

DETERMINACIÓN DE ADITIVOS ALIMENTARIOS EN MUESTRAS DE ALIMENTOS PROCESADOS EN ECUADOR: NIVELES Y RIESGOS

DETERMINATION OF FOOD ADDITIVES IN SAMPLES OF PROCESSED FOODS IN ECUADOR: LEVELS AND RISKS

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RESUMEN

Este estudio se centra en la determinación de aditivos alimentarios en alimentos procesados en Ecuador, abordando tanto los niveles presentes como los riesgos asociados a su consumo. Los antecedentes del problema radican en el uso extendido de aditivos en la industria alimentaria y su percepción negativa entre los consumidores debido a la falta de información y normativas inadecuadas. Se identifican como aditivos comunes el BHA, BHT, tartrazina y el MSG, todos ellos utilizados como conservantes, colorantes o potenciadores de sabor. El objetivo principal del estudio es evaluar los niveles de aditivos en alimentos procesados en Ecuador y determinar los riesgos para la salud pública, tomando en cuenta las normativas vigentes. La metodología empleada fue una revisión bibliográfica sistemática, analizando estudios nacionales e internacionales, así como normativas locales como la NTE INEN 1334:2011 y la NTE INEN-Codex 192:2013. Entre los resultados, se encontró que los niveles de aditivos como los nitritos y nitratos en productos cárnicos superan en ocasiones los límites recomendados, incrementando los riesgos de cáncer. Además, conservantes como el BHA y BHT presentan riesgos de toxicidad y carcinogenicidad cuando se exceden las dosis permitidas. En conclusión, se resalta la necesidad urgente de reforzar las regulaciones y la educación al consumidor sobre los riesgos de los aditivos alimentarios. Asimismo, se propone una mayor investigación sobre aditivos naturales y la implementación de mejores prácticas en la industria alimentaria para mitigar los riesgos asociados.

Palabras clave

Aditivos, normativas, seguridad alimentaria, dosis recomendada, Ecuador

ABSTRACT

This study focuses on the determination of food additives in processed foods in Ecuador, addressing both the levels present and the risks associated with their consumption. The background of the problem lies in the widespread use of additives in the food industry and their negative perception among consumers due to lack of information and inadequate regulations. BHA, BHT, tartrazine and MSG are identified as common additives, all of them used as preservatives, colorants or flavor enhancers. The main objective of the study is to evaluate the levels of additives in processed foods in Ecuador and determine the risks to public health, taking into account current regulations. The methodology used was a systematic bibliographic review, analyzing national and international studies, as well as local regulations such as NTE INEN 1334:2011 and NTE INEN-Codex 192:2013. Among the results, it was found that the levels of additives such as nitrites and nitrates in meat products sometimes exceed the recommended limits, increasing the risks of cancer. In addition, preservatives such as BHA and BHT present risks of toxicity and carcinogenicity when the permitted doses are exceeded. In conclusion, the urgent need to strengthen regulations and consumer education on the risks of food additives is highlighted. Furthermore, further research on natural additives and the implementation of best practices in the food industry to mitigate the associated risks is proposed.

Keywords

Additives, regulations, food safety, recommended doses, Ecuador

INTRODUCTION

The consumption of processed foods is a predominant characteristic in the modern diet of many countries, including Ecuador. Processed foods usually contain food additives, compounds or mixtures of substances that are introduced into the products to modify their chemical, physical and sensory characteristics. Its main objective is to improve the preservation, stabilization and, in some cases, the attractiveness of the food for consumers. However, the use of additives in the food industry has been a source of debate due to concerns about their impact on human health. This research addresses the presence and levels of additives in processed foods in Ecuador, with a focus on the potential risks associated with their consumption.

Food additives, both of natural and synthetic origin, have been subject to evaluation by international organizations such as the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO). Through the Joint Expert Committee on Food Additives (JECFA), these organizations conduct rigorous analyzes to determine the risks that these additives could pose to human health (1). The safety of additives is evaluated according to international standards, and only those that do not present a significant risk are approved for use in food production globally. This process includes both natural and synthetic additives, and is applied to various processed foods consumed by millions of people daily around the world (2).

