Journal of Young Scientist, Volume VII, 2019
ISSN 2344 - 1283; ISSN CD-ROM 2344 - 1291; ISSN Online 2344 - 1305; ISSN-L 2344 – 1283

GENERAL ASPECTS REGARDING NATURAL AND SYNTHETIC ADDITIVES IN FOOD

Gianina - Gabriela HIRJANU, Fănuţa - Andreea COLĂCEL

Scientific Coordinator: Assoc. Prof. PhD Alina ORŢAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011464, Bucharest, Romania, Phone: 0742586202

Corresponding author email: hirjanugianina@yahoo.com

Abstract

Since the dawn of man, our species searched for better ways to feed themselves, by developing more efficient methods of hunting, animal / vegetable domestication, food preservation by physical methods, and finally, by adding molecules to food in order to enhance flavours or to preserve it.
Today, more than 2500 additives are intentionally added to food in order to keep certain properties or to extend shelf life, while many others were banned throughout the years, some of them at a global level and others only in specific countries. In essence, food additives are substances added to food to preserve flavour or enhance its taste, appearance, or other qualities.
We distinguish two important categories of food additives: artificial and natural ones. No matter the origin is, they both present advantages or disadvantages. On the one hand, synthetic substances are, obviously, cheaper and easier to produce than the natural ones, but in the same time they can be the major cause of a variety of diseases. On the other hand, natural substances are an easier way to a healthier life, if they are used in the right doses. Also, we have to be aware that their price can be even twice higher compared to the artificial additives.
This paper attempts to highlight the benefits of natural additives, their synergy and potency as a great leap from synthetic additives that in most cases have a single effect on food.

Keywords*: natural additives, synthetic additives, benefits.*

INTRODUCTION

Since the dawn of man, our species searches for better ways to feed itself, by developing more efficient methods of hunting, animal/vegetable domestication, food preservation by physical methods, and finally, by adding molecules to food in order to enhance flavours or to preserve it.
Back in the 1800s, food additives were intentionally used for food adulteration. Years later, the availability of effective methods for food analysis, together with regulatory pressures, started to reduce the significance of this problem. In the middle of the 20th century, processed food became an important part of human nutrition, and legal chemical additives became increasingly prevalent in them.
Today, more than 2500 additives are intentionally added to food in order to keep certain properties or to extend shelf life, while many others were banned throughout the years, some of them at a global level and others only in specific countries (Ackroff, 2014; Ackroff, 2016).
As for their purpose, food additives are substances added to food to preserve flavour or enhance its taste, appearance, or other qualities. Some additives have been used for centuries; for example, preserving food by pickling (with vinegar), salting, as with bacon, preserving sweets or using sulphur dioxide as with wines. With the advent of processed foods in the second half of the twentieth century, many more 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 (Arias-Carrión, 2010).

METHODS AND MATERIALS

For preparing this review, the search for scientific paper was carried out considering the following key words: ‘Natural Additives’,

'Synthetic additives' or 'ADHD'(attention deficit hyperactivity disorder), on the database PubMed (US National Library of Medicine, National Institute of Health) and ScienceDirect (the leading platform of peer-reviewing literature).
After the examination of the found titles, there were selected only the titles of the articles that include information about food additives and human body's health. For an advanced selection, there were applied the following filters: publications after 2007, English and Romanian articles. The bibliography was studied with the intention of finding the most relevant articles for the aim of this review. The results of recent studies were considered before the older hypothesis and, after that, the information was systemized, so the present paper presents the main issues regarding the contemporary vision of nowadays, natural and artificial substances added on food.

