

Food additives in ultra-processed products and some health effects

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Abstract

Public policies and recommendations on food and nutrition, traditionally based on quantities and proportions of nutrients or types of food, are now limited. Industrial food processing with the use of chemical additives has become the main driving force of the global food system. Consequently, the traditional diet has been abandoned to adopt one with higher energy density and products made with multiple chemicals. The purpose of this review was to describe some relevant aspects of the additives found in the most consumed ultra-processed products, in Mexico, and some of their negative consequences on people's health. It was observed that all the products reviewed contain highly and medium dangerous additives that generate various health effects, such as obesity, type 2 diabetes, cardiovascular diseases, Parkinson's disease, some types of cancer, increased symptoms of attention deficit hyperactivity disorder (ADHD), as well as alterations in the intestinal microbiome and its consequent immunological alterations.

Keywords: Food additives. Ultra-processed products. Health effects.

Introduction

In recent years, there has been a considerable decrease in the consumption of healthy foods, which have been displaced by products known as ultra-processed (UP) foods, presented as ready-to-eat dishes, adequately packaged, and often more economical than traditionally prepared meals^{1,2}.

The food industry has promoted the consumption of UP products made from industrial processes to which various chemical additives are added, as well as a high content of sugar, fats, and sodium. Despite being energy-dense and of poor nutritional quality, they have

been presented as harmless and nutritious, generating confusion among nutrition and health professionals as well as the general population². In addition, colorants, flavorings, emulsifiers, and other additives are added to make the product more palatable; additives are also used to prolong their shelf life and prevent the proliferation of microorganisms. Additives, flavorings, colorants, emulsifiers, sweeteners, thickeners, and anti-foaming agents are also added to disguise undesirable sensory properties and create attractive products³⁻¹¹.

The increase in their consumption has been associated with the development of obesity (*odds ratio* = 1.36; 95% CI, 1.34–1.70, *p*-value < 0.001)⁴,

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type 2 diabetes mellitus (T2DM) (moderate consumption: relative risk (RR), 1.12; 95% confidence interval [CI], 1.06-1.17; high consumption: RR, 1.31; 95% CI, 1.21-1.42)⁵, cardiovascular diseases (hazard ratio [HR] for a 10% increase in the proportion of ultra-processed foods: 1.12; 95% CI, 1.05-1.20)⁴, cerebrovascular diseases (HR, 1.11; 95% CI, 1.01-1.21)⁴, Alzheimer's disease (HR, 1.14; 95% CI, 1.00-1.30), depression (HR, 1.22; 95% CI, 1.16-1.28, p-value < 0.001)⁴, some types of cancer (HR for a 10% increase in the proportion of ultra-processed foods: 1.12; 95% CI, 1.06-1.18)⁴, all-cause mortality (HR, 1.28; 95% CI, 1.11-1.48, p-value = 0.001)⁴, as well as alterations in the gut microbiome and its consequent immunological changes.

The implementation of the NOVA system (derived from the word nova, meaning new, in Portuguese)¹⁵ has helped understand and categorize the nutritional quality of foods based on the degree of processing (Table 1), categorizing them into unprocessed or minimally processed, culinary ingredients, processed, and UP^{2,12}.

In Mexico, since the 1980s, political-economic changes have favored the food industry, leading to increased importation, production, commercialization, and sale of UP products¹³. Various companies dedicated to their production have seen substantial economic growth globally. For example, in 2012, Mexico ranked 2nd in Latin America in sales of these products², as dietary behavior has been socially imposed insensitively, and individuals' ability to freely decide what to eat has been mediated by their income, advertising, and the availability of food products. Thus, Mexico has recorded an income of 125 billion dollars¹⁴, with a mean annual increase of 2.1%, according to the Food and Agriculture Organization (FAO). Mexico has become an attractive market for the sale of this type of product¹⁵.

Therefore, the effect of UP on individuals' health has become a topic of major analysis and debate. Recently, various research groups at the national and international levels, to which we will refer in this review, have attempted to identify and analyze the large number of chemical additives used in the industrial processing of UP. However, the available information on this topic is scattered across various texts.

This review aims to describe some relevant aspects of the additives found in the most consumed ultra-processed products in Mexico and some of the negative health consequences for people who consume them.