In Ecuador, the use of food additives has been regulated in accordance with international regulations, although the country faces several challenges. One of the main problems is the public perception of food additives. For many consumers, the presence



of additives in food is associated with artificial and harmful products, which generates significant mistrust. Furthermore, the lack of adequate and accessible information about food additives has contributed to the formation of myths and fears around their consumption. This has been compounded by recent food scandals that have raised concerns about the safety of processed foods in the country (3). Misinformation, in many cases, is due to sensational or misinterpreted media coverage that tends to stigmatize additives as harmful, without considering the scientific evidence that supports their safe use under the conditions approved by international organizations.

The classification of food additives is well defined in the international regulatory framework, where they are categorized according to their specific functions in the preservation and improvement of food. According to the European Food Safety Authority (EFSA), additives can be classified into several categories: substances that modify organoleptic characteristics, substances that prevent chemical or biological alterations, stabilizers of appearance and physical properties, correctors of plastic qualities, and an additional group that covers functions not included in the above (4). This classification is of vital importance to ensure that processed foods maintain their quality and safety throughout the entire production and distribution chain.

However, the Ecuadorian food industry faces important challenges regarding the use and development of food additives. Although there are more than 10,000 food additives approved by the United States Food and Drug Administration (FDA) globally, consumer acceptance of additives in Ecuador has been limited. The local food industry has shown relatively slow development compared to other countries in terms of the implementation of new additives that meet the demands of the modern market, which demands more natural, healthy and sustainable products (5).

This context is further complicated by the lack of local studies exploring the use of additives in processed foods in Ecuador. Internationally, rigorous evaluation of food additives is essential for their approval and safe use in the market, but in Ecuador the data available on additives in processed foods is scarce. Consumers are often misinformed about the functions and safety of additives, causing unnecessary confusion and concern. This highlights the urgent need for local research that accurately measures the levels of additives present in food products available in the country and evaluates potential risks to public health.

At the international level, significant progress has been made in the regulation and control of food additives, thanks to the collaboration of organizations such as the WHO, FAO and EFSA. These organizations have established strict criteria to ensure that only additives that do not pose health risks are used in foods. However, in Ecuador, the negative perception of additives continues to be an obstacle for the food industry. Most consumers are unaware that many additives have a natural origin and that their use is intended to improve the quality and safety of the products they consume.

The use of food additives must comply with criteria established in the Codex Alimentarius, which states that their use is permitted only if it presents clear technological advantages, such as improving the shelf life of products, without inducing errors or deceiving consumers, and always ensuring that they do not represent a health

risk. Recent scandals in Ecuador related to product contamination have led to increased surveillance by health authorities, but have also generated growing distrust around products containing additives.

Against this backdrop, it is essential that the Ecuadorian food industry adopts a more proactive approach to transparency and consumer education about food additives. The main objective of this study is to determine the levels of food additives present in processed foods in Ecuador and to evaluate the risks associated with their consumption for the health of consumers through the joint review of the regulations in force.

MATERIALS AND METHODS

This analysis is a bibliographic review. The methodological route used in the preparation of this article includes these stages: search, organization, systematization and analysis of documents related to the topic, highlighting several important topics.

The research is based on a bibliographic review with compilation of information with a deep understanding of the topic to be discussed, taking advantage of resources such as online search engines, Google, Google Scholar, among others. In addition, databases such as Scielo, DSpace ESPOCH, and the Institution's virtual library are consulted, which provide access to research, theses and scientific articles, documents, magazines, the vast majority with information from the last ten years. In addition, references and standards were included that referred to the regulation of food additives that complement the required information.