EUROPEAN REGLEMENTATIONS

In the European Union, the use of additives is based on very strict requirements about their replacement and the need to use them. An additive, in order to be marketed and used, has to be on the Union list of allowed additives (community's legislation based on the so-called "positive lists"). Basically, if an additive is on such a list, it means that it has been undergoing evaluation, which concluded that at the intended dose of use it does not have problems which could affect consumers' health (risk assessment test). Also, a reasonable technological need for its use is prove, its use does not mislead the consumer (concerning the nature, freshness, quality or quantity of the used ingredients) and it complies with specific purity to requirements (so that the substance itself is safe and won't occur problems regarding the use of additives in foodstuffs because of contaminants such as heavy metals).
The whole process of evaluating and authorizing food additives requires human and material resources, the costs being particularly high in the case of new additives introduction, but the aim is ensuring the European consumer's food safety who is protected from any potential risks caused by food additives (Zugravu, 2008).
A substance can or cannot be an additive. It depends on the circumstances. For instance, in the purification of cooking salt, it is not permitted the usage of iodine or sodium iodate as food additives. Although, these substances are used at the iodination of salt, because it represents a healthy source for human body needs. In this situation, the sodium iodate is not considered an additive, but a source of minerals. Moreover, the sodium ascorbate and the calcium carbonate are two substances that can be used as additives, but also as sources of nutrients in food supplements or fortified foods.
It is not enough that an additive does not have negative effects over health. Its usage must be technologically motivated, otherwise it is not allowed to be used.
Another always important aspect is the labelling, because it is directly connected with the right informing of the consumer. The main concern when labelling is that the consumer needs to be aware of what he is buying (in terms of ingredients, properties and other characteristics of the food) costumer's health is protected and the product can be used without risks (whether we talk about allergens, persistence, storage conditions or usage information) (Zugravu, 2008).

CLASIFICATION

Within the EU, food additives are divided into 26 functional classes, depending on their function in food and registered with an 'E' number: sweeteners, colorants, 'preservatives' antioxidants, carriers, acids, acidity regulators, anticaking agents, antifoaming agents, bulking agents, emulsifiers, emulsifying salts, firming agents, flavour enhancers, foaming agents, gelling agents, glazing agents, humectants, modified starches, packaging gases, propellants, raising agents, sequestrants, stabilizers, thickeners, and flour treatment agents (Council Regulation 1333/2008) (Table1).

Table 1.The 'E' number of food additives

E number	substance
E100 – E199	Colorants
E200 – E299	Preservatives
E300 – E399	Antioxidants and acidity regulators
E400 – E499	Thickeners, stabilizers & emulsifiers
E500 – E599	pH regulators & anti-caking agents
E600 – E699	Flavour enhancers
E700 – E799	Antibiotics
E900 – E999	Miscellaneous (e.g. foaming agents, waxes)
E1000 – E1299	Various additives
E1400 – E1499	Modified starches
E1500 – E1525	Artificial flavors and solvents for flavorings

The American approach of food additives narrows down the number of classes and allows additives to be mentioned in 2 or more classes. According to the FDA (Food and Drugs Administration), there are more than 3000 food additives allowed in the United States, which are distributed into 6 groups: Preservatives, nutritional additives, colouring agents, flavouring agents, texturizing agents, and miscellaneous agents (Alonso, 2015)

The preservatives group is divided into 3 subgroups, although some additives may serve more than 1 function in foods: antimicrobials, antioxidants, and antibrowning agents. Within the flavouring agents group, there are 3 subgroups: the sweeteners, the natural or synthetic flavours, and the flavour enhancers. The texturizing agents comprise emulsifiers and stabilizers. Finally, the miscellaneous agents are composed of many classes: chelating agents, enzymes, antifoaming agents, surface finishing agents, catalysts, solvents, lubricants, and propellants (Branen and others 2001). Despite the various classes of additives and the different classifications used, they can be divided in 4 fundamental groups with regard to their origin and manufacture: natural additives (obtained directly from animals or plants); similar to natural additives (produced synthetically imitating natural ones); modified from natural (natural additives that are then modified chemically); and finally artificial additives (synthetic compounds).

ARTIFICIAL ADDITIVES

When it comes to artificial additives, it is easy to understand that there are lots of topics to be debated. As the name states, it is a substance invented by man to improve different characters in food. But what man did not expected was that his product would have secondary negative effects.

There are positive and negative sides on each topic, so even artificial substances have their qualities. Synthetic additives improved and developed the entire food world, giving it a new aspect and booming the standard level of people expectations (Ackroff, 2012; Akihisa, 2007).

As a general knowledge, the most 3 important man's needs are water, food and the need for reproduction, so each of them represent the key point for some of the greatest industries. Nowadays, we live in the speed, but also the obesity century, so the demand for food has grown surprisingly. The big companies tried to reproduce what nature gives us in small quantities, which involves lower costs for bigger amount of additives. The final result is the variety of food additives, the diversity of food assortments and the special aspects and tastes that make the human brain release the hormone of happiness, the well-known "dopamine".

