

ARTIFICIAL SWEETENERS-A REVIEW

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ABSTRACT

Nonnutritive sweeteners (NNS) have become an important part of everyday life and are increasingly used nowadays in a variety of dietary and medicinal products. They provide fewer calories and far more intense sweetness than sugar-containing products. Six of these agents (aspartame, saccharine, sucralose, neotame, acesulfame-K, and stevia) have previously received a generally recognized as safe status from the United States Food and Drug Administration, and two more (Swingle fruit extract and advantame) have been added in the recent years to this ever-growing list. They are claimed to promote weight loss and deemed safe for consumption by diabetics; however, there is inconclusive evidence to support most of their uses and some recent studies even hint that these earlier established benefits regarding NNS use might not be true. There is a lack of properly designed randomized controlled studies to assess their efficacy in different populations, whereas observational studies often remain confounded due to reverse causality and often yield opposite findings. Pregnant and lactating women, children, diabetics, migraine, and epilepsy patients represent the susceptible population to the adverse effects of NNS-containing products and should use these products with utmost caution. The overall use of NNS remains controversial, and consumers should be amply informed about the potential risks of using them, based on current evidence-based dietary guidelines.

KEYWORDS- Diabetes, metabolic disorder, non-nutritive sweeteners, obesity

INTRODUCTION

I.OBESITY

Obesity is a major public health problem that exhibits no boundaries^[1]. It affects children and adults, and spans all ethnicities and races. In the USA between 1980 and 2000, the overall prevalence of obesity increased significantly among adult men and women. For unclear reasons, though the overall prevalence has remained stable since 2000, there seems to be an increasing trend toward obesity in women and the extreme obesity class. Studies suggest that obesity is far more

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complex than previously thought and is a result of numerous internal host factors and external environmental factors^[2]. Several factors that contribute to obesity include but are not limited to the consumption of energy dense foods, large portion sizes, physical inactivity, alterations in the host gut microbiome, consumption of a

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predominantly high fat and/or high sugar diet, and the use of artificial sweeteners (AS). Obesity is a major problem throughout the world. Surveys consistently show that people are concerned by weight and its health related implications, and for that most individuals are making a concerted effort to either maintain or lose weight [3].

Today the major goal of diabetes management is control of blood glucose [4]. So, the consumers have a free choice of food products. They must choose the right food to comply with dietary recommendations and at the same time the food industry can considerably contribute to this change by providing adapted food products. This led food industry to discover several forms of alternative intense sweeteners, which have made possible to offer consumer the sweet taste without the calories.

Sugar cannot simply be replaced by this type of intense sweetener because the question of bulk, quality, intensity of sweetness and physical characteristics. Due to these features, rare sugars are desirable for low calorie, as well as bulk sweetener [5]. These sugars tend to have desirable sweetness but are not metabolized in the human body and therefore do not provide calorie intake.

A sweetener is a food additive, which mimics the effect of sugar on taste. Therefore, they are called sugar substitutes. Consumers often select those foods, which are composed of low-calorie sweetener because they want the taste of sweetness without added calories [6]. The dietary option that such product provides may be especially helpful in the management of obesity or diabetes mellitus. A sugar substitute is a food additive that mimics the taste of sugar but usually has less food energy. These are both natural and synthetic. The synthetic based ones are referred to as artificial sweeteners [7]. These artificial sweeteners also called non-nutritive or low-calorie sweeteners. These are intense sweeteners, providing no or a few calories per gram. They are used in beverages, dietary products, medicines, etc. Artificial sweeteners have gained attention as nutritional tools that provide a sweet taste without the extra energy derived from

foods and drinks containing caloric sugars and thus may assist in weight-loss plan adherence [8]. They play an important role in the treatment of diabetes mellitus and obesity as well as in the maintenance of dental.

II. TYPES OF ARTIFICIAL SWEETENERS

Saccharin

Saccharin is an artificial sweetener with zero food energy and no calories [9]. This is the earliest and one of the oldest sugar substitutes used for about a century in processed food and beverages industries. Saccharin is 300 times more sweetener than sucrose [9,10].

Uses: Saccharin is used in various food products like carbonated soft drinks, table top sweeteners, and in few desserts. In hygiene oral products this sweetener hides the taste of undesirable flavour of other ingredients. Apart from its usage as sugar substitute, saccharin is used as deposition of nickel in electrolyte [11].

Permissible levels by an individual per day: 5mg/kg of body weight

Health effects: Experimental studies suggested that saccharin shows both positive and negative outcomes in including cancer in rats, dogs and humans. In 1997, saccharin was banned by the FDA based on the results of animal studies linking saccharin to cause bladder cancer in rats.