Table 1. Classification of foods according to the NOVA system

The OPS classified foods and beverages based on their degree of processing and nutritional contribution, using the NOVA system into:

Unprocessed or Minimally Processed Foods

Processed Culinary Ingredients: Designed to be combined with foods to make meals and dishes.

Processed Foods

Ultra-processed foods (UP)

- UP products generally contain few or no whole foods. They are industrial formulations made with substances that have no culinary use, synthesized from food constituents such as modified starches and other substances not naturally present in foods. Chemical additives are used to modify the color, flavor, or texture of the final product.
- UP foods have little to no nutritional quality and high energy density due to their high content of saturated fats or trans fats (partially hydrogenated palm, palm kernel, or soybean oil), as well as sweeteners with high glycemic indices, such as high fructose corn syrup.
- They are high in sodium and are often designed to induce overconsumption.
- Usually consumed in large portions.
- Poor in dietary fiber, proteins, minerals, and vitamins.
- Various techniques are used, including extrusion, molding, and preprocessing, combined with frying.

Source: Pan American Health Organization Ecuador, World Health Organization of the Americas¹⁶.

Ultra-processed products in Mexico

The presence of the food industry in Mexico has displaced the predominant dietary pattern consolidated over several centuries, replacing it with industrialized foods, resulting in an "epidemiological transition," in which, in addition to primarily childhood malnutrition, what is now one of the most important public health problems in Mexico: obesity¹⁶.

The consumption of foods considered unhealthy has changed over the years. In 2014, the Pan American Health Organization (PHO) indicated that sales of UP products in seven Latin American countries were soft drinks 50%, juices 13%, sweets 12%, cookies and pastries 11%, and dairy products 8%¹⁶. Reports from the National Health and Nutrition Survey (NHNS) in its different versions have shown that non-dairy sweetened beverages (soft drinks and juices) are consumed by more than 80% of the population; sweets, snacks, and cereals by more than 50%, while sweetened dairy beverages by 30% and processed meats by 10%. During confinement due to the COVID-19 pandemic, UP consumption increased substantially¹⁷.

One of the most vulnerable population sectors for consuming UP products is children and adolescents. In a study conducted among Mexican high school

adolescents¹⁸, it was observed that the most consumed were the following: sweets¹⁹, pastries and cookies²⁰, fried foods²¹, sweetened cereals²², processed and deli meats^{23,24}, fast food, bread²⁵, instant soups²⁶, dressings²⁷, soft drinks^{28,29} whose components and interactions result in various health effects (Fig. 1), juices³⁰, and flavored and sweetened dairy products³¹. The additives contained in ultra-processed foods, which will be referred to throughout the text, are listed in Table 2.

Methodology

Information was searched from June to December 2021. For the literature search, the electronic databases MEDLINE, EMBASE, SCOPUS, as well as the Food Additives Catalog and their technical reports, and journalistic reports were used. The search strategy employed the terms: "Ultra-processed food" AND "food additives" AND "health outcomes," ultra-processed food* OR ultra-processed products AND "food additives," ultra-processed diet* AND "food additives" AND "health outcomes," "food additives"/AND "ultra-processed food"/.

Results

Food additives and their effects on health

Food additives are natural or synthetic (chemical) substances added during the processing or production of foods. Natural ones are not considered harmful to health; however, many of those added to UP are synthetic. For their approval for human consumption, additives are scientifically evaluated by the Joint FAO/WHO Expert Committee on Food Additives (JECFA), which is overseen by the FAO and the World Health Organization (WHO)³²; however, even though several chemical additives are accepted, their long-term health effects are unknown due to their relatively recent use and associations with various diseases as mentioned later.

All UP products contain additives, whose primary purpose, among others, is to prevent the proliferation of microorganisms, improve organoleptic characteristics, and even conceal the unattractive qualities of the final product. Food additives can be classified according to the *E number* code, used by the European Union and the European Free Trade Association, indicating that at some point, their use was permitted in products for the European market, into colorants (E100 and

E1XX), preservatives (E200 and E2XX), antioxidants (E300 and E3XX), stabilizers (E400 and E4XX), thickeners, gelling agents, texturizers, emulsifiers, flavor enhancers (E621), acidulants, and sweeteners (E500 and E5XX)³³.