On the other hand, it is obviously that any chemical substance added on food can cause a lot of health diseases such as obesity, neuronal diseases or ageing (Figure 1).

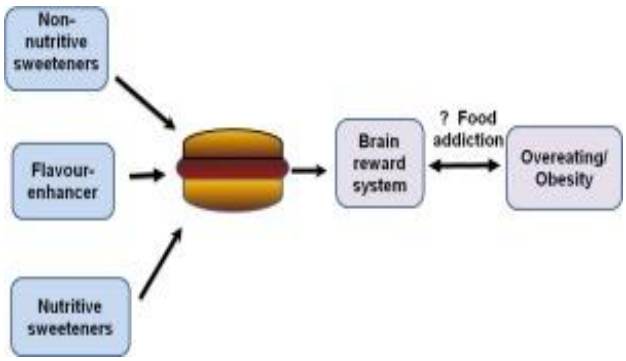

Figure 1. Dependence between additives and obesity

Studies have shown that certain foods or their additives appear to induce reinforcement behaviours that are similar to or possibly exceed those associated with drug addiction. Another topic that is debated today refers to the possibility of artificial food adds of causing attention deficit hyperactivity disorder (ADHD) on children. It is very important to know ADHD has increased in the last 20 years. The increase may be due to more accurate

diagnosing or it could be partially related to the preservatives and other food additives that children consume.

NATURAL ADDITIVES

On the other side of the topic there are natural additives. But what do we really know about them? Are natural additives shedding some light on the controversy of food additives or creating more entropy? For some decades now, natural food additives have been gaining more interest both from the public and food manufacturers. Generally, the middle-income consumer will choose food at a lower cost, but the high class of the society prefers choosing a food containing natural additives over synthetic ones (Ackroff, 2010; Ackroff, 2013).
In a time where the public is more aware and interested in what they eat, natural additives have been gaining interest both from the food industries and the consumers. Some studies show that consumers prefer food prepared with natural additives rather than chemical ones, due to health reasons. Although quite promising, natural additives still face some drawbacks and limitations as well as conflicting information (Avena, 2008).
For example, the additive called Annatto is yellowish orange and is obtained from the seeds of the tropical tree Bixaorellana. It has been reported as an occasional cause of urticaria and anaphylaxis. Saffron, from the flower of Crocus sativa, is another yellow food colouring that has been reported to cause anaphylaxis in patients. Both have also positive aspects making the food tasty and good looking in the same time.
Tartrazine-a synthetic azo dye- has been reported as a rare cause of urticaria and may increase bronchial reactivity in children with asthma. There is a general belief and some confusion about cross-reactivity between tartrazine and acetylsalicylic acid. Increased hyperreactivity to tartrazine in patients with asthma and who are aspirin sensitive was reported in a few studies but not by others. Tartrazine, a widespread food colorant has been linked to irritability, restlessness and sleep disturbance in children (Figure 2).

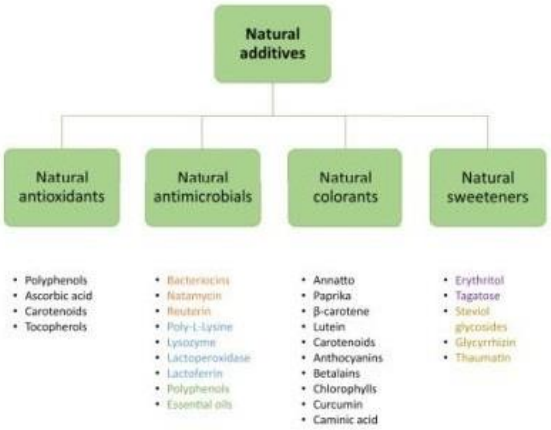

Figure 2. Natural Additives Classification

The benefits of natural additives are, anyway,almost endless, their synergy and potency is a great leap from synthetic additives that carry out, in most cases, only one effect over the food. While synthetic compounds have just a single aim, when it comes to the natural ones things look differently. Used properly, they can have good influence to people's health or provide severe diseases such as cancer, diabetes or depression. For instance, beta carotene is a red-orange pigment used as antioxidant, colorant, raw material for vitamin A and also may slow down cognitive decline (Anton, 2010; Apovian, 2014)
An aspect that can be expected is that not even nature is perfect. A major disadvantage of natural adds is the big amount of money needed to extract them and, in addition, their capacity to enhance flavours is not always uniform (Astbury, 2013; Astbury, 2014).
Moreover, in the latest decade, food industry developed a new exotic brunch, forgetting about the toxicity of some natural substances. Products compounded of marijuana and cannabis constitutes, today, the well-known "high cuisine". Brownies are among the most common food products infused with marijuana, however, almost any food product may be infused with marijuana. In addition to placing marijuana directly in food, marijuana-infused cooking oil can be used when frying or searing different products, and marijuana-infused butter can be spread directly on prepared food. Cannabis is another secret ingredient for fine tastes and it starts to be added in the most of luxury dishes. What people overlook is that these hallucinogen substances keep their