The search was carried out using keywords such as: Additives, Ecuador, food additives, food situation, recommended doses. Once the documents were obtained, the useful ones were determined based on the information they contain. In addition, an attempt was made to select those that came from reliable databases. Those that had the greatest acceptance were those that provided aspects and data of national impact or those of certified provisions and regulations, which have been generated by international systems focused on food safety, in addition to providing exhaustive information on the classification of additives and what each of them is related to.

Once the information was selected, the information presented within all the selected investigative works was compared to collect, organize and determine the information, thus maintaining the information that most closely resembles our topic and that which is attached to the national context since this is basically the focus of the research. After having reorganized the information, the information provided by various authors of selected works is determined, analyzed and compared to generate a critical analysis regarding the information analyzed.

RESULTS

National regulations for the use of additives

NTE INEN 1334-1: 2011: Labeling of food products for human consumption. Part 1. Requirements.

For food additives belonging to various classes, included in the list of food additives and generally permitted for use in foods, the common name should be used together with the specific name, or with the international identification number of the food additive (6).

Manual for the registration of companies and products for veterinary use

This document, which consists of detailed instructions and regulated by the ARCSA, provides guidelines for the registration of food additives, composed of the following parameters: Commercial name of the product, classification, tariff classification, applicant, contract manufacturer or producer establishment, physical form, composition of the product, method of manufacturing or preparation of the product, specifications and characteristics of the product, commercial presentations and packaging characteristics, control and evaluation methods, indications for use, target species, dosage and form of consumption, doses in foods and method of administration, preparation of the product for its proper use. Maximum duration, composition, toxicity, etc., after preparation and reconstitution (7).

NTE INEN-CODEX 192:2013: Codex general standard for food additives

This National Standard stipulates the conditions under which commercially available food additives may be used in all foods, even if no standards have been established. The use of food additives must comply with detailed Codex standards. Additionally, this standard defines and classifies individual foods or foods in which the use of additives is not permitted (8).

Pollution cases in Ecuador

Nitrites and nitrates and their risks to human health

When reviewing the various stages of the meat product process, it is important to take into account the ingestion of already contaminated meat and ingredients and the addition of certain ingredients in excess in their formulation. This must be done through precautions such as the selection and control of suppliers, control of the weight of ingredients and especially, chemical additives that may be harmful to the health of consumers, such as nitrite. Additional compounds may form during fermentation, curing and smoking. The formation of these compounds can be avoided if precautions and best practices are considered, however, the possibility of their occurrence should always be considered (9).

Throughout the smoking process, polycyclic aromatic hydrocarbons (PAHs) can be produced, particularly Benzo(a)pyrene, which is a potential carcinogen. The toxicity of some PAHs results in elevated levels in foods such as smoked meat products. Furthermore, we can find various dangerous compounds closely related to meat products such as protein oxidation products, lipid oxidation products, biogenic amines (BA) that become directly harmful, and heterocyclic aromatic amines (HAA) (9).

Reference values reported in the literature also vary widely depending on local regulations and proposed scientific limits. In Ecuador the permitted limit values are between 2 µg/kg and 30 µg/kg. However, there are differences in the criteria for selecting which Nitrosamines to legally limit, which shows that there is much more work to be done by regulations for chemical hazards in meat products (9).

Main additives used in the country

The most common food additives in processed foods in Ecuador include:

The increasing dependence on processed foods in the modern diet has brought about the widespread use of food additives, which play a crucial role in the preservation, improvement and stability of products. Among these additives, synthetic preservatives such as Butylated hydroxyanisole (BHA) and Butylated hydroxytoluene (BHT) are commonly found in products such as cookies, oils, pastries, and dehydrated soups. Both preservatives have been the subject of studies due to their possible toxicity and carcinogenicity, which has generated concern regarding their permitted levels and the risks they present to human health, as seen in Table 1.

