidants.[14]

Antimicrobials

Got from microorganisms are particles coming about because of living organic entities that affect others e.g., bacteriocins. Nearly 300 bacteriocins have been found till now, and some of them can prevent the creation of specific proteins. Class I, class

II, and bacteriolysins are the three types of bacteriocins. Class I contains lanthionine, class II does not, and bacteriolysins are non-bacteriocin lytic proteins.[15]

Colorants from Nature

Colorants can be used in food to make it feel more engaging and mouth-watering, which are key aspects to consider while selecting food taken from the shelves. Colorants are frequently employed to either augment existing color that has been lost during construction or during a possible usage term or to assign new ones to it. Food colors are divided into three categories: Natural food colorants are those that are generally used; nature-analogous colorants are those that, although being blended in businesses, are still natural and mimic the usual ones; and counterfeit/engineered colorants are those that are not commonly utilized.[16] Natural or nature-analogous colorants account for a considerable share of colorants in the food industry, and some of them have been legislated worldwide.[17]

Natural Sweeteners

Sweeteners have been utilized for quite a long time to make foods and drink savory and enjoyable to purchasers. Sugar was first discovered because of its high caloric content. Obesity was encouraged in the population, especially among children and newborns. Saccharine, a low-calorie sweetener, became available in the seventeenth century along similar lines. The popularity of these sweeteners prompted the development of others, the most extensively used of which being cyclamates, aspartame, and acesulfame-K. Sugars have also been the subject of numerous outrages and debates, with charges of cancer-causing nature, embryo abnormalities, poisonousness to liver and bladder, among different risks. Albeit large numbers of these claims have been explored and the sugars have been considered protected, a specific doubt among shoppers waits, in addition, some are prohibited in the United States and others in the European Union (for example, cyclamic corrosive and cyclamates, which are prohibited in the United States).[13]

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