

Effects of Sodium Bicarbonate Mouthwash on Saliva pH and Oral Microflora

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ABSTRACT

Introduction: Prevention of dental and oral disease is considered very important in maintaining daily dental and oral health. One way to prevent this is through sodium bicarbonate mouthwash. The aim of this study was to determine the effectiveness of sodium bicarbonate mouthwash in preventing dental caries. **Methodology:** using a narrative review method from several databases including Pubmed, Google Scholar, and the BMC Oral Health website. **Conclusion :** Mouthwash Sodium Bicarbonate is an effective cleaning agent, it can be used to remove stains on teeth, remove bad breath and can whiten teeth because this mouthwash can reduce bacterial growth and remove plaque buildup.

INTRODUCTION

In current dental practice, dental plaque has been established as the main causative agent for dental caries. To understand the pathophysiology of the disease it is considered that fermentation, which produces strong organic acids such as lactic acid with other acids helps in increasing the acidic environment leading to dissolving of tooth enamel leading to caries. In a study it has shown that plaque on the tooth surface, when exposed to sucrose, can accelerate acid production, resulting in a decrease in pH which can only occur gradually to be returned to the basic limit of plaque pH. Dental caries is a complex disease in which there is an interaction between tooth structure, oral microbial biofilms that form on tooth surfaces, dietary sugars, and, to a lesser extent, starch, and salivary and genetic influences. Biofilms metabolize sugars and produce acids, over time demineralizing tooth enamel and can lead to progressive decay of the hard tissues of the teeth, and if left untreated, pain, abscesses, and possible tooth loss. The important role of the interaction between dietary sugars and dental biofilm is well established. However, views on the role of certain organisms, such as *Streptococcus mutans*, in causing caries have changed over time. Several other species of biofilm microorganisms are from the genera *Veillonella*, *Lactobacillus*, *Bifidobacterium*, and *Propionibacterium*; low pH non-S *mutans streptococcus*; *Actinomyces*; and *Atopobium* species with acid-producing and acid-resistant properties have also been associated with caries.

It is important to have a healthy oral cavity through personal oral care (i.e., dental plaque management) because with proper oral health care, plaque, dental caries, and oral diseases can be prevented. Among the various kinds of oral care aids for teeth, there is the use of mouthwash. The use of mouthwash is increasing in South Korea, and many studies have been conducted to effectively eliminate bad breath and prevent oral diseases. For another reason, it seems that the use of mouthwash is increasing because it reduces the number of pathogenic bacteria in the mouth, keeps the mouth soft, comfortable and removes foreign bodies in the mouth.

LITERATURE REVIEW

1. Sodium Bicarbonate Mouthwash

Baking soda is a chemical compound with the formula NaHCO_3 , this compound is called Sodium Bicarbonate. Because baking soda crystals are soft, baking soda is considered to have a low abrasiveness that can reduce the potential for damage to enamel and dentin. For years, the American Dental Association has recommended the use of baking soda in dentistry. Baking soda is an effective cleaning agent, it can be used to remove stains from teeth, eliminate bad breath and can whiten teeth because baking soda can reduce bacterial growth and remove plaque buildup. Baking soda does not cause abrasion to the tooth structure, safety, biocompatibility, low cost, and antibacterial properties make it one of the most economical yet efficient and abrasive materials especially for use in dental products such as toothpaste and mouthwash. Sodium bicarbonate mouthwash has been introduced for oral health care which can not only improve patient comfort but also help maintain water levels in the mouth, it can also help reduce the risk of secondary infections. Sodium bicarbonate does not have a

direct antimicrobial effect but has an active role as a cleansing agent due to its ability to dissolve mucus and remove dirt. Using baking soda as a mouthwash has been proven to cause a decrease in plaque pH after 49 minutes. Baking soda dissolves in water at normal room temperature (around 20 °C). Baking soda doesn't dissolve in alcohol. For safe use, baking soda is diluted in water. Baking soda is stable in open air and at normal room temperature, so it can be stored in a closed place and does not need special handling. This mouthwash solution can be made by mixing half a teaspoon of baking soda with 8 oz (250 ml) of water.