Table 1. Butylhydroxyanisole (BHA) and Butylhydroxytoluene (BHT)

food additive	Processed foods that contain it	Permitted levels (IDA)	Risks	Effectiveness
BHA (Butylhydroxyanisole)	Cookies, oils, pastries, dehydrated soups	0.3 mg/kg/day	Possible carcinogenicity, toxicity in high proportions.	Very effective against animal fats, less effective against vegetable fats.
BHT (Butylhydroxytoluene)	Cookies, oils, pastries, dehydrated soups	0.125 mg/kg/day	Possible carcinogenicity, toxicity in high proportions, allergies, vasculitis.	Very effective against animal fats, less effective against vegetable fats.

Butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) were originally implemented as antioxidants in petroleum and rubber. In 1950, it was introduced as antioxidants in foods that contain unsaturated fatty acids, cookies, oils, pastries or dehydrated soups (11). Possible carcinogenicity has been reported in laboratory animals. For this reason, the FDA removed them from the GRAS list, although it considers them acceptable. People also have a certain risk of allergies and vasculitis. The ADI of BHA is 0.3 mg/kg/day and the ADI of BHT is 0.125 mg/kg/day¹³ (12).

Dyes such as tartrazine (E102)



Tartrazine (E102) is an artificial coloring widely used in the food industry to give an intense yellow color to various products. Although its use is authorized in many countries and is considered safe in the permitted quantities, some associated risks have been reported, especially in sensitive people (Table 2).

Table 2. Tartrazine (E102)

Guy	Synthetic azo dye
Origin	Oil
Color that gives	deep yellow
Uses	Sausages, cheeses, ice creams, yogurts, cookies, soups, soft drinks, preserves, etc.
ADI (Acceptable Daily Intake)	7.5 mg/kg/day (established by FAO/WHO)
Health risks	Neurotoxicity: Animal studies have shown that high doses of tartrazine can cause damage to brain tissue and affect learning and memory. However, more studies are required to determine whether these effects extrapolate to humans.

Proving that it is highly toxic, which causes behavioral problems such as hyperactivity (12). Therefore, high and intermediate doses of tartrazine cause deficits in learning and memory in these animals as well as neurotoxicity that can be attributed to the promotion of lipid peroxidation products and reactive oxygen species that cause damage to brain tissue (13).

Bright blue FCF (E133)

Synthetic dye of the triarylmethane type with a molecular weight of 792.85 g/mol. This compound is described as a sodium salt soluble in water, but poorly soluble in ethanol. The marketing code in Europe is E 133 (see Table 3).

Table 3. Bright blue FCF (E133)

Parameter	Description
Guy	synthetic dye
Color that gives	deep blue
Uses	Confectionery, beverages, cakes, pastries, ice cream, dog food, pharmaceuticals, cosmetics
Allowed levels	They varied depending on the food: 20-500 mg/kg in solid foods, 100 mg/L in beverages
ADI (Acceptable Daily Intake)	6 mg/kg body weight (EFSA)
Toxicity	Low chronic toxicity in animal studies. However, adverse effects have been observed at high doses in rats.
Genotoxicity	It is not considered genotoxic.
Regulations	Approved in many countries, including the EU and the United States. Banned in China.
Health risks	It is generally considered safe in permitted doses. Possible adverse effects in high doses and in sensitive people.



Sweetener such as Saccharin (E954)

The sweetening power of saccharin, synthesized in 1878, and its salts is between 300-550 times that of sugar cane. Of all the salts, sodium is the most used. It has no caloric value, it is eliminated unchanged in urine. It has not been demonstrated at the doses commonly used that it does not have toxic or carcinogenic effects. Although it is true that in 1976 a controversy arose, now settled, for having induced bladder cancer in experimental animals, in poorly planned studies (very high doses). Other experimental designs or mutagenesis tests did not confirm these data and continue to be used¹⁵. Currently its ADI is 5 mg/kg/day (12).

Stabilizer such as Guar Gum (E412)

Guar gum is a plant material obtained by crushing the seeds of *Cyamopsis tetragonoloba*. It belongs to the legume family and its scientific name comes from its resemblance to broad beans. In the European Union, guar gum conforms to the stabilizer E-412 on the list of additives. It is mainly used to emulsify, thicken and stabilize mixtures and, being a plant extract, guar gum is suitable for vegans.