Colorants

Since they have no nutritional function, these compounds are used exclusively to add or restore color and make foods more attractive. However, colorants have been documented to be the most hazardous food additives to health. For example, caramel color IV (E150) is the most used and is made with ammonium and sulfites that, when heated, produce by-products called 2-methylimidazole and 4-methylimidazole (2-MI and 4-MI), which have been associated with cancer and, more recently, with the composition and abundance of the microbiota^{34,35}; thus, its use should not be permitted and should be replaced by natural colorants, yet it continues to be widely used³⁴.

Other colorants are azo dyes synthesized from petroleum. Food companies use them to have a greater profit margin because they are cheaper. Moreover, they are more stable and brighter than most natural colors. Most approved colorants currently cause health problems³⁵.

The most widely used are Yellow 5 or Tartrazine (E102), Yellow 6 or Sunset Yellow (E110), Allura Red or Red 40 (E129), Patent Blue V (E131), and Blue 1 or Brilliant Blue (E133). These colorants release histamine, so their consumption is associated with multiple allergic reactions such as atopic dermatitis, angioedema, eczema, and even anaphylaxis, and they can intensify asthma symptoms. They have also been linked to issues, such as anxiety, insomnia, breathing difficulties, migraine, and some cancers³³. Various studies have concluded that colorants are associated with an increase or difficulty in controlling attention deficit /hyperactivity disorder (ADHD) symptoms^{11,36}. Similarly, the combination of colorants with additives has shown a higher relation to this disorder¹¹. Moreover, it was found that mixtures of 4 colorants and sodium benzoate alter behavior even in non-hyperactive children³⁶. These colorants are found in all the UP products analyzed in this study.

Among the **non-azoic** colorants are Quinoline Yellow (E104) and Erythrosine (E127), both of high toxicity, Indigotine or Indigo Carmine (E132) of medium toxicity, and Titanium Dioxide (E171), which the European Union banned in 2021 due to its effect on the immune system³⁷. It is used in various UP products (Table 2).