Although baking soda can clean teeth well, the downside to using baking soda is the lack of fluoride which is needed to protect against cavities. In addition, baking soda has a salty taste that consumers may find objectionable. The effect of baking soda in removing plaque can be attributed to the physical properties of baking soda crystals in removing plaque from the tooth surface, the interaction between the plaque matrix and dissolved baking soda, which can reduce the viscosity of plaque and make it easier to remove with a toothbrush.

2. Effect of Sodium Bicarbonate on Saliva pH

Sodium bicarbonate is one of the ingredients that can stimulate salivary secretion. This increase in salivary secretion is related to the salivary buffer system in the oral cavity, because the pH and buffer capacity of saliva will increase during an increase in salivary secretion. In the field of dentistry, the effect of using sodium bicarbonate in the form of chewing gum, gel, and tablets to increase the pH in the mouth has also been widely used in terms of helping the buffer capacity of the saliva itself. Because of its ability to increase pH, sodium bicarbonate is known to be naturally alkaline, which is then based on these benefits, it is also often given to xerostomia sufferers.

3. Effect of Sodium Bicarbonate on Flora in the Oral Cavity

Sodium bicarbonate (NaHCO_3), or baking soda, has a special role in dentistry due to its growing use in toothpastes and mouthwashes. There are many beneficial properties including, low cost, safety, low abrasiveness, water soluble, acid neutralizing properties, fluorine compatibility, and antibacterial ability. The alkalinity of baking soda can neutralize acids produced by microbes in the dental biofilm, so that the tooth enamel matrix tends not to be demineralized. Another factor responsible for baking soda's antibacterial effect is its ability to change osmotic pressure. The hypertonic nature of baking soda causes the hypotonic components of the bacterial cells to lose water, causing dehydration and killing the bacterial cells. However, it is said that baking soda must interact with bacterial cells for at least 30 minutes to be effective in killing bacterial cells. The antibacterial ability of baking soda is not very strong, this is due to its soluble nature, besides that, baking soda is also able to damage the bacterial matrix structure and damage the bond between bacteria and tooth surfaces. Baking soda can also play a role in changing or reducing the virulence of bacteria which play an important role in causing caries. The results of Kelly and Kristin's research in 2005 said that baking soda has a good antibacterial effect in preventing the growth of *S. mutans* bacteria.

Laboratory studies on antimicrobial agents found to be bactericidal in baking soda concentrations ranging from 75 micromolar per liter to more than 10 millimolar per L for gram-negative facultative bacteria found in dental plaque biofilms such as *Actinobacillus Actinomycetemcomitans*, *Haemophilus aphrophilus*, *Eikenella corrodens*, and *Capnocytophaga gingivalis*. Baking soda was also found to be bactericidal concentrations from the combination of hydrogen peroxide and baking soda showing synergistic antimicrobial activity. A concentrated solution of baking soda can immobilize oral spirochetes and motile rods in the periodontal pocket fluid mixture.

METHODOLOGY

The research uses the Narrative Review method, where the author considers references by choosing titles, keywords and content related to the theme. Search for references using databases, namely: Pubmed, Google Scholar, and BMC Oral Health, where the author uses references from the last 10 years.

DISCUSSION

In a study conducted by Chandel S, et al. (2018), this study was designed to determine the effect of sodium bicarbonate mouthwash on salivary pH and oral microflora. The method of this study was to use Twenty-five healthy subjects collected at the Department of Dentistry at Era Medical College. Subjects may not brush their teeth overnight. Pre-rinsing samples (control) were collected one hour after dinner and asked to rinse with freshly prepared sodium bicarbonate solution. Saliva samples were collected the next day using sterile gauze in marked bottles. Aerobic bacterial culture was carried out by transferring the sample directly from the swab to the surface of Blood agar and Mac Conkeys media. Colony forming unit (CFU) and the pH was calculated for the saliva samples before and after rinsing. The results of this study resulted that gargling with sodium bicarbonate was effective in increasing salivary pH above the threshold needed to prevent enamel demineralization and increase remineralization. Sodium bicarbonate mouthwash can be considered a cheap and effective alternative to chlorhexidine and alcohol mouth rinses, especially if long-term use is required.

In a study conducted by Farooq L, et al (2020), this study was designed to evaluate the role of probiotic solutions, baking soda and mineral water on salivary pH. This study was a cross-sectional study conducted at the Karachi Institute from 10 January to 25 June 2020. Out of 150 participants, 60 met the inclusion criteria and explained the research procedure 60 participants were divided into three groups, each group consisting of 20 participants. Group 1 was given probiotic mouthwash; Group 2 was given baking soda mouthwash and group 3 was given mineral water mouthwash. Participants were told to rinse their mouths before and after consuming food and changes in saliva before and after were recorded. The results of this study were gargling with a solution of baking soda and mineral water to increase the salivary pH to normal.

In a study conducted by Shin AR, et al. (2018) this study was designed to emphasize the need for gargling in a good oral environment, to examine changes in the oral environment through saliva before and after optimal use of mouthwash, and to improve oral hygiene. This research was conducted on 20 female students at a university located in Gangwon Province who had no history of special medication in the last 6 months and did not smoke. Group 1 (n = 5) gargling with 0.2% chlorhexidine gluconate (CHX), group 2 (n = 5) with 7.5% Povidone Iodine (PVI), group 3 (n = 5) with sodium bicarbonate-normal saline, and group 4 (n = 5), control group, with sterile distilled water. After collecting 10 ml of saliva from each group, rinse 15 ml of each solution for 1 minute, then 10 ml of saliva is taken. In measuring the pH of 10 ml of saliva in a stable state before and after rinsing with mouthwash, each group was measured using a pH meter. After measuring the pH, the glass electrodes were washed with sterile distilled water every time the salivary pH was measured for all groups. The results of this study confirmed that sodium bicarbonate-normal saline has the effect of increasing pH, because the pH of saliva increases after use. but not statistically significant because the value of $P > 0.05$ and Colony forming unit (CFU) of *S. mutans* in the normal saline sodium bicarbonate group decreased, but also not statistically significant because of the value of $P > 0.05$).

CONCLUSIONS AND RECOMMENDATIONS

Dental health is one aspect of overall health. Thus, dental health is also the result of interactions between physical, mental, and social conditions. Teeth have an important role when speaking and determine a person's face. Apart from that, teeth and mouth function as aesthetics and beauty, so many people think that teeth and mouth are an integral part of general health and dental aesthetics are an invaluable thing. Healthy teeth will increase a person's self-confidence. If the appearance of a person's teeth is sloppy, dirty, dull in color or blackish brown, this will reduce a person's self-confidence. Baking soda is an effective cleaning agent, it can be used to remove stains from teeth, eliminate bad breath and can whiten teeth because baking soda can reduce bacterial growth and remove plaque buildup. The American Dental Association has recommended using baking soda as a toothpaste. Sodium bicarbonate is an ingredient that can stimulate saliva secretion. In addition, baking soda has a good antibacterial effect in preventing the growth of *S. mutans* bacteria.

a. Dental health practitioner

This writing is useful for dental health practitioners in conducting interventions to prevent dental and oral diseases, especially dental caries in the community. Where they can provide education to the public that sodium bicarbonate mouthwash can be used as an effective inhibitor of dental plaque formation so that it can be used as an option in efforts to prevent dental and oral diseases.

b. Community

This research is useful for the community in their efforts to reduce DMF-T rates, prevalence, and incidence of dental caries so that they can improve dental and oral health in populations of people who have a high risk of dental and oral diseases.

c. Dentistry Student

This writing is useful for dental students so they can develop research on sodium bicarbonate mouthwash which can be used as a more innovative and varied mouthwash.

ADVANCED RESEARCH

The limitation of this study is that it is still a narrative review, where more complete facts are needed, so analytic research is needed to find out cause and effect. Further research is also needed to find out the latest findings regarding the effects of sodium bicarbonate mouthwash which have not been found before using stronger laboratory evidence.

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