Due to its properties, it is used in the preparation of soups, juices, cakes, sauces, bakery products, ice cream and drinks in general. Guar gum is allowed in foods up to 1% in foods. Consuming large amounts of these ingredients can cause digestive problems such as bloating, nausea or diarrhea. Inappropriate use in foods can change the texture and flavor of foods.

When taking guar gum as a remedy to lose weight or prevent health problems, it is necessary to consider that at the intestinal level the mechanism of action of this substance at the intestinal level can interact with some medications. It may also be prohibited in people with esophageal or intestinal narrowing problems. For this reason, it is recommended to consult your doctor before taking guar gum-based supplements (16).

Xanthan Gum (E415)

Xanthan Gum is a natural high molecular weight polysaccharide. It is produced industrially through the fermentation of pure cultures of the microorganism *Xantomonas campestris*. It is a salt of sodium, calcium or a high molecular weight polysaccharide that contains D-glucose, D-mannose, D-glucuronic acid and at least 1.5% pyruvate (17).

Emulsifier such as Lecithin (E322)

Natural emulsifier extracted from soy or eggs used in powdered milk, mayonnaise, butter, cookies, cocoa powder, cooking and baking sprays.

It is commonly recognized as safe (GRAS) food additive and has been approved by the US FDA, the European Union and the Codex Alimentarius Commission. The commercial code is E 322. Also applied as a texture improver, antioxidant, emulsifier,

and flavor protector in the preparation of few foods, used in the cosmetic, chemical and pharmaceutical industries, among others (18).

Flavor enhancer such as Monosodium Glutamate (MSG E621)

MSG naturally present in many foods, especially those rich in protein, also in various vegetables, the majority currently added to foods is synthesized industrially. When added to foods, it imparts a flavor similar to that of natural glutamate and acts as an accentuating or enhancing agent, which can be described as a salty taste, called "umami" or fifth taste. MSG is added to cooked and processed salty foods as an additive (E621) (19) (see Table 4).

Table 4. Monosodium glutamate (MSG E621)

Parameter	Description
Origin	Naturally present in some foods (tomato, cheese, mushrooms). Industrially produced by fermentation.
Flavor it gives	Umami (savory taste)
Uses	Soups, sauces, snacks, processed meats, laminated products, fast food
Allowed levels	There is no maximum limit established internationally. It is governed by Good Manufacturing Practices (GMP).
Toxicity	Studies have shown low acute and chronic toxicity. However, adverse reactions have been reported in some people, known as "Chinese restaurant syndrome."
Genotoxicity	It is not considered genotoxic.
Regulations	Approved in most countries, including the EU and the United States.
Health risks	Generally considered safe for most people. However, some people may experience adverse reactions such as headaches, nausea, tingling, among others.

Natural additive alternatives

Natural sweeteners such as Stevia Glycosides

It is obtained from the leaves of the Stevia rebaudiana plant and is up to 300 times sweeter than sugar. It is made from the Stevia rebaudiana plant, grown for its sweet leaves. Commonly known as sweet leaf, sugar grass, sweet grass or simply Stevia (see Table 5).

Table 5. Stevia glycosides

Parameter	Description
Origin	Stevia rebaudiana plant
Flavor it gives	Sweet, 200 to 300 times sweeter than sucrose
Uses	Diet foods and drinks, diabetic products, tabletop sweetener, baked goods.
Allowed levels	They varied depending on the region and the product. Check local regulations.
ADI (Acceptable Daily Intake)	Established by various regulatory agencies (FDA, EFSA) as safe for human consumption.
Toxicity	Studies have shown low acute and chronic toxicity. Considered safe even in high doses.



Genotoxicity	It is not considered genotoxic.
Regulations	Approved in most countries, including the EU and the United States.
Health risks	Considered safe for most people. Possible mild side effects in some people (bitter feeling, upset stomach).