Acesulfame potassium (Ace-k)

Acesulfame potassium is used as general sweetener [12]. This is a white crystalline material which is stable up to high temperatures (250 °C). Because of its high stability under high temperature, it is used in many bakery products.

Uses: Acesulfame-k is mostly used in various fields of sugar substitutes. Commonly used fields of Ace-k are table top sweeteners (in packet form), sweet drinks, confectioneries, desserts, dairy products, chewing gums, oral hygiene products and pharmaceutical industries [13].

Health effects: In humans, acesulfame-K is not metabolized. In spite of its potassium content, it has no effect on potassium intake. However, acetoacetamide, a by-product of ace-K can be toxic if utilised in high amounts.

Permissible levels by an individual per day:15mg/kg of body weight

Aspartame

Aspartame is the most discussed sugar substitute which tastes like sugar^[14]. This is highly stable to hot temperatures and has modest solubility in water. This rate of solubility of aspartame is directly proportional temperature.

Uses: Aspartame is commonly applied as artificial sweetener in all fields of processed food.

Health effects: The consumption of aspartame at higher doses may lead to hepatocellular injury and effects the liver antioxidant grade.

Permissible levels by an individual per day:50mg/kg of body weight

Neotame

Neotame is the recently discovered sweetener which is derived from aspartame^[15]. Neotame is formed when tertiary butyl group is added to amine free group of aspartic acid. The neotame was accepted as general purpose or tabletop artificial sweetener in the year 2002 except in poultry and meat by Food and Drug Administration (FDA or USFDA)^[16].

Health effects: Safety studies demonstrated that neotame has no hostile effects in clinical observations, physical and microscopic findings.

Permissible levels by an individual per day:0.3mg/kg of body weight

Sucralose

Sucralose is one of the largely consumed sugar substitute^[17]. Sucralose is highly stable, safe and even used at higher temperatures (baked food products). Sucralose is up to 1000 times sweeter

than sucrose, thrice sweet as aspartame and acesulfame potassium and sucralose is twice sweet as saccharin^[17,18].

Health effects: Current studies report shrinking of thymus glands on the intake of 5% sucralose in the diet. However, proper assessment of the records and specific immunotoxicity studies evidently cleared the misconception proving that the involution of thymus glands was mainly due to the nutritional deficit.

Permissible levels by an individual per day:5mg/kg of body weight

Natural Sugars Versus Artificial Sugars

Sugars in diet can be natural or added. Natural sugars occur naturally in foods such as fruit (fructose) and milk (lactose)^[19]. These, being rich high calories, can raise blood sugar levels. Some of examples include brown sugar, cane sugar, confectioner's sugar, fructose, honey, jiggery, khand, molasses, Turbinate or "raw" sugar (dehydrated cane juice)^[20]. These are called natural sugars because firstly these occur on their own; and secondly these are not manipulated by humans. Natural sugars occur in ample amount in fruits and give them sweet and appealing taste. However, some foods are not sweet but contain sugars. Carrots, Beets, cabbage and potatoes contain some of these compounds.

Added sugars refers to caloric sweetener (sugars and syrups) added to foods during its production and processing^[21]. It is chemically indistinguishable from natural sugars, but characterized by extra calories with no nutritional value. These are also known as extrinsic sugars while naturally occurring sugars are known as intrinsic. Consumption of added sugars has been associated with increased risk of heart disease, high blood pressure, type 2 diabetes and obesity.

Thumb rule is to avoid products with added sugars; however, the growing use of alternative sweeteners make it difficult to determine which ingredients count as sugar, because there are multiple sources

of sugar with different names. While we sometimes add sugar to food by ourselves, most of it comes from prepared and processed foods, example, breakfast cereals and sweetened beverages. A reduction in added sugar intake can lower the obesity and heart disease epidemics. Added-sugar limit should not be more than 100 calories per day (about 6 teaspoons or 24 grams) for women and 150 calories per day (about 9 teaspoons or 36 grams) for men^[22].

Research Limitations

AS are found in non-edible products and are often ingested or used without consumer awareness, thus making it extremely difficult to establish clear causality in human studies that use dietary recall questionnaires. Many of the studies evaluating the effects of AS on metabolic parameters avoid this dilemma by using rodent models where all of the variables are strictly controlled. Although rodent models glean some insight into the effects of AS, the outcomes are inconsistent in humans.

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CONCLUSION

So, research is required to make natural sugars having the desired quantities of sweetness, low caloric value, and least observed physiological effects. Products containing Stevia and Mono ammonium glycyrrhizin should be encouraged as besides carrying the goodness of natural ingredients, it is free from the hazardous effects of other chemical-based alternates. MAG (Mono ammonium glycyrrhizin) enhances the flavour of cocoa and chocolate-flavoured products, flavours and sweetens candy, confectionery, and beverages, and masks the bitter taste of pharmaceuticals

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