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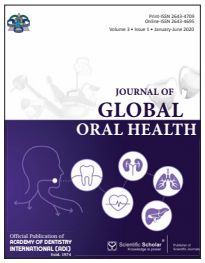

Review Article

Non-sugar substitutes: Effects on oral health

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ABSTRACT

With people becoming more and more aware of the detrimental effects one's lifestyle can have on health, people are shifting to what we refer to as "sugar-free" in the hope of being able to live a healthier life, but what we don't know are the hidden effects these labeled products have. There are recent studies and comments about the hazardous effects that these sugar-free products have on both general and oral health. The recent World Health Organization recommendations suggest that the use of artificial sweeteners may pose a risk of cancer development, which raises many eyebrows as these artificially sweetened products have seen an extensive boon in the past few years due to the possible health benefits that are said to be associated with them. It sometimes appears that what we are told is beneficial for us one day and it is then said to be detrimental for us the next. This can make determining exactly what we should be doing to maintain our optimal health difficult. Hence, this review talks about the effects of non-sugar substitutes and what must be done about them.

Keywords: Non-sugar substitutes, Artificial sweeteners, Dental erosion, Aspartamine, Oral health

INTRODUCTION

Dental caries is a complex chronic illness, with factors such as bacteria, saliva, sugar intake, oral hygiene, diet, fluoride exposure, and hereditary influencing its severity. Untreated tooth decay affects 28% of adults aged 35–44 and 18% of adults 65 and older. Caries have been around for more than a million years, and it is still very common in poor nations.[1]

Obesity, type 2 diabetes, dental caries, and dental erosion have all become serious challenges for physicians, dentists, and parents due to widespread poor eating and drinking habits. With the rising popularity of harmful, sticky, and easily accessible refined carbohydrate-rich foods and beverages, issues relating to the body's metabolic activity and dental health have gained prominence.[2]

Microorganisms that ferment carbohydrates and produce acids feed on sugars and other dietary carbohydrates that can be fermented. The tooth enamel becomes demineralized as a result of the acidity, which is the first stage of dental caries lesions. Therefore, reducing the activity of the etiological components will reduce caries. These include minimizing the ingestion of fermentable carbohydrates and preventing the growth of acidogenic bacteria in the mouth by practicing proper oral hygiene. Fluoride use also reduces enamel vulnerability to acid disintegration, which prevents tooth cavities.[3]

Sugar substitutes are most commonly a part of candies, chewing gums, soft drinks, and energy drinks; these may lead to acid production too and, hence, may cause irreversible loss

of tooth surface or dental erosion. Acids are often used in beverages and confections as flavorings and preservatives, but little is known about how they affect tooth health. The location of dental abnormalities may vary depending on whether the acidic substance is in liquid or solid form. The anterior maxillary and mandibular teeth appear to be more susceptible to erosion from acidic drinks. The most common symptoms of erosion from solid acids, like those found in candies, include smooth, silky-glazed enamel and cupping of the occlusal surfaces of posterior teeth.[4]

METHODOLOGY

The data regarding this topic is sparse, even though there is an increasing need to know about the effects these substances have. The current review is mainly based on sources from databases such as Google Scholar PubMed and the knowledge freely available on the internet. We were unable to do a meta-analysis and estimate the amount of dental erosion because there was no well-done research or randomized trials on the subject. Thus, the review is descriptive.

The trend to eliminate sugar has gained popularity. Artificial, non-nutritive sweeteners like saccharin and sucralose satisfy your sweet tooth while being low in calories. For people with diabetes, sugar-free options are particularly crucial. Artificial sweeteners can lessen tooth decay as well. Oral bacteria cannot make acid or procreate since there is no sugar for them to ingest. One sugar alternative, Xylitol, has even been demonstrated to lower the incidence of cavities because oral bacteria bring it in because they mistake it for sugar but are unable to metabolize it, leading to their demise.

Some of the commonly available sugar-free products are listed below:

Sugar free drinks: Drinks with artificial sweeteners can help consume less sugar; however, it has been found that these sweeteners are just as likely to contain substances that weaken teeth enamel. As the enamel thins, it becomes more easily lost by brushing, exposing the dentin of the teeth and leading to cavities.

