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The Effect of Artificial Sweeteners in Chewing Gum, Helpful or Harmful?

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Abstract

Objective/Aims: This review of literature was designed to analyze the effects of artificial sweeteners in chewing gum in the oral cavity. The intent was to recognize which formulations of artificial sweeteners in chewing gum lead to beneficial outcomes in the oral cavity and which formulations lead to harmful effects.
Methods: The review of literature analyzed the conclusions of primary and secondary resources accumulated from PubMed. Multiple scholarly studies were filtered based upon meta-analysis, cross-sectional, and cohort studies. The following key terms were used: artificial sweetener, chewing gum, plaque, saliva, microbes, and oral health. A summative report was created based upon the relevant findings. Articles selected were published after 2014.
Results: The studies collected were assessed using a measure of saliva and plaque pH, salivary function, caries occurrence, remineralization, and oral flora. Xylitol made the most beneficial impact on the oral cavity. Research indicates artificial sweeteners have shown an immense advantage over conventional sugar in chewing gum, and its resulting effects on hard tissue.
Conclusion: The relationship between artificial sweeteners and oral health supports different advantageous outcomes in the oral cavity. In conclusion, although studies using artificial sweeteners can show benefits to the oral cavity, the dose of artificial sweetener required to yield these results are often not found in chewing gum.

Introduction

Artificial sweeteners have become increasingly popular since they were developed in the 1870s. Saccharin, the first artificial sweetener discovered, was created accidentally by Constantine Fahlberg. Fahlberg spilled the compounds he synthesized in the lab on his hands and discovered the intensely sweet taste while eating a meal later on that day. [1] Saccharin gained popularity quickly and was integrated into society and multiple food sources. Various formulations of this product have become popular since, due to suspicions that saccharin can cause cancer. Some of the most popular artificial sweeteners used today include xylitol, sorbitol, maltitol, and mannitol. The food industry often markets products that contain artificial sweeteners instead of sucrose, as sugarless. One of the most popular sugar-free items is chewing gum. Artificial sweeteners have remained a staple in today's diet, due to studies which revealed the multiple advantages over sucrose. Studies have been conducted focusing on the relationship between different formulations of artificial sweeteners and saliva and plaque pH, salivary function, caries occurrence, remineralization, and oral flora.[2] This review of literature discusses the specific effects artificial sweeteners in chewing gum have in the oral cavity. The intent is to recognize which formulations of artificial sweeteners in chewing gum lead to beneficial outcomes in the oral cavity and which formulations lead to harmful effects.

Review of Literature

Xylitol

Anticariogenic: Substituting a non-fermentable sweetener such as xylitol in place of sucrose, caries causing microbes are deprived of their energy source which inhibits decay. [3]
Plaque: A study conducted by the University of Turku in Finland at the Institute of Dentistry found the consumption of xylitol decreased the growth and accumulation of dental plaque in dental students up to 50% unlike traditional sugars such as sucrose, D-fructose, or D-glucose. [4]
Remineralization: Xylitol has been shown to have remineralization and rehardening properties due to its non-fermentable properties and ability to stimulate salivary flow. [4]
Microbial Interaction: Xylitol weakens adhesive properties of microbes by impairing polysaccharide formation. [4]
Saliva: A study was conducted on 90 school children who were divided into two groups and instructed to eat lunch, then chew on xylitol-sweetened gum or paraffin pellets for 15 minutes. The salivary flow rate was measured by collecting the stimulated saliva in a graduated beaker. The study concluded xylitol stimulated salivary flow and raised saliva pH. [5]

Sorbitol

Cariogenic: Sorbitol is lacking anticariogenic effects; research has shown oral microorganisms Streptococci and lactobacilli are capable of fermenting sorbitol. [6]
Microbial Composition: The results concluded sorbitol did not significantly affect the composition of dental plaque, S. Mutans, and Lactobacilli were undetected. [7]
Saliva: Sorbitol has shown to increase salivary flow while chewing flavored gum, but decreases after the flavor in gum is lost. [3]

Maltitol

Plaque: A study conducted by the Journal of Oral Microbiology concluded chewing gum that contained maltitol decreased the number of A. naeslundii and Actinomyces microbes found in dental plaque, but had a minimal impact on the plaque microbiome overall. [8]
Microbial Composition: An in vitro study revealed that growth of *A. massiliensis*and *A. johnsonii* was impeded in a concentration-dependent manner, showing full inhibition in the presence of 1% maltitol. The growth of *A. israelii* was partially inhibited at maltitol concentrations of 1% and higher. The growth of *A. naeslundii* and *A. gerencseriae* were only slightly impaired at the highest concentration tested. [9]

Mannitol

Anticariogenic: In a study conducted on rats exhibited a caries-reducing potential with mannitol exhibiting a 70% reduction in caries. [10]
Microbial Interaction: A study conducted revealed the artificial sweetener is able to be fermented by the oral microorganisms S. mutans and lactobacilli. [6] This could potentially be harmful to the oral hard tissues and induce caries.

Chewing Gum in Dentistry

Figure 1: Visual representation of the effects xylitol containing chewing gum has on hard tissue.

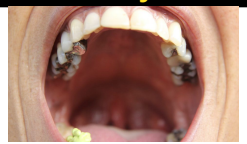

Figure 2: Visual representation of the effects sucrose containing chewing gum has on hard tissue. [12]

Results

The benefits of artificial sweeteners on hard and soft tissues in the oral cavity have been widely accepted in the last century. Research has revealed xylitol exhibits the most advantageous effects. As discussed, xylitol has been proven to possess anticariogenic, antiplaque, remineralization, antimicrobial, ability to raise saliva pH, and salivary flow inducing properties. [11] While other artificial sweeteners have similar capabilities, they are able to be fermented by microbes or have insignificant favorable effects in humans. Artificial sweeteners can be utilized as a helpful aid to improve oral health.

Conclusion

This review of literature will assist the chewing gum population in recognizing the most beneficial formulation of artificial sweeteners in chewing gum. Studies show a number of positive outcomes resulting from artificial sweeteners in chewing gum. Among the artificial sweeteners researched, Xylitol was proven to have the most beneficial effects on the oral cavity through clinical studies. Although studies using artificial sweeteners show benefits to the oral cavity, the concentration of artificial sweetener required to yield all of the results are often not found within chewing gum.

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