

EFFECTIVENESS OF GREEN COCONUT WATER (*Cocos nucifera* Linn Var. *Viridis*) GARGLE ON SALIVARY pH CHANGES IN 17-YEAR-OLD ADOLESCENTS

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ABSTRACT

Introduction: The acidity level of saliva plays a crucial role in enhancing the remineralization process of teeth. Green coconut water (*Cocos nucifera* Linn Var. *Viridis*) contains higher levels of tannins compared to other coconut varieties. Tannins exhibit antibacterial properties that can inhibit bacterial growth. However, the consumption of young coconut water can lower salivary pH due to its naturally low pH (5.5). The presence of acidic ions, such as vitamin C, total solids, lactic acid, and reducing sugars—including fructose, glucose, and amino acids—contributes to this effect. **Aim:** To determine the effectiveness of green coconut water (*Cocos nucifera* Linn Var. *Viridis*) gargling in altering salivary pH before and after use. **Methods:** This study employed a quasi-experimental design with a pre- and post-test control group approach. A total of 49 samples participated in the study. The subjects gargled with green coconut water, and their salivary pH was measured using a pH meter. **Results:** Statistical analysis using the Paired t-test showed a p-value of 0.00 ($p < 0.05$), indicating a significant difference in salivary pH before and after gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*). **Conclusion:** The findings of this study demonstrate a significant reduction in salivary pH after gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*), suggesting its effectiveness in lowering salivary pH in 17-year-old adolescents.

Keywords: Green coconut water, saliva pH, gargling

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INTRODUCTION

Oral and dental health refers to the well-being of both hard and soft tissues of the teeth, as well as the associated structures within the oral cavity, ensuring they remain free from functional disturbances, aesthetic issues, and discomfort caused by diseases or occlusal abnormalities that

may hinder an individual's ability to eat, speak, and socialize. With the advancement of time, dental and oral health problems have become increasingly prevalent. Several factors influence the occurrence of dental and oral diseases, including education, socioeconomic status, dietary patterns, and cultural habits. The most common oral health issue among the Indonesian population is dental caries. The primary factors contributing to caries development include saliva, microorganisms, and substrates such as food and time. Other factors influencing caries

include gender, age, hormones, and individual oral health behaviors.^{1,2,3,4}

To date, dental caries remains the most widespread oral disease in society, affecting both adults and children. Adolescents are one of the most vulnerable groups to dental and oral health problems. Research conducted by Hendry Boy and Ahmad Khairullah reported that the prevalence of dental caries among adolescents is 98.3%.^{5,6}

One of the main contributing factors to caries formation is saliva. Under normal conditions, salivary pH in the oral cavity is approximately 7. However, when salivary pH drops to ≤ 5.5 , the oral environment becomes highly susceptible to caries. The acidity level of saliva plays a crucial role in enhancing the remineralization process of teeth.⁷

One effective method to maintain oral health is through gargling. Gargling with mouthwash can eliminate bacteria in interdental areas that are difficult to reach with a toothbrush. However, the long-term use of alcohol-containing mouthwashes can lead to xerostomia (dry mouth), reduced salivary production, bad breath, and an increased risk of tooth decay. Consequently, the World Health Organization (WHO) has recommended and promoted the use of traditional and herbal medicines in national health programs due to their accessibility, affordability, and safety, with minimal adverse effects.¹⁰

Indonesia is one of the largest coconut-producing countries in Southeast Asia. According to the Indonesian Plantation Statistics, South Sulawesi ranks third among Sulawesi regions in coconut production, with a total output of 72,069 tons. One of the most beneficial parts of the coconut fruit is its water. Young coconut water has long been recognized as a health-promoting beverage.