The ADI of sweeteners remains a subject of medical research worldwide, as non-caloric sweeteners add sweetness to foods and beverages without providing energy or raising postprandial blood sugar levels. In fact, the World Health Organization (WHO) and the FDA, as well as the American Diabetic Association, rely on several research findings. Although there is currently no sufficiently reliable data to prove that daily consumption of moderate amounts of artificial sweeteners can be harmful, the increase in these additives in certain products, such as soft drinks, may increase consumption by the population (20).

ε-Polylysine

It is a natural antibacterial agent ideal for prolonging shelf life and has high natural antibacterial activity against a wide range of fungi, Gram positive and Gram negative bacteria and their spores. In addition, it significantly inhibits the growth of bacteria, yeasts, molds, viruses, etc. Widely used in food, chemical, pharmaceutical and other industries, polylysine is completely digested and absorbed by the body and decomposes into essential lysine in the human body without any side effects. Research shows that they used different concentrations of ε-polylysine 10 (0.2%, 0.4%, 0.6%) to preserve tilapia fillets that were stored at 4 °C, and also applied it at a concentration of 0.005% ε-polylysine (50 mg/kg) in yogurt (21).

Propolis

It is a hive product made up of resins that bees collect from certain plant species. Because it is a natural product, it has a GRAS (generally recognized as safe) label. Several studies show that propolis has antioxidant, antimicrobial and antifungal properties, among others. These vary according to the origin of the plant, chemical composition, climatic season, extraction method, age and geographical area of collection. This makes it a potentially attractive natural product to be used as a food preservative instead of synthetic additives. In addition to its ability to prevent or slow oxidation reactions, several studies have demonstrated the effects of propolis against certain bacteria, fungi, and food pathogens (21).

DISCUSSION

Food additives are substances that are commonly used in the food industry; they can be used to improve food qualities such as: flavor, appearance, conservation, among other properties. The use of food additives in Ecuador is regulated by various standards which are national and international or documents synthesized from them, however, due to the poor handling and use of these additives, serious problems are occurring within the health of consumers, it is also due to the lack of strict regulation of many industries.



The study by (15) in 2014, based on data collected from 172 people who were randomly selected, showed that changes in the intestinal microbiota have been demonstrated after the ingestion of some sweeteners, particularly non-caloric artificial sweeteners (ENA). They found a positive correlation between NAS consumption and the Enterobacteriaceae family, the Deltaproteobacteria class, and the Actinobacteria phylum (10).

Seven healthy volunteers who normally did not consume NAS or foods containing NAS with a maximum ADI of saccharin (5 mg/kg) were followed for one week. Therefore, their results on days 1 to 4 showed glycemic responses that decreased on days 5 and 7, with a >30% difference. A high dose of saccharin can have a detrimental consequence on glucose tolerance since there are changes in the intestinal microbiota.

Another study, carried out in 4 days with 31 adults with a record of their diet and a proportion of fecal sample on day five, analyzing their sample by pyrosequencing, showed that the consumption of greater quantities of sweeteners, such as aspartame, did not affect it, but there was some variation in bacterial diversity (10).

Among the regulations that govern the use of additives in foods is the NTE INEN 1334:2011 regulation on labeling of food products for human consumption. Part 1. Requirements. According to the INEN, (22) It is a regulation that establishes different important parameters within the labeling and labeling of marketing foods, among them it talks about additives and how these must be named within a label in which an attempt is made to provide technical and specific information to the consumer.

In order for them to choose their products based on their needs, another regulation is the one proposed by AGROCALIDAD (7) which is a manual for the registration of companies and products for veterinary use, however within it the requirements that are needed to be able to register an additive that is going to be part of a food are detailed. It is worth highlighting the importance of using additives for animal feed since most of these animals are destined for human food products.