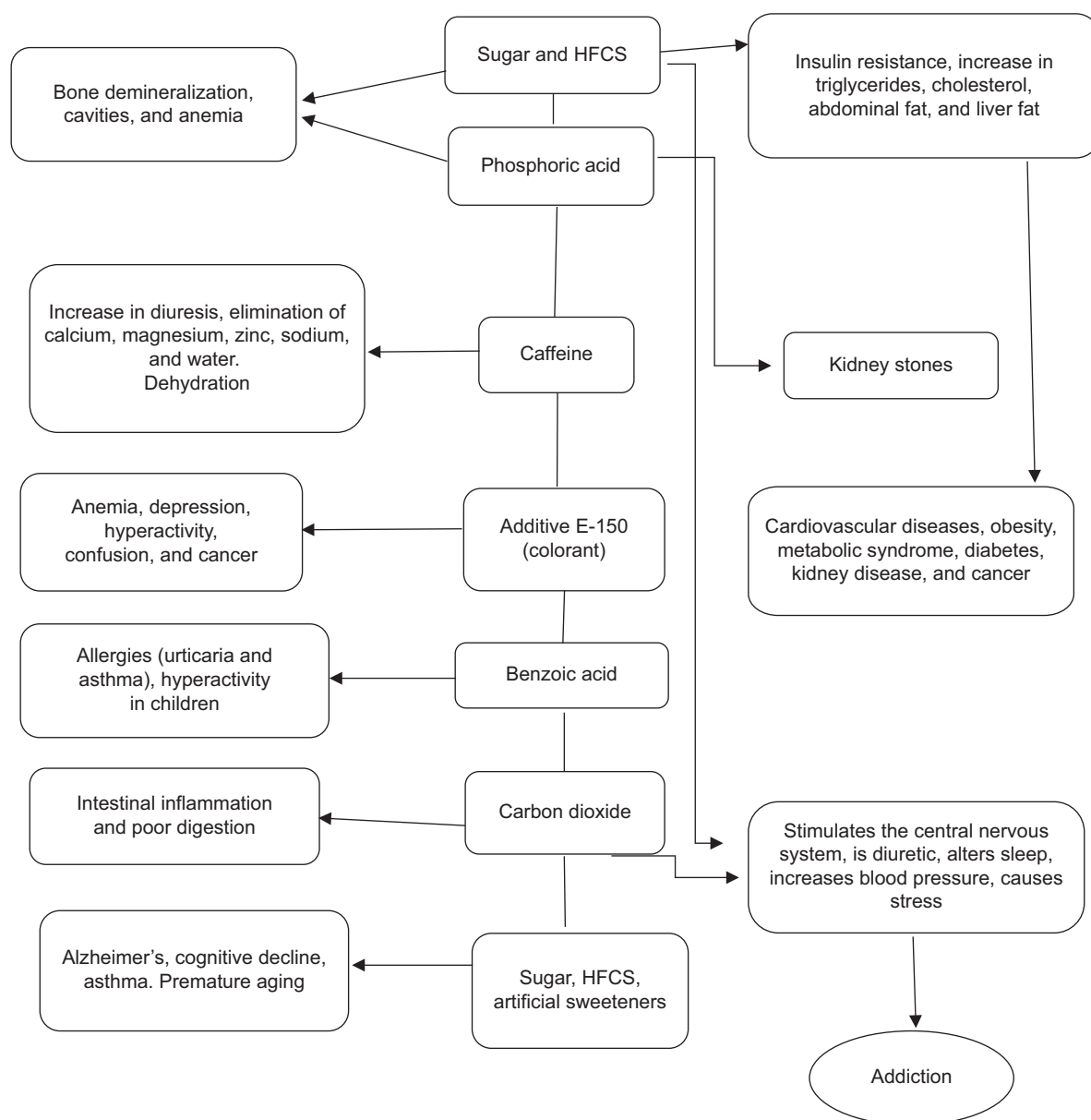


Figure 1. Example of the interaction of Coca-Cola components.

Source: *The power of consumers. An X-ray of Coca-Cola original taste (600 mL)*³¹.

Preservatives

Physical preservation methods, such as refrigeration or freezing, freeze-drying, and vacuum packing are very effective but have a short duration and high cost. Therefore, compounds that can be natural or synthetic are used to prevent the growth of fungi, yeasts, and bacteria, as well as to slow changes in color, flavor, or texture. Sodium chloride or common salt was the first chemical preservative used and an effective antimicrobial agent. Some synthetic

preservatives are considered to have low or medium toxicity, such as ethanol, lactic acid, tartaric acid, citric acid, glycerin, or sorbic acid; and others are harmless, such as cinnamon, oregano, thyme, and mustard, among others³⁸.

Among chemical preservatives, nitrites (E249-52) are notable. Although they are classified as having medium toxicity, they have been reported to affect hemoglobin and oxygen transport³⁹. There is also evidence that nitrites can produce some types of gastrointestinal (GI) cancers⁴⁰. Sodium nitrite, when

Table 2. Medium and high toxicity additives contained in the most consumed ultra-processed products

Ultra-processed foods and beverages	Preservatives	Colorants	Antioxidants	Emulsifiers thickeners/stabilizers	Flavor enhancers	Acidulants
Candies	Sulfites Benzoates Potassium sorbate*	Azoic: Yellow 5, Red 40 Non-azoic Caramel IV	BHA TBHQ	Carrageenan Silicon dioxide Modified starch Xanthan gum Lactic esters of mono- and diglycerides of fatty acids	Acesulfame K***	Phosphoric acid
Pastries and Cookies	Sulfites Benzoates Sodium propionate Potassium sorbate*	Azoic: Yellow 5, Red 40 Non-azoic Caramel IV	EDTA TBHQ	Ammonium chloride Tartaric and lactic esters of mono- and diglycerides of fatty acids Silicon dioxide Cellulose Modified starch Xanthan gum	Monosodium glutamate	Phosphoric acid
Chips	Sodium benzoate Potassium sorbate*	Azoic: Yellow 5, Yellow 6, Red 40, Brilliant blue Non-azoic Caramel IV Erythrosine	BHA TBHQ BHT	Potassium and ammonium chloride Tartaric and lactic esters of mono- and diglycerides of fatty acids Silicon dioxide Cellulose Modified starch Xanthan gum	Monosodium glutamate Sodium inosinate Sodium guanylate	Phosphoric acid
Sweet Cereals	Sulfites	Azoic: Allura Red AC (Red 17), Sunset Yellow FCF (Yellow 6), Tartrazine (Yellow 5), Brilliant Blue FCF Caramel IV Erythrosine (Red 3)	BHA BHT TBHQ	Tartaric and lactic esters of mono- and diglycerides of fatty acids Silicon dioxide Cellulose Modified starch Xanthan gum	Acesulfame K**	Phosphoric acid
Processed Meat	Sulfites Benzoates Sodium nitrite Sodium propionate	Carmine (Red 40) Caramel II	BHA BHT TBHQ	Carrageenans Potassium chloride Tartaric and lactic esters of mono- and diglycerides of fatty acids Cellulose Modified starch	Monosodium glutamate	Phosphoric acid
Fast Food	Sulfites Benzoates Sodium nitrite	Azoic: Allura Red, Sunset Yellow, Tartrazine, Red 3, Carmine (Red 40) Titanium dioxide (White 6)	BHA BHT TBHQ	Carrageenan Ammonium and calcium chloride Tartaric and lactic esters of mono- and diglycerides of fatty acids Cellulose Modified starch	Monosodium glutamate Disodium inosinate Disodium guanylate	Phosphoric acid

