

The Effect of Mouth Rinsing with Brewed Peppermint Tea (*Mentha Piperita L.*) on Salivary Acidity (PH)

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ABSTRACT

Backgrounds: The use of natural ingredients as mouthwash offers a safe and effective alternative to improve oral cavity hygiene. One of the widely used plants is peppermint. Peppermint tea leaves (*Mentha piperita L.*) contain active compounds with antimicrobial properties, which can help reduce the number of plaque-causing bacteria, including *Streptococcus mutans*. The main compounds in peppermint tea leaves, such as menthol, provide a fresh aroma and also have antimicrobial effects beneficial for oral cavity health.

Objectives: This study aims to explain the effect of gargling with peppermint tea infusion on the acidity (pH) level of saliva.

Methods: In this study, the type of research used is clinical experimental with a Pretest-Posttest Design with Control Group. Data normality was tested using the Shapiro-Wilk test, followed by statistical tests using the Paired T-test and the Independent T-Test.

Results: The statistical test results showed an increase in saliva pH ($P=0.000$) after gargling with peppermint tea infusion.

Conclusion: Peppermint tea infusion (*Mentha piperita L.*) can increase salivary pH.

KEYWORDS: Salivary pH, Gargling, Peppermint Tea, *Mentha piperita L.*

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INTRODUCTION

Oral and dental health is an important part of overall body health. This is because any disorder that affects the structure of the teeth and mouth can have a negative impact on other organs and systems in the body.¹ Factors such as behavioral patterns, environmental conditions, genetics, and access to medical services play a role in determining a person's oral and dental health.² Dental caries and periodontal disease are two major problems that are often found in Indonesia and other developing countries.³ Based on data from the Indonesian Health Survey (SKI) in 2023, it was found that 56.9% of Indonesians complained of having oral and dental problems.⁴

Dental caries is a condition characterized by damage to the hard tissues of teeth caused by acids produced by

bacterial fermentation of carbohydrates. The main cariogenic organisms that have been identified are *Streptococcus mutans* and *Lactobacillus*. However, the explanation of the cause of caries involves an interaction between important factors, namely the condition of the teeth, diet, plaque bacteria, and time.⁵ The growth of *Streptococcus mutans* and *Lactobacillus* bacteria in the oral cavity tends to increase when the salivary pH is low (pH 4.5-5.5).⁶

Saliva is a fluid found in the oral cavity. Its composition is 99% water, with approximately 1% consisting of various components, including organic and inorganic components, electrolytes, mucus, antimicrobