

The effect of soft drink acidity levels on tooth mineral solubility

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Abstract

Introduction. Acid can affect dental health. Soft drinks typically can be categorized as acid. Their high acidity can result in tooth erosion and increase tooth mineral's solubility.

Methods. This article review conducted using related journals about soft drinks and tooth mineral's solubility. All of the chosen articles were published within the last 10 years.

Discussion. Soft drinks' acidity could affect tooth mineral with several mechanisms; tooth mineral demineralization, decreasing pH, and buffering effect. Some studies showed different results, but generally, results from recent studies showed the significant relation between the consumption of soft drinks with tooth mineral's solubility.

Conclusion. There is a significant relationship between the consumption of carbonated drinks and the solubility of tooth minerals. That's why to keep dental and oral health, it is very recommended to avoid excessively consuming soft drinks and replace it with healthier drinks, as well as maintaining dental and oral hygiene by routinely brushing the teeth.

Keywords: Soft drink; Tooth mineral's solubility; Acidity; Demineralization; Dental Health

1. Introduction

Acids can affect dental health. One of the negative effects of high acidity is tooth erosion and reduced solubility of tooth minerals. Acids are found in a variety of foods and beverages, including soda and soft drinks [1].

Several recent studies have examined the effects of acid on dental health. A study published in 2019 suggests that there is a relationship between tooth acidity and the solubility of minerals in teeth [2]. The study showed that the higher the acidity, the greater the effect on decreasing the solubility of minerals in teeth.

Recent research suggests that several factors can affect the strength of tooth minerals, including diet, consumption of acidic foods and drinks, and improper dental care [3]. In the study, the technique used to test the acidity level of tooth minerals involved measuring the pH of the oral cavity after consuming certain foods and drinks that have the potential to lower the pH, such as fruit juice or soft drinks. The results showed that higher acidity accelerated the erosion of tooth enamel and reduced the solubility of tooth minerals [3].

Soft drinks or carbonated drinks have a close relationship with human dental health. The high acidity of these drinks can cause tooth erosion and increase the solubility of tooth minerals. Tooth minerals, especially calcium and phosphate, are essential for healthy teeth and bones [4].

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Several recent studies have examined the relationship between soda and tooth minerals. A study published in 2022 [5] showed that soda containing phosphoric acid and citric acid can cause tooth enamel dissolution, especially if consumed regularly or if oral hygiene is not maintained properly. The study also found that soda with added sugar had more tooth decay than drinks without added sugar.

Regular consumption of carbonated drinks can reduce the mineral content of teeth. Phosphoric acid, sugar and citric acid content in carbonated drinks causes erosion of tooth enamel, increasing the risk of cavities and hypersensitivity [6].

2. Material and methods

This review article was compiled by searching for relevant articles on search engines and scientific websites such as Google Scholar, ScienceDirect, and PubMed using the keywords “soft drink” and “tooth mineral solubility”. The selected articles were published within the last 10 years. The research subjects of each article focused on teeth and soft drinks.

3. Results and discussion

Drinking a lot of soda affects the solubility of mineral s in the teeth. This can cause tooth decay and other dental and oral problems. The acidity level in beverages such as soft drinks can affect the solubility of tooth minerals through several mechanisms. Soft drinks generally contain phosphoric acid and carbonic acid, which can react with tooth enamel and dentin and cause damage to tooth minerals [7]. The mechanisms involved include:

- Demineralization of tooth enamel: Acid in drinks can release mineral ions, such as calcium and phosphate, from tooth enamel, making the enamel softer and more easily eroded.
- Decreased pH: Acid in drinks can lower the pH of the environment around the teeth, which can increase the activity of acid bacteria and accelerate demineralization of tooth enamel.
- Buffering effect: Acid in drinks can interfere with the ability of saliva to neutralize acid in the mouth. This can worsen damage to tooth enamel.

Several recent studies have shown that carbonated drinks with high acidity levels can contribute to tooth enamel damage and increase the risk of tooth decay. The study showed that high consumption of carbonated drinks can cause a decrease in the pH around the teeth and accelerate the demineralization of tooth enamel [8].

A study by Ratih *et al.* [9] showed that drinking soft drinks regularly can affect the solubility of tooth minerals. This study found that drinking soft drinks regularly can increase the solubility of tooth minerals, especially in tooth enamel. This can lead to decreased strength and thickness of tooth enamel, as well as increase the risk of tooth decay.

Another study by Farah *et al.* [10] showed that the acid content in soft drinks can cause a decrease in pH in the mouth and erode tooth minerals. This study found that the higher the acidity level in soft drinks, the greater the likelihood of tooth decay.

Naveen Kumar *et al.* [11] showed that soft drink consumption can significantly reduce the microhardness of enamel. Another study by Kavitha *et al.* [12] showed a reduction in tooth minerals in enamel after exposure to soft drinks.

Research by Saraiva *et al.* [13] also showed that soft drink consumption is associated with decreased tooth minerals and enamel damage. This study also shows the long-term effects of soft drink consumption on dental and oral health.

Erviana *et al.* [14] proved through their research that the solubility of calcium in deciduous teeth after immersion for various durations of time was higher compared to the solubility of calcium in permanent teeth. Immersion was carried out in carbonated soft drinks (Fanta).

Research by Tadakamadla *et al.* [15] showed that the soft drink used in their study had an average pH of 2.84 and enamel pieces soaked in the soft drink had a weight loss of $12.4\% \pm 3.77$ after 24 hours.

The results of this study are further supported by a study conducted by Melo [16] which stated that there was a decrease in the concentration of the minerals Na, P, K, Fe, Al, Mn, Zn, Ba, Cu, V, Cr, Se, As, Pb, Cd, and Ni in teeth soaked in grape juice. In the group of teeth soaked in orange juice, a decrease in the concentration of the minerals Ba, Cd, Cr, K, Mg, Mn,

P, V, and Zn was found. Meanwhile, in the group of teeth soaked in Coca Cola, a decrease in the concentration of the minerals Ba, Mn, P, Na, K, Ca, and Se was found.

Therefore, it is highly recommended to avoid excessive consumption of soft drinks and replace them with healthier drinks such as mineral water, unsweetened tea, or fresh fruit juice. In addition, proper dental care such as brushing and cleaning teeth regularly is also very important in maintaining healthy dental minerals [17].

4. Conclusion

Although some studies show different results, in general, the results of recent studies show a significant relationship between soft drink consumption and tooth mineral solubility [18]. In order to maintain healthy teeth and tooth minerals, it is highly recommended to maintain a healthy diet, avoid acidic foods and drinks, and perform proper dental care such as brushing and flossing regularly.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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