(Continues)

Table 2. Medium and high toxicity additives contained in the most consumed ultra-processed products (*continued*)

Ultra-processed foods and beverages	Preservatives	Colorants	Antioxidants	Emulsifiers thickeners/stabilizers	Flavor enhancers	Acidulants
Sliced Bread	Sulfites Benzoates Nitrites Calcium propionate Potassium sorbate*	Tartrazine (Yellow 5)	BHA BHT TBHQ, Azodicarbonamide	Carrageenan Ammonium chloride and lactic acids Tartaric esters of mono- and diglycerides of fatty acids Silicon dioxide Cellulose Modified starch Xanthan gum	Monosodium glutamate Sodium inosinate Sodium guanylate Disodium guanylate	Phosphoric acid
Instant Soups	Sulfites Benzoates	Sunset Yellow FCF (Yellow 6) Tartrazine (Yellow 5) Caramel IV Allura Red AC (Red 17) Ponceau 4R (Red 7)	BHA BHT TBHQ	Carrageenan Silicon dioxide Modified starch Xanthan gum	Monosodium glutamate Sodium inosinate Disodium inosinate Sodium guanylate Disodium guanylate	Phosphoric acid
Dressings	Sulfites Benzoates Potassium sorbate*	Caramel III Tartrazine (Yellow 5) Sunset Yellow FCF (Yellow 6) Titanium dioxide (White 6) Allura Red AC (Red 17) Brilliant Blue FCF Orange	BHA BHT TBHQ EDTA	Carrageenan Cellulose Modified starch X Anthan gum	Monosodium glutamate	Phosphoric acid
Soft Drinks	Sulfites Benzoates Potassium sorbate*	Caramel IV Tartrazine (Yellow 5) Sunset Yellow FCF (Yellow 6) Carmine (Red 40)		Modified starch	Acesulfame K**	Phosphoric acid
Juices	Sulfites Benzoates Potassium sorbate*	Tartrazine (Yellow 5) Sunset Yellow FCF (Yellow 6) Caramel IV Allura Red	EDTA	Modified starch Xanthan gum	Acesulfame K**	Phosphoric acid
Flavored Dairy	Potassium and sodium sorbate*	Chlorophylls and chlorophyllins (Natural Green 3) Caramel IV Carmine (Red 40) Sunset Yellow FCF (Yellow 6) Brilliant Blue Erythrosine (Red 3) Allura Red AC (Red 17) Canthaxanthin (Orange 8)	TBHQ	Carrageenan Cellulose Tartaric and lactic acid esters of mono- and diglycerides** Modified starch	Acesulfame K**	Phosphoric acid

BHT: butylated hydroxytoluene; TBHQ: tert-butylhydroquinone; BHA: butylated hydroxyanisole; EDTA: ethylene diamine tetra acetate.

*Low toxicity.