On the other hand, we also have the NTE INEN CODEX 192:2013 standard, which is the general Codex standard for food additives, which stipulates the conditions under which additives can be used in foods and even in those that do not have specified standards, a type of requirements are established, defining and classifying them based on their use and as this must be implemented using the maximum doses and recommended doses, this standard was adapted to govern the use of additives in the country according to the FAO (23), the standard will determine the appropriate use in addition to the critical limits for its implementation.

In recent years, cases of contamination of foods that are on the market have been heard, which have generated rejection by the consumer due to the increase in the number of diseases triggered by these contaminated products. However, an uncertain panorama is observed since the cases are increasing and there is no strict regulation by public entities to reduce the contamination rate of these foods. One of the most common and heard cases within the country is contamination by nitrites and nitrates, which when used in a high dose are toxic and carcinogens, therefore it is necessary to determine a dose of use



based on experimentation since within the rules and regulations there are no permitted limit values, this figure should not intervene in the modification and alteration of the food nor should it be harmful to the consumer, this additive is widely implemented within the meat industry.

Another contaminant present in the meat industry are meat finishers according to (24) which are supplied to animals in order to obtain weight gain and performance, which when used in inadequate doses and times can have repercussions on the carcass with the presence of these products still in the body.

The defects of certain sweeteners also lead to several serious consequences within the consumer. Recently, the effects of sweeteners on the intestinal microbiota have been studied, where it has been determined that caloric artificial sweeteners affect glucose tolerance and increase the risk of developing metabolic diseases. It has been shown that the consumption of saccharin in very high doses affects glucose tolerance due to the change that develops in the intestinal microbiota (1).

Among the additives most used nationally we find preservatives such as BHA and BHT, colorants such as tartrazine and brilliant blue, as well as sweeteners such as saccharin and stabilizers such as gums, including guar gum and xanthan gum. In all the foods present on the market, the ingredients are observed and within them the additives that are used, however, it is worth emphasizing that the use of additives is not a negative aspect for the food industry but rather the quantities and irresponsibility of certain companies when using doses that are not recommended. Due to all these events, the population tends to choose more artisanal and natural products to avoid contamination of their food.

The consumer is also aware of the additives used in each food since these are detailed on the back of the label. Taking a more general approach to the panorama of the use of additives in the country, the WHO recommends that the authorities of the various countries monitor the presence of additives in beverages and foods to ensure that the legislation and regulations in force in that country are complied with and said authorities should supervise the activity of the various companies in the industries which are responsible for guaranteeing the safety and security of the food (25).

CONCLUSIONS

The present study on the determination of food additives in processed foods in Ecuador reveals the presence of widely used preservatives and synthetic colorants, such as BHA, BHT and tartrazine, in everyday consumer products. Despite their effectiveness in food preservation, these additives pose health risks when consumed in excess, such as the possible carcinogenicity of BHA and BHT, or the neurotoxicity of tartrazine. The permitted levels of these additives vary according to current regulations, however, the lack of strict controls and adequate information for the consumer can contribute to the increased risk of exposure to potentially toxic compounds, which requires greater regulation and surveillance in the use of these additives.

The use of flavor enhancers, such as monosodium glutamate (MSG), and their presence in various processed foods in Ecuador, poses a public health dilemma. While the acute and chronic toxicity of MSG is low, its association with adverse reactions in sensitive individuals and its contribution to increased consumption of umami-rich foods, which may contribute to obesity, are aspects that should not be overlooked. The results suggest that, although Good Manufacturing Practices (GMP) are an acceptable standard for regulation, more information is needed to educate consumers about the potential risks associated with excessive consumption and to ensure that MSG levels are maintained within the parameters.

The analysis of the current regulations on food additives in Ecuador shows that there are still gaps in the regulation, especially with respect to substances such as nitrites and nitrates, used in meat products. These compounds, under certain processing conditions such as curing and smoking, can be transformed into nitrosamines, potentially carcinogenic compounds. Despite the limit values established by local authorities, the variability in international regulations suggests the need for greater control and uniformity in the regulation of these additives, as well as the implementation of better manufacturing practices to mitigate chemical risks in processed foods.

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