| ISSN: 2395-7639| www.ijmrset.com| Impact Factor: 7.580 | A Monthly Double-Blind Peer Reviewed Journal |

|| Volume 7, Issue 6, June 2020 ||

Food Additives and Their Chemical Impacts on Health

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ABSTRACT: Food additives are substances added to food to preserve flavor or enhance taste, appearance, or other sensory qualities. Some additives have been used for centuries as part of an effort to preserve food, for example vinegar (pickling), salt (salting), smoke (smoking), sugar (crystallization), etc. This allows for longer-lasting foods such as bacon, sweets or wines. With the advent of processed foods in the second half of the twentieth century, many additives have been introduced, of both natural and artificial origin. Food additives also include substances that may be introduced to food indirectly (called "indirect additives") in the manufacturing process, through packaging, or during storage or transport.[1][2]

KEYWORDS: food,additives,preserve,flavor,vinegar,artificial,packaging,salting

I. INTRODUCTION

To regulate these additives and inform consumers, each additive is assigned a unique number called an "E number", which is used in Europe for all approved additives. This numbering scheme has now been adopted and extended by the Codex Alimentarius Commission to internationally identify all additives,[3] regardless of whether they are approved for use.

E numbers are all prefixed by "E", but countries outside Europe use only the number, whether the additive is approved in Europe or not. For example, acetic acid is written as E260 on products sold in Europe, but is simply known as additive 260 in some countries. Additive 103, alkannin, is not approved for use in Europe so does not have an E number, although it is approved for use in Australia and New Zealand. Since 1987, Australia has had an approved system of labelling for additives in packaged foods. Each food additive has to be named or numbered. The numbers are the same as in Europe, but without the prefix "E".

The United States Food and Drug Administration (FDA) lists these items as "generally recognized as safe" (GRAS);[4] they are listed under both their Chemical Abstracts Service number and FDA regulation under the United States Code of Federal Regulations.

- See list of food additives for a complete list of all the names.[citation needed]

Categories

Food additives can be divided into several groups, although there is some overlap because some additives exert more than one effect. For example, salt is both a preservative as well as a flavor.[5][1]

Acidulants
: Acidulants confer sour or acid taste. Common acidulants include vinegar, citric acid, tartaric acid, malic acid, fumaric acid, and lactic acid.

Acidity regulators
: Acidity regulators are used for controlling the pH of foods for stability or to affect activity of enzymes.

Anticaking agents
: Anticaking agents keep powders such as milk powder from caking or sticking.

Antifoaming and foaming agents
: Antifoaming agents reduce or prevent foaming in foods. Foaming agents do the reverse.

Antioxidants
: Antioxidants such as vitamin C are preservatives by inhibiting the degradation of food by oxygen.

Bulking agents
: Bulking agents such as starch are additives that increase the bulk of a food without affecting its taste.

Food coloring
: Colorings are added to food to replace colors lost during preparation or to make food look more attractive.

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Fortifying agents
: Vitamins, minerals, and dietary supplements to increase the nutritional value

Color retention agents
: In contrast to colorings, color retention agents are used to preserve a food's existing color.

Emulsifiers
: Emulsifiers allow water and oils to remain mixed together in an emulsion, as in mayonnaise, ice cream, and homogenized milk.

Flavorings*
: Flavorings are additives that give food a particular taste or smell, and may be derived from natural ingredients or created artificially.
: *In EU, flavorings do not have an E-code and they are not considered as food additives.

Flavor enhancers
: Flavor enhancers enhance a food's existing flavors. A popular example is monosodium glutamate. Some flavor enhancers have their own flavors that are independent of the food.

Flour treatment agents
: Flour treatment agents are added to flour to improve its color or its use in baking.

Glazing agents
: Glazing agents provide a shiny appearance or protective coating to foods.

Humectants
: Humectants prevent foods from drying out.

Tracer gas
: Tracer gas allows for package integrity testing to prevent foods from being exposed to atmosphere, thus guaranteeing shelf life.

Preservatives
: Preservatives prevent or inhibit spoilage of food due to fungi, bacteria and other microorganisms.

Stabilizers
: Stabilizers, thickeners and gelling agents, like agar or pectin (used in jam for example) give foods a firmer texture. While they are not true emulsifiers, they help to stabilize emulsions.

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 regarding diabetes mellitus, tooth decay, or diarrhea.

Thickeners
: Thickening agents are substances which, when added to the mixture, increase its viscosity without substantially modifying its other properties.

Packaging
: Bisphenols, phthalates, and perfluoroalkyl chemicals (PFCs) are indirect additives used in manufacturing or packaging. In July 2018 the American Academy of Pediatrics called for more careful study of those three substances, along with nitrates and food coloring, as they might harm children during development.[6]

II. DISCUSSION

With the increasing use of processed foods since the 19th century, food additives are more widely used. Many countries regulate their use. For example, boric acid was widely used as a food preservative from the 1870s to the 1920s,[7][8] but was banned after World War I due to its toxicity, as demonstrated in animal and human studies. During World War II, the urgent need for cheap, available food preservatives led to it being used again, but it was finally banned in the 1950s.[7] Such cases led to a general mistrust of food additives, and an application of the precautionary principle led to the conclusion that only additives that are known to be safe should be used in foods. In the United States, this led to the adoption of the Delaney clause, an amendment to the Federal Food, Drug, and Cosmetic Act of 1938, stating that no carcinogenic substances may be used as food additives.[9] However, after the banning of cyclamates in the United States and Britain in 1969, saccharin, the only remaining legal artificial sweetener at the time, was found to cause cancer in rats.[10] Widespread public outcry in the United States, partly communicated to Congress by postage-paid postcards supplied in the packaging of sweetened soft drinks, led to the retention of saccharin, despite its violation of the Delaney clause.[11] However, in 2000, saccharin was found to be carcinogenic in rats due only to their unique urine chemistry.[12][13]