**High-toxicity artificial sweetener.

mixed with sodium chloride, generates nitrosamines and carcinogenic substances. For this reason, the WHO has classified processed meats as carcinogenic²⁴. Before the advent of current refrigeration systems, nitrate was used in the form of saltpeter to cure meats; this was crucial for preventing botulism (*Clostridium botulinum*). Since the 20th century, sodium nitrite has been used due to its better effects. In 1970, it was noted that nitrite could cause cancer. However, the U.S. National Toxicology Program stated that it was safe; nevertheless, it has been proven otherwise^{24,40,41}. Sulfites (E220-228) and benzoates (E211-219), derived from sulfur, are widely used despite being considered highly toxic. Sulfites have been associated with digestive problems and vitamin deficiencies (as they inactivate vitamin B12), nausea, headache, rhinitis, urticaria, angioedema, and asthma exacerbations^{33,35}. Benzoates have been linked to hyperactivity, especially in combination with colorants, and are harmful to the gut microbiome; their accumulation can promote tumor formation, which is why they have been removed from some bottled beverages³³. Propionate (calcium, sodium, and potassium), a highly toxic antioxidant, has been associated with insulin resistance, obesity, and T2DM³³.

Antioxidants

These additives are used in a wide range of UP products as they prevent the oxidation of fats in food by delaying rancidity and catalytic oxidation caused by light and oxygen and prevent food discoloration. They are also classified as food preservatives^{33,42}.

Antioxidants can be natural, such as tocopherols, citric acid, chlorophylls, and synthetic, which are petroleum-derived, for example, butylated hydroxytoluene and tert-butylhydroquinone, which have been associated with hyperactivity, allergies, urticaria, nausea, vomiting, delirium, hypercholesterolemia, and liver metabolic changes and are potentially carcinogenic, which is why their use is banned in several countries³³. Butylated hydroxyanisole and ethylene diamine tetra acetate in low doses inhibit mineral and iron absorption; cause diarrhea, abdominal pain, and coagulation problems leading to bleeding, renal damage; and also affect chromosomes. Azodicarbonamide, used in flours, has been associated with ADHD, allergies, kidney stones, and thyroid problems³³.

Stabilisers or gelatinisers emulsifiers, thickeners, and texturisers

STABILIZERS

Stabilizers are used to maintain the consistency and texture of foods and prevent ingredients of different polarities from separating. These additives allow the mixing of ingredients such as fat and water, and they also improve viscosity. Most stabilizers are not considered harmful to health³³. Some, like gums, are obtained from resins or seeds, such as lecithin (E322)³³ and carrageenans (E407), which are extracted from seaweed and have the ability to react with milk proteins. Carrageenan is a high-toxicity stabilizer without nutritional properties and is widely used in UP products. In large quantities, it has been associated with intestinal ulcers, allergies, immune alterations, decreased mineral absorption, and long-term carcinogenic effects, besides negatively altering the gut microbiota^{8,33}.

Carrageenan, like cellulose and its derivatives from carboxymethylcellulose (E466, 68, 69), is not digestible by digestive enzymes, does not provide nutrients, and acts like natural fiber. Despite claims that they have no toxic effects, GI adverse reactions and, in some cases, intestinal obstruction have been described, and they are suspected to be carcinogenic. They have also been shown to alter the gut microbiota^{8,33}.

Ammonium and calcium chloride are synthetic stabilizers frequently used in bakery and fast food. In small doses, they can cause headaches and digestive disorders; in high doses, they have been associated with intestinal hemorrhages, vomiting, diarrhea, and gastric ulcers. They are contraindicated for individuals with liver damage³³.

Diacetyl tartaric acid esters of mono- and diglycerides (E472e) and lactic acid esters (E472b) are emulsifiers and antioxidants used to maintain moisture primarily in bakery products, dairy, processed meats, and cereals. They are related to hepatomegaly and kidney injury in animals, and results are awaited to confirm effects in humans³³. Silicon dioxide (E551) is a highly toxic anti-caking agent used in bread, fried foods, soups, and candies, and it has been associated with stomach cancer³³.

Starch derivatives and modified starches (dextrins) are natural or synthetic thickeners widely used due to their low cost, as they are obtained from corn. They are modified into starch ethers or esters to be used. Although they are claimed to be harmless, starch is refined flour that degrades into glucose and is quickly

absorbed in the intestine, immediately entering the bloodstream and causing blood glucose levels to rise sharply. This increases the risk of developing metabolic diseases and can trigger or complicate insulin resistance or T2DM³³. In addition, when not absorbed, they participate in lipogenesis and have been associated with hyperactivity⁴³. Most modified corn starch comes from genetically modified corn⁴⁴.

