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Gargling with red grape *(Vitis Vinifera)* infused water to stabilize saliva pH, is it effective?

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ABSTRACT

Background: Saliva plays a crucial role in maintaining the pH balance of the mouth, preventing enamel demineralization and caries. While conventional mouthwashes are often used to stabilize pH, their chemical content can cause side effects such as irritation and dry mouth. Alternatively, fruits can be used to help maintain pH balance naturally. These fruits contain bioactive compounds with antioxidant and antimicrobial properties that support oral health. **Objective**: To analyze the effectiveness of red grape infused water in stabilizing saliva pH. **Methods**: This study employed a pre-experimental design with a pretest-posttest one-group design. The research was conducted on students at SMP Pattimura Jagakarsa, South Jakarta. The sampling technique used proportional stratified sampling involving 60 students. The research instrument consisted of saliva pH measurement sheets and data were analyzed using the Wilcoxon test. **Results**: gargling with red grape infused water was effective in stabilizing saliva pH in the oral cavity, with a p-value of 0.000. **Conclusion**: gargling with red grape infused water is effective in stabilizing saliva pH in the oral cavity.

INTRODUCTION

Saliva plays a vital role in maintaining the balance of the oral ecosystem. Its buffering capacity serves to maintain salivary pH within a normal range. A drop in salivary pH, resulting from the metabolic activity of bacteria in the oral cavity, increases the risk of enamel demineralization and caries. Conversely, a stable salivary pH is essential for preventing enamel demineralization, inhibiting the growth of acidogenic bacteria, and supporting the process of tooth remineralization. (Lely, 2023)

To maintain salivary pH stability, individuals often use mouthwash. However, the chemical agents in conventional mouthwashes, such as alcohol and Chlorhexidine, are associated with adverse side effects, including mucosal irritation, xerostomia (dry mouth), and disruption of the normal oral flora (Kurniawan & Fatmasari, 2020). Various approaches can be used to help maintain pH balance, one of which involves using natural ingredients like fruits. These fruits contain bioactive compounds—such as flavonoids, polyphenols, tannins, and resveratrol which have been scientifically proven to possess potent antioxidant and antimicrobial properties. (Putri et al., 2022)

Red grapes (*Vitis vinifera*) are a fruit rich in polyphenols, flavonoids, tannins, and resveratrol, all of which are known to have antioxidant and antimicrobial properties. The active compounds in red grapes can inhibit the growth of cariogenic bacteria, such as *Streptococcus mutans*, and help neutralize acids within the oral cavity. Therefore, gargling with a solution derived from red grapes has the potential to increase or maintain salivary pH within the normal range. Furthermore, this method is easy to apply, cost-effective, and free from the alcohol or harsh chemicals commonly found in conventional mouthwashes. (Kurniawan & Fatmasari, 2020)

The active compounds in these red grapes are hypothesized to have a dual effect: not only inhibiting the growth of cariogenic bacteria such as *Streptococcus mutans*, but also helping to neutralize the acidic byproducts they produce. Thus, gargling with red grape infused water has the potential to increase or stabilize salivary pH back to a normal range, without the adverse effects caused by chemical mouthwashes. Despite its significant potential, scientific studies specifically investigating the effectiveness of red grape

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infused water as a mouthwash for altering salivary pH remain very limited. Therefore, this study aims to evaluate the effect of gargling with red grape infused water on salivary pH changes, in order to provide a scientific foundation for the development of innovative oral care products that are natural, safe, and non-invasive.

METHOD

This study used a pre-experimental method with a one-group pretest and posttest design. The use of this design was intended to analyze the effect of red grape infused water on changes in salivary pH. The sampling technique used in this study was proportional stratified sampling**.** This method is applied when the population consists of different groups (such as classes), to ensure that all groups are proportionally represented. The sample in this study consisted of 60 eighth-grade students from Pattimura Junior High School.

The intervention media used in this study was red grape infused water**.** Red grape infused water is a drink made by soaking 50 grams of red grape slices in 100 ml of mineral water for 4–5 hours in a refrigerator. With this ratio, the resulting solution has a concentration of approximately 50% b/v. The first stage of this study involved measuring salivary pH before the intervention was administered. After the initial measurement, each respondent was given 150 ml of the red grape infused water and instructed to rinse their mouth with it for 10 seconds. Then, a waiting period of 30 minutes followed, after which salivary pH was measured again.

The instrument used in this study was **a** salivary pH measurement sheet, which served as a reference for recording the pH measurement results. Data analysis was conducted by performing a normality test, followed by the Wilcoxon test**.**

RESULT

This study was conducted in April 2025 by measuring the effect of red grape infused water on the acidity level (pH) of saliva in 8th-grade students at SMP Pattimura Jagakarsa, Jagakarsa District, South Jakarta City. The measurements were taken twice: before administering the red grape infused water as a mouth rinse and after the intervention.

Table 1. Distribution of respondent characteristics

Variable	n	%
Age		
13	5	8,3
14	41	68,3
15	11	18,3
16	3	5,0
Total	60	100
Gender		
Man	22	36,7
Woman	38	63,3
Total	60	100

Table 1 shows that the number of respondents in this study was 60 students, all of whom were 8th-grade junior high school students. The majority, 41 students (68.3%), were 14 years old, and most of the respondents were female, totaling 38 students (63.3%).