Green coconut water from coconuts aged 1–3 months exhibits superior antibacterial properties compared to coconuts older than three months. Green coconut water (*Cocos nucifera* Linn Var. *Viridis*) contains a higher concentration of tannins or antidotes (antitoxins) compared to other coconut varieties. Tannins possess antibacterial properties that inhibit bacterial growth.^{12,13}

METHOD

This study employed a quasi-experimental research design with a pre- and post-test control group design. The study was conducted at SMA Negeri 6 Maros in November 2024. The sampling technique used was purposive sampling, resulting in a total of 49 twelfth-grade students from SMA Negeri 6 Maros as participants. The inclusion criteria required that participants be 17 years old and have no known allergies to the test material. The instruments used in this study included a pH meter, medicine cups, rinsing glasses, a stopwatch, tissue, writing instruments, face masks, and gloves. The materials used were green coconut water (*Cocos nucifera* Linn Var. *Viridis*) and label paper.

Participants who met the inclusion criteria were required to sign an informed consent form. All participants were instructed to collect their saliva samples by spitting into a pre-provided medicine cup for pH measurement before intervention (pre-test). The spitting method was applied, where students were instructed to collect saliva at the floor of the mouth and spit every 60 seconds until a total volume of 5 mL was obtained in the medicine cup. Following the pre-test, participants were provided with 30 mL of green coconut water (*Cocos nucifera* Linn Var. *Viridis*) and instructed to gargle for 30 seconds before discarding the liquid. Subsequently,

participants collected another saliva sample using the same spitting method, where they accumulated saliva at the floor of the mouth and spit every 60 seconds until reaching 5 mL in the medicine cup for post-test pH measurement.

RESULTS

The research titled "The Effectiveness of Green Coconut Water (*Cocos Nucifera* Linn Var. *Viridis*) Mouthwash on Salivary pH Changes in 17-Year-Old Adolescents at SMA 6 Maros" involved 49 students, consisting of 24 males and 25 female samples. Research data was presented in a salivary pH assessment sheet before and after gargling with green coconut water. The data were then collected and recorded, followed by processing and analysis using SPSS version 27. The research results were then distributed as follows:

Table 1. Salivary pH before gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*)

Salivary pH	Frequency (N)	Percentage (%)
Acidic	26	53,1
Neutral	3	6,1
Alkaline	20	40,8
Total	49	100,00

Based on Table 5.1, the majority of participants had acidic salivary pH before gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*), accounting for 26 respondents (53.1%). Additionally, three respondents (6.1%) had neutral salivary pH, while 20 respondents (40.8%) had alkaline salivary pH before the intervention.

Table 2. Salivary pH after gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*)

Salivary pH	Frequency (N)	Percentage (%)
Acidic	47	95,9
Neutral	2	4,1
Alkaline	-	-
Total	49	100,00

Based on Table 2, the majority of participants had acidic salivary pH after gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*), accounting for 47 respondents (95.9%). Additionally, two respondents (4.1%) had neutral salivary pH, while no respondents exhibited alkaline salivary pH after the intervention.

Table 3. Comparison of salivary pH before and after gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*)

		N	Mean Rank	Sum of Ranks
After - Before	Negative Ranks	23 ^a	12.00	276.00
	Positive Ranks	0 ^b	.00	.00
	Ties	26 ^c		
	Total	49		

* Note: Wilcoxon test results

a. After < Before

b. After > Before

c. After = Before

The Wilcoxon test analysis revealed a significant difference in salivary pH before and after gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*). Among the 49 respondents, 23 participants experienced a decrease in salivary pH after gargling, while 26 participants exhibited no change in pH before and after the intervention. The test yielded an Asymp. Sig. Value of 0.000 (< 0.05), indicating a statistically significant difference in salivary pH before and after gargling with green coconut water.

DISCUSSION

The findings of this study on the effectiveness of gargling with green coconut water (*Cocos nucifera* Linn Var. *Viridis*) in altering salivary pH among 17-year-old adolescents involved 49 students from SMA Negeri 6 Maros,

comprising 24 males and 25 females. Salivary pH was measured using a pH meter. The Wilcoxon test was used to analyze changes in salivary pH before and after gargling, yielding a p-value of 0.000 (< 0.05). This indicates a statistically significant difference between pre- and post-gargling salivary pH, confirming that green coconut water affects salivary pH in 17-year-old adolescents.