In 2007, Food Standards Australia New Zealand published an official shoppers' guidance with which the concerns of food additives and their labeling are mediated.[14] In the EU it can take 10 years or more to obtain approval for a new

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food additive. This includes five years of safety testing, followed by two years for evaluation by the European Food Safety Authority (EFSA) and another three years before the additive receives an EU-wide approval for use in every country in the European Union.[15] Apart from testing and analyzing food products during the whole production process to ensure safety and compliance with regulatory standards, Trading Standards officers (in the UK) protect the public from any illegal use or potentially dangerous mis-use of food additives by performing random testing of food products.[16]

There has been significant controversy associated with the risks and benefits of food additives.[17] Natural additives may be similarly harmful or be the cause of allergic reactions in certain individuals. For example, safrole was used to flavor root beer until it was shown to be carcinogenic. Due to the application of the Delaney clause, it may not be added to foods, even though it occurs naturally in sassafras and sweet basil.[18]

Hyperactivity

Periodically, concerns have been expressed about a linkage between additives and hyperactivity,[19] however "no clear evidence of ADHD was provided".[20]

Toxicity

In 2012, the EFSA proposed the tier approach to evaluate the potential toxicity of food additives. It is based on four dimensions: toxicokinetics (absorption, distribution, metabolism and excretion); genotoxicity; subchronic (at least 90 data) and chronic toxicity and carcinogenity; reproductive and developmental toxicity.[21] Recent work has demonstrated that certain food additives such as carboxymethylcellulose may cause encroachment of microbes from the gastrointestinal tract into the protective mucus layer that lines the intestines.[22] Additional preclinical work suggests that emulsifiers may disrupt the gut microbiome, cause or exacerbate inflammation, and increase intestinal permeability.[23] Other food additives in processed foods, such as xanthan gum, have also been shown to influence the ecology of human gut microbiomes and may play a role in the divergence of gut microbiomes in industrialized societies as compared to pre-industrialized societies.[24] Although still controversial, some scientists hypothesize that these changes to human gut microbiomes may be a contributing factor to the rise in chronic inflammatory diseases in industrialized populations.[25]

Micronutrients

A subset of food additives, micronutrients added in food fortification processes preserve nutrient value by providing vitamins and minerals to foods such as flour, cereal, margarine and milk which normally would not retain such high levels.[26] Added ingredients, such as air, bacteria, fungi, and yeast, also contribute manufacturing and flavor qualities, and reduce spoilage.[27]

Food Additive Approval in the United States

The United States Food and Drug Administration (FDA) defines a food additive 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".[28] In order for a novel food additive to be approved in the U.S., a food additive approval petition (FAP) must be submitted to the FDA.[29] The identity of the ingredient, the proposed use in the food system, the technical effect of the ingredient, a method of analysis for the ingredient in foods, information on the manufacturing process, and full safety reports must be defined in a FAP.[30] For FDA approval of a FAP, the FDA evaluates the chemical composition of the ingredient, the quantities that would be typically consumed, acute and chronic health impacts, and other safety factors.[28] The FDA reviews the petition prior to market approval of the additive.

Standardization of its derived products

ISO has published a series of standards regarding the topic and these standards are covered by ICS 67.220.[31]

III. RESULTS

Food additives are chemicals added to foods to keep them fresh or to enhance their colour, flavour or texture. They may include food colourings (such as tartrazine or cochineal), flavour enhancers (such as MSG) or a range of preservatives.

Most food additives are listed on the product label, along with other ingredients, in a descending order by weight (flavours are an exception and do not need to be identified). Sometimes, the additive is spelt out in full. At other times, it is represented by a code number: for example, cochineal may be listed as Colouring (120); sodium sulphite may be shown as Preservative (221).

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For most people, additives are not a problem in the short term. However, 50 of the 400 currently approved additives in Australia have been associated with adverse reactions in some people. Some food additives are more likely than others to cause reactions in sensitive people.[21]

It is often the additives that are used to give a food a marketable quality, such as colour, that most commonly cause allergic reactions. Some of these hypersensitive reactions include:

- Digestive disorders – diarrhoea and colicky pains
- Nervous disorders – hyperactivity, insomnia and irritability
- Respiratory problems – asthma, rhinitis and sinusitis
- Skin problems – hives, itching, rashes and swelling.

It is important to realise that many of the symptoms experienced as a result of food sensitivities can be caused by other disorders. Medical diagnosis is important. If you try to diagnose yourself, you may restrict your diet unnecessarily and neglect an illness.[22]

Some food additives that may cause problems for some people include:[23]

- Flavour enhancers – monosodium glutamate (MSG) 621
- Food colourings – tartrazine 102; yellow 2G107; sunset yellow FCF110; cochineal 120
- Preservatives – benzoates 210, 211, 212, 213; nitrates 249, 250, 251, 252; sulphites 220, 221, 222, 223, 224, 225 and 228
- Artificial sweetener – aspartame 951.

IV. CONCLUSIONS

Food additives are chemicals that are added to food to keep it from spoiling, as well as to improve its colour and taste. Some are linked to negative health impacts, while others are healthy and can be ingested with little danger. According to several studies, health issues such as asthma, attention deficit hyperactivity disorder (ADHD), heart difficulties, cancer, obesity, and others are caused by harmful additives and preservatives. Some food additives may interfere with hormones and influences growth and development. It is one of the reasons why so many children are overweight. Children are more likely than adults to be exposed to these types of dietary intakes. Several food additives are used by women during pregnancy and breast feeding that are not fully safe. We must take specific precaution to avoid consuming dangerous compounds before they begin to wreak havoc on our health.[25]

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