Table 2. Data normality test

Variable	p-value	
	Pre Test	**Post Test**
pH salivary	0,000	0,000

Table 3 shows the results of the normality test for saliva pH before and after the intervention, which were not normally distributed because the p-value was < 0.05. Therefore, a non-parametric test was used. In this study, the test conducted was the Wilcoxon test.

Tabel 3. Average Saliva pH Level Before and After the Intervention

Variabel	Mean±SD	Min-Max	p-Value
pH Saliva			
Pre-test	5,95±0.287	5-7	0.000
Post-test	7,03±0.181	7-8	

Table 3 shows that the average saliva pH before the intervention using red grape infused water as a mouth rinse was 5.95 with a standard deviation of 0.287, while the saliva pH after the intervention was 7.03 with a standard deviation of 0.181. The statistical test results showed a p-value of 0.000, indicating a significant difference in the average saliva pH before and after the intervention with red grape infused water mouth rinse among 8th-grade students at SMP Pattimura, South Jakarta.

DISCUSSION

A study on 60 eighth-grade students at SMP Pattimura Jagakarsa on April 10, 2025, showed that the effectiveness test results from before and after rinsing with red grape-infused water had a p-value of 0.000 (p < 0.05). This indicates that rinsing with red grape-infused water is effective in stabilizing salivary pH in the oral cavity. Previous research suggests that red grapes can change the acidity of saliva from more acidic to more neutral, which is linked to the compounds they contain. The active components in red grapes include flavonoids, tannins, anthocyanins, and resveratrol. (Kertiasih & Artawa, 2020)

Flavonoids and tannins have antibacterial and antioxidant properties. These compounds can inhibit the activity of the glucosyltransferase enzyme found in Streptococcus mutans bacteria — acid-producing bacteria that contribute to a decrease in oral pH. As a result, the acidity level of saliva in the oral cavity can remain stable or even increase, which helps maintain oral health and reduce the risk of dental caries.(Nabila et al., 2022)

Anthocyanins have high antioxidant activity. These compounds interact with proteins in saliva to form a protective layer that helps maintain pH balance and reduce acidity in the mouth. Resveratrol is a polyphenol compound found in grape skins and has strong antioxidant and anti-inflammatory properties. It helps maintain saliva pH balance by inhibiting the growth of acid-producing bacteria in the mouth, thereby contributing to better oral health. (Torres-Rochera et al., 2023)

Other studies have also shown that grapes are rich in polyphenol compounds that play a key role in reducing plaque index, including flavonoids, tannins, and fatty acids. Flavonoids are known to inhibit plaque accumulation and formation by damaging bacterial proteins, enzymes, and polypeptide walls. Tannins, with their antibacterial properties, can reduce and inhibit plaque formation by damaging bacterial cell membranes and disrupting the glucosyltransferase process (Nn. K. A. P. Putri et al., 2020).

The findings of this study also align with the theory proposed by other researchers stating that the tannin and catechin compounds in red grapes can influence changes in saliva acidity. Tannins inhibit dental plaque formation by interfering with bacterial glucosyltransferase enzymes and damaging bacterial membranes, causing bacterial proteins to lyse. (Putri et al., 2022)

Catechins inhibit plaque formation by denaturing bacterial proteins using phenols found in catechins; phenols are toxic to bacteria, causing the protein's three-dimensional structure to unravel and damaging the bacteria's biological activity. These antibacterial compounds tannins and catechins in red grapes inhibit bacterial growth, thereby reducing their ability to ferment food, which prevents a drop in saliva pH. Therefore, consuming red grape infused water can help maintain a balanced saliva pH level in the oral cavity. (Janah et al., 2021)

One interesting aspect of this study is the taste of red grape infused water. The natural flavor of grapes that dissolves into the water makes it an easy-to-consume option, especially for students. Moreover, the benefits for oral health are quite significant. With a more neutral pH level after consuming the infused water, the oral cavity is better protected from tooth demineralization, which can lead to caries. This indicates that red grape infused water not only neutralizes acidic pH but also has the potential to prevent dental caries. (Rodriguez et al., 2022)

However, this study differs from previous research in certain aspects, particularly in the form of treatment used - red grape infused water. This study focused on the consumption of infused water, while others emphasized direct consumption of grapes or grape-based products and mouth gargling. Based on this study, there is a notable difference in the effects of consuming red grapes or grape-based products via gargling, drinking, or chewing. While gargling may superficially seem to reach more areas of the mouth, physiologically, drinking red grape infused water provides a more comprehensive and sustained effect in increasing saliva pH. This is because drinking infused water stimulates both mechanical and chemical activity in the salivary glands - through swallowing and the natural flavor of the grapes - which in turn promotes increased saliva production. Saliva plays a crucial role in maintaining pH stability in the mouth. (Corona et al., 2021)

In addition, bioactive compounds in red grapes such as resveratrol, tannins, and flavonoids are absorbed into the body and may have systemic effects. These include improving the balance of oral microbiota and inhibiting the growth of acidogenic bacteria such as Streptococcus mutans, which plays a key role in enamel demineralization. (Putri et al., 2022)

CONCLUSION

Based on the research results, it can be concluded that gargling using red grape (*vitis vinifera*) infused water is effective in stabilizing the pH of saliva in the oral cavity.

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