Saliva is a complex, colorless fluid in the oral cavity, composed of a mixture of secretions from the major and minor salivary glands located within the oral mucosa. The interpretation of salivary pH is categorized as neutral at pH 7, acidic at pH < 7 , and alkaline at pH > 7 . After consuming carbohydrate-containing foods, glucose undergoes fermentation, producing acidic compounds that create an acidic environment around the teeth, leading to a decrease in pH. Consequently, frequent and repeated sugar consumption maintains plaque pH below normal levels, resulting in enamel demineralization.^{13,54}

According to Warman et al. (2024), gargling plays a crucial role in maintaining oral hygiene, including the tongue and teeth, by removing food debris and plaque, thereby preventing bad breath. Gargling with green coconut water is one method to reduce plaque formation, prevent caries, and lower the risk of periodontal disease. Proper gargling technique involves forcefully rinsing the liquid around the teeth and oral cavity using coordinated movements of the lips, tongue, and cheeks for at least 30 seconds while keeping the teeth closed.¹⁵

Coconut water is a nutrient-rich fluid, containing potassium (3120 mg/L) and sodium (1050 mg/L). Potassium is a positively charged ion, primarily found intracellularly, with 95% residing in intracellular fluids. It plays an essential role in

fluid and electrolyte balance, as well as acid-base homeostasis.¹⁵

Green coconut water contains tannins, which exhibit antibacterial properties (Kurniah, 2012). Tannins bind iron, inhibiting glucosyltransferase, which subsequently reduces bacterial adhesion. A decrease in bacterial adhesion impairs amylase enzyme activity, leading to a reduction in maltose production and consequently lower carbohydrate fermentation. This decrease in oral carbohydrate fermentation results in a less acidic oral environment, thereby increasing salivary pH.¹³

According to Sahdena et al. (2023), the foods and beverages consumed influence whether saliva becomes acidic or alkaline. Gargling with young coconut water can lower salivary pH due to its low pH (5.5) and the presence of acidic ions such as vitamin C, total solids, lactic acid, and reducing sugars (fructose, glucose, and amino acids). The organic acids in coconut water play a significant role in altering salivary pH. The more metabolizable organic acids present, the lower the salivary pH.¹⁶

After consuming alkaline foods or beverages, such as lime water, tea, honey, green and yellow vegetables, tuberous vegetables, and certain fruits, drinking young coconut water can help restore normal salivary pH. However, consuming acidic foods, including eggs, meat, fish, seafood, poultry, fried foods, refined grains (white rice, white bread, wheat flour, noodles), processed foods, white sugar, coffee, and carbonated beverages, followed by young coconut water may further decrease salivary pH.¹⁶

The results of this study demonstrate that salivary pH decreased after gargling with green coconut water. However, the reduction was only 0.9

units from the normal pH, indicating that coconut water remains safe for consumption. It is recommended to consume coconut water after eating alkaline foods to help normalize salivary pH, whereas consuming it after acidic foods should be avoided, as it may further lower salivary pH. These findings are consistent with Chendrakasih et al. (2017), who reported that coconut water reduces salivary pH, with a pre-consumption pH of 7.07 and a post-consumption pH of 6.93.¹⁶

CONCLUSION

Based on the findings of this study on the effectiveness of gargling with green coconut water (*Cocos nucifera Linn Var. Viridis*) in altering salivary pH among 17-year-old adolescents at SMA Negeri 6 Maros, it can be concluded that: The salivary pH before gargling with green coconut water (*Cocos nucifera Linn Var. Viridis*) was determined. The salivary pH after gargling with green coconut water (*Cocos nucifera Linn Var. Viridis*) was identified. The effectiveness of green coconut water (*Cocos nucifera Linn Var. Viridis*) in influencing salivary pH was observed.

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