properties and may causes severe health problems (Alcaraz-Iborra, 2014).

CONCLUSIONS

To conclude, what we all can expect is the fact that any chemical substance added on food can cause a lot of health diseases such as obesity, neuronal illnesses or aging. Certain sources proved that some foods or their additives appear to induce reinforcement behaviours that are similar to drug addiction.

All in all, even though natural additives have their weaknesses, those are overlooked by the advantages of eating something natural over some synthetic products. Used properly, these additives can balance a right diet for a healthy body, because, all that truly should matter would be a healthy living and every person's aim should become 'Mens sana in corpora sano'.

REFERENCES

Ackroff K., Kondoh T., Sclafani A., 2014. Dried Bonito Dashi: a preferred fish broth without postoral reward actions in mice. Chem Senses, 39, 159–166.

Ackroff K., Sclafani A., 2016. A Flavor Preferences Conditioned by Dietary Glutamate. Adv Nutr.7.

Ackroff K., Sclafani A., 2010. Oral and postoral determinants of dietary fat appetite. In: JP M, J l.C., editors. Fat Detection: Taste, Texture, and Post Ingestive Effects. CRC Press; Boca Raton: Chapter 12.

Ackroff K., Sclafani A., 2013. Flavour preferences conditioned by oral monosodium glutamate in mice. Chem. Senses 38:

Ackroff K., Weintraub R., Sclafani A., 2012. MSG intake and preference in mice are influenced by prior testing experience. PhysiolBehav.

Akihisa T., Hayakawa Y., Tokuda H., Banno N., Shimizu N., Suzuki T., Kimura Y., 2007. Cucurbitane glycosides from the fruits of Siraitiagrosvenorii and their inhibitory effects on Epstein-Barr virus activation. J Nat Prod.

Alcaraz-Iborra M., Carvajal F., Lerma-Cabrera J. M., Valor L. M., Cubero I, 2014. Binge-like consumption of caloric and non-caloric palatable substances in ad libitum-fed C57BL/6J mice: pharmacological and molecular evidence of orexin involvement. Behav Brain Res.

Alonso-Alonso M., Woods S. C., Pelchat M., Grigson P. S., Stice E., Farooqi S. et al, 2015. Food reward system: current perspectives and future research needs. Nutr Rev. 73: 296– 307.

Anton S. D., Martin C. K., Han H.et al., 2010. Effects of stevia, aspartame, and sucrose on food intake, satiety, and postprandial glucose and insulin levels. Appetite

Apovian C.M, 2014. Sugar-sweetened soft drinks, obesity, and type 2 diabetes. JAMA: The J.Am. Med. Association.292: 978.

Arias-Carrión O, Stamelou M, Murillo-Rodríguez E, Menéndez-González M, Pöppel E, 2010. Dopaminergic reward system: a short integrative review. International Archives of Medicine 3:24

Astbury N. M., Taylor M. A., French SJ, Macdonald IA, 2014. Snacks containing whey protein and polydextrose induce a sustained reduction in daily energy intake over 2 wk under free-living conditions. Am J ClinNutr.

Astbury N. M., Taylor M. A., Macdonald I. A., 2013. Polydextrose results in a dosedependent reduction in ad libitum energy intake at a subsequent test meal. Br J Nutr.

Avena N. M., Bocarsly M. E., Rada P., Kim A., Hoebel B. G., 2008. After daily bingeing on a sucrose solution, food deprivation induces anxiety and accumbens ACCEPTED MANUSCRIPT dopamine/acetylcholine imbalance. PhysiolBehav.

Zugravu C. A., 2008. 'The Safety of Using Additives in Food', material realised with the support of the National Centre of Monitoring the Risks in Life and Work Environment.