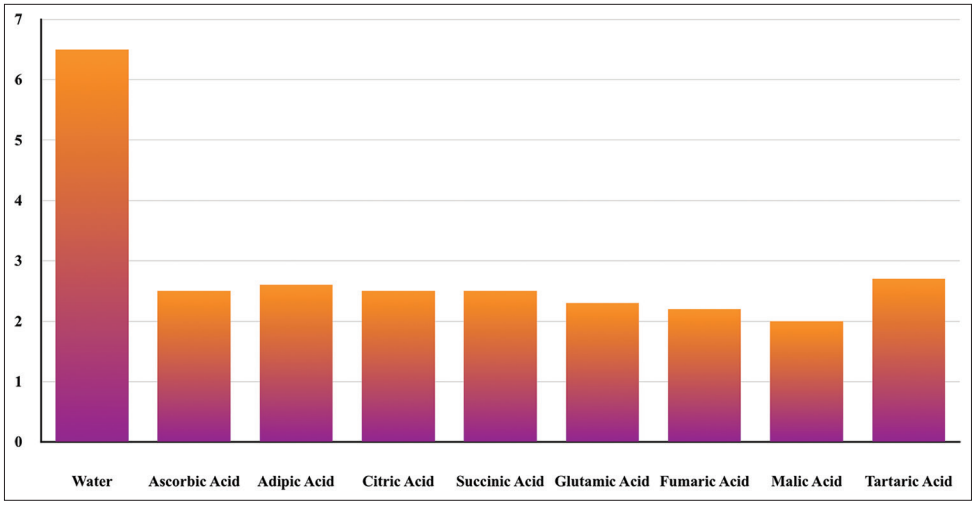
Candies: Teeth could be harmed by candies that are flavored with chemicals like citric acid. Even though they do not contain sugar, sticky and chewy candies can leave behind a difficult-to-clean residue between teeth.

Chewing gums: Chewing sugar-free gum can be good for teeth, particularly if one cannot clean and floss after a meal. However, some artificial sweeteners are preferable to others. Studies have shown that the sweetener Xylitol works better than any other sweetener to prevent tooth decay. Whether or not a gum contains Xylitol, chewing it still aids in rinsing acidic meals off the teeth's surface, preventing the acid from eroding the enamel. Gum chewing leads to the production of more saliva, which helps wash away leftover food.

Dental erosion: Another crucial component of sugar-free candies and beverages is the addition of additional substances, like acids, to create an appealing flavor. In addition, acids are employed as food preservatives. Acidic flavoring ingredients have the same damaging effects on dental enamel from a dental health perspective as the microorganism-produced acids from sugar fermentation. The demineralization seen *in vitro* studies 39 and demonstrated after drinking sugar-free beverages serve as proof of this. More research is required in this field of study because the impact of acids in sugar-free goods has not yet been extensively investigated *in vivo*.[5] Kleber *et al*., recognized the potential of erosion from acidic additions in sugar-free food as early as 1978.[6] Both the original flavor and the sour versions of sweets were potentially erosive, according to a study by Wagoner *et al*.; usually, the erosive capacity was directly proportionate to the acidity of the candies under investigation.[7] In a study by Davies *et al*., the acidic filling of chewing gum decreased the microhardness of both primary and permanent enamel. Orange juice, a well-known erosive agent, has been proven to be less erosive than sour sweets.[4] The addition of protective chemicals such as calcium and/or phosphate to candies has been studied because tooth erosion is an irreversible condition, and erosive lesions on teeth are challenging to treat.[8] When compared to candies lacking calcium, the erosive potential of candy was significantly reduced at salivary calcium concentrations of roughly 15 mmol/L (P = 0.001)[9][Graph 1].

Although it has been strongly believed that non-sugar sweeteners can decrease the incidence of dental caries, what is worth mentioning is that foods with artificial sweeteners, which tend to stick to the teeth, can very well cause the incidence of dental caries and thereby be of no value in the prevention of dental caries. At present, there are no alternatives other than Xylitol, which has shown a promising outcome in the prevention of dental caries.[10]

Aspartame is a synthetic (chemical) sweetener that is used in a variety of foods and beverages, including diet drinks, chewing gum, gelatin, ice cream, dairy products like yogurt and morning cereal, toothpaste, and prescription drugs, including cough drops and chewable pills, according to a statement from the World Health Organization (WHO). The non-sugar sweetener aspartame was labeled as a potential carcinogen by the WHO on July 13th, but it is safe to consume up to 40 mg/kg of body weight each day. There, however, is a need for further research in this regard due to limited studies and, therefore, the limited results of those studies.



Graph 1: pH changes with various acids found in non-sugar sweeteners and a comparison with water.

CONCLUSION

The results of multiple research have demonstrated that using sugar-free sweeteners in place of table sugar is a healthier option for preventing dental caries, despite some dispute. However, sugar-free treats and drinks with acid flavorings and preservatives lower the salivary pH below a threshold level, which may lead to dental erosion, and those with sticky components may cause dental caries, too. Trials employing sugar-free goods, either with or without acidic additions, must be adequately designed and randomized to find better insights into this topic. With the recent statement from the WHO, it has become all the way more important to be vigilant about the use of these chemically produced sweeteners, and studies on other compounds apart from aspartame must be undertaken.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

Patient's consent was not required as there are no patients in this study.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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