Of the natural-origin gums, guar gum (E412) and xanthan gum (E415) are the most widely used thickeners. They have medium-to-low toxicity. They are water-soluble fibers that can have a laxative effect, causing diarrhea, abdominal pain, and distension, and even cases of intestinal obstruction have been described³³.

Flavor enhancers

The most well known are monosodium glutamate (MSG), E621, as well as monopotassium, calcium, ammonium, and magnesium glutamates, which are also called vegetable protein, soy protein, natural flavor, hydrolyzed protein, or *umami* (savory). *Umami* refers to one of the five recognized tastes, along with sweet, sour, bitter, and salty. MSG is a chemical additive widely used in the food industry, especially in savory foods. It is semi-synthetic, obtained by bacterial fermentation of residual vegetable or animal sugars; originally, it was extracted from seaweed and wheat⁴⁵. Adverse reactions associated with its consumption include headache, skin burning sensation, nausea, tachycardia, and even loss of consciousness; this set of symptoms is known as “Chinese restaurant syndrome,” which is controversial⁴⁶.

Even in low doses, it has an excitotoxic effect (stimulates appetite and invites continued eating) and is associated with obesity, T2DM, and other metabolic diseases. It is also neurotoxic, as it can rapidly destroy neurons⁴⁷. It is contraindicated for individuals with ADHD and neurological diseases such as bipolar disorder, Alzheimer's, Parkinson's, epilepsy, and schizophrenia. It is recommended that ADHD patients eliminate colorants, MSG and monopotassium glutamate, sodium benzoate, and carrageenan from their diet^{33,48}. Disodium inosinate (E631) and disodium guanylate (E627) are other highly toxic flavor enhancers, as they transform into uric acid, which can increase the risk of gout; they are also considered addictive, and their effects are associated with ADHD, asthma, insomnia, and skin, and mucous membrane irritation³³. Acesulfame (E950) is the most harmful synthetic sweetener, used in sweet UP products and mainly in those labeled as “low calorie.” It has been

associated with neurological problems and hyperglycemia, and long-term could be carcinogenic³³.

Acidulants

Acidulants are additives used to increase acidity and modify or enhance the flavor and aroma of UP foods and beverages. They are added to reduce the sweetness sensation produced by high sugar content. The most commonly used acidulants are acetic, ascorbic, citric, benzoic, boric, butyric, hydrochloric, erythorbic, stearic, tartaric, and phosphoric acids³³.

Phosphates (E338) (sodium, calcium, monocalcium, etc.) are the most used; besides being acidulants, they function as emulsifiers, antioxidants, and preservatives³³. Phosphates have been approved by the Food and Drug Administration and various organizations; however, they specify a maximum allowed intake²⁹.

Since they are used in many foods and beverages (particularly colas), it is very likely that this amount is exceeded. In addition, the combination of phosphoric acid with refined sugar and fructose hinders iron absorption, potentially contributing to anemia, and, due to their effect on decreasing the absorption of phosphorus and calcium, increasing the risk of osteoporosis and damage to tooth enamel, as well as renal and cardiovascular conditions. At high doses, they can cause hyperactivity problems and digestive disorders²⁹.

Conclusions

The change in diet observed since the 1970s and 1980s involved the development of industrial food processing, coupled with multimillion-dollar advertising campaigns that have misled the population into believing these foods are nutritious and healthy. The influence of various factors in complex interactions, such as urbanization, income, prices, massive entry of women into the labor market, changes in family structures, individual preferences, cultural traditions, as well as geographical and environmental factors, has been fundamental in this change.

All the products found today in supermarkets and convenience stores have accompanied humanity over time. The food industry, attentive to the needs and tastes of the population, has taken all these products, originally composed of natural ingredients, to the UP category.

It is the government's obligation to establish regulations limiting the food industry, as well as to create mechanisms for it to take responsibility and offer

products that do not harm health. It is crucial to build bridges between academia and public policies. For example, the foods donated by the state during the COVID-19 pandemic were not the healthiest, undoubtedly due to the lack of guidance from those who know the healthiest food options at affordable costs³³.

Actions aimed at improving diet and promoting healthy eating require strong political commitment, supported by the determined backing and empowered movement of citizens and civil organizations to seek better healthy options. This implies that the population, particularly health personnel, is adequately informed not only about what constitutes an appropriate diet but also about the risks associated with the consumption of potentially dangerous food additives.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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