



## Safety of Artificial Sweeteners

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### Abstract

Artificial sweeteners are substitute for sugar that we consume daily. They are classified as food additive that provide taste similar as sugar, but with less food energy. The aim of this review work is to investigate laws and regulatives in Bosnia and Herzegovina, European Union, USA, and compare them to show are artificial sweeteners safe?. In the law of Bosnia and Herzegovina, food additive is defined, but artificial sweeteners is not. There is the Ordinance on the health safety of Dietary Supplements that may be placed on the market, where artificial sweeteners are defined, and as well as ADI (Acceptable Daily Intake). In Croatia, Croatian Agency for food and European Food Safety Authority have clear limits of artificial sweeteners and their benefits and harm. In USA, Food and Drug Administration and WHO are the one who have limits for artificial sweeteners. Today we have many different studies that examines safety of artificial sweeteners that are contrary. That brings another problem of proving their safety. For some artificial sweeteners, we have ADI, but we should have ADI for all of them. It is important to examine their LOAEL (Lowest observed adverse effect level) and NOAEL (No observed adverse effect level), so that we could say with certainty that artificial sweeteners are safe if they are taken in ADI.

**Keywords:** Artificial; Sweeteners; Safety; Bosnia and Herzegovina

Artificial sweeteners are substitute for sugar that we consume daily. They are classified as food additive that provide taste similar as sugar, but with less food energy [1].

Food additives are used in food production, and they include spices, vitamins, minerals and other products. Definition of food additives includes substances of known chemical structure, that are not usually consumed as food, or typical ingredient of food, no matter on their food value, that are additional in food, because they improve technological effect and maintain sensory properties [2].

Based on their origin additives for sugar can be classified on natural and artificial [2,3].

After studies that were conducted, the maximal dose of additives that does not exert toxic effects is „No observed adverse effect level“ (NOAEL). If different studies showed different dosage, the lowest NOAEL is taken. The lowest dosage of additive that exert toxic effects on health is „Lowest observed adverse effect level“ (LOAEL) [2].

FDA classified Acceptable Daily Intake (ADI) for every artificial sweetener and it represents maximal dosage of food additive that can be consumed safely on a daily basis during life without adverse effects, and it includes a safety factor from 100 times [4].

Food industry recognized our wish for sweet taste, and made alternatives for sugar. The question is do they actually help people that have diseases such as diabetes? How safe are they? This topic is controversial and opinions are divided [4].

The aim of this review work is to investigate laws and regulations in Bosnia and Herzegovina, European Union, USA, and compare them to show are artificial sweeteners safe?

In the law of Bosnia and Herzegovina, food additive is defined, but artificial sweeteners is not [5]. There is the Ordinance on the health safety of Dietary Supplements that may be placed on the market, where artificial sweeteners are defined, and as well as ADI [6].

In 2004., based on the Ordinance daily amount of saccharin was less than 180 mg, cyclamate less than 700 mg, aspartam less than 2800 mg and kalij acesulfam less than 1050 mg, for persons with 70 kg. Daily amount of saccharin for persons who have diabetes should not be more than 1000 mg [6].

In European Union the European Food Safety Authority is organization in charge for approving artificial sweeteners. Artificial sweeteners are listed as food additives, and they are evaluated before they are approved and they have authorization for market. European Commission and their member decides which additives can be used in foods and at what level. They also include studies that examined benefits and potential harms of artificial sweeteners in their decision [7].

In USA, Food and Drug Administration is the one who set limits for artificial sweeteners. FDA also classifies artificial sweeteners as food additives. Regulations by FDA includes petition for seeking approval for food additives. To get approval from FDA for artificial sweeteners, it is necessary to prove safety before they can be released to the market [8].

When we compare laws in USA and European Union, we can see they both required proves for safety that is incorporated in the laws in countries. Comparing the laws in Bosnia and Herzegovina with the laws in USA and European Union, food additives are incorporated in all laws. In Bosnian laws, we do not have artificial sweeteners included directly in the law. The laws for artificial sweeteners are incorporated in Ordinance on the health safety of Dietary Supplements. The difference of European Union and in USA with Bosnian

laws is that in European Union and USA have artificial sweeteners defined directly by laws [6-8].

The safety of saccharin was tested in 1882., since then are debated between scientists. In 1997., FDA forbidden saccharin because it induced cancer in rats, which was withdrawn in 2000. The main reason for that was that this research included very high dose of saccharin, and rat model could not compare to human model that was investigated. In the end saccharin was declared as safe, but its usage was decreased, while other alternatives were increasingly used [4].

Cyclamate was discovered in 1937. They were tested in studies in 1970 and linked with potential carcinogen. Cyclamate can be degraded to cyclohexylamine, which is cancer tumor in bladders of rats. Adverse effects of cyclamate were shown on males and their gonads. These effects are because of cyclo-hexil-amin which is an intermediate product made by the influence of intestinal flora. This evidence made cyclamate prohibited. After many years, other researches showed they are safe. These effects were not confirmed in people, and today cyclamates are available on the lists of artificial sweeteners [9].

Xylitol (E967) is sugar alcohol found in fibrous fruits and vegetables, trees, corn cobs and human body. Xylitol does not depend on sugar and it has low glycemic index. It can be found in many products such as toothpaste, because it can reduce bacteria's in mouth [10].

Aspartame is nonnutritive artificial sweetener that is part of gums, candies, toothpaste or drugs. It is one of the most tested artificial sweetener. Today we have many studies that examined its safety, even though it is questioned today [1]. Acceptable Daily Intake of aspartame is 40 or 50 mg/kg body mass depending on limits based on EFSA or FDA. Average intake in Europe is between 3 and 10 mg/kg per day, and in USA is between 5 and 13 mg/kg per day [7,8].

Acesulfame-K was approved in 1998. by FDA. It is 200 times sweeter than sugar. The advantage of this sweetener is that it is stable on high temperatures and it has good solubility, so it is suitable for cooking and many processes. The letter K is there because it has potassium that can be found in human body. Studies showed that many sweeteners were excreted by urine, because they do not degrade inside body [1,4].

Sucralose is about 600 times as sweet as sugar. It was approved in 1999. By FDA. It is stable on high temperatures, so it is suitable for cooking and it is insoluble in fat. Sucralose eliminates unchanged from human body. Sucralose has good shelf time, because it keeps sweetness longer than aspartame [4].

Neotame was approved in 2002. by FDA. It is 40 times sweeter than aspartam, and 8000 times sweeter than sugar, so only small dose are needed of this sweetner. It is more stable than aspartame, and can be founded in foods and drinks, bakery products, desserts, chewing gum. It does not leave metallic taste after use [1,4].

Stevia is approved in 2008. by FDA. It derives from plant *Stevia rebaudiana* Bertoni. Stevia has two sweetener: Rebaudioside A and stevioside that are sweeter 200-300 times than sugar and calorie-free. Comparing different studies showed that stevia sweeteners are safe for people of all ages and an Acceptable Daily Intake (ADI) of 4 mg/kg body weight. Stevia is substance that is natural, and has the least adverse effects that are proved [1,4].

In conclusion, it is important to say that artificial sweeteners play important role in manufacturing of food. Today we have many different studies that examines safety of artificial sweeteners that are contrary. That brings another problem of proving their safety. For some artificial sweeteners, we have ADI, but we should have ADI for all of them. It is important to examine their LOAEL and NO-AEL, so than we could say with certainty that artificial sweeteners are safe if they are taken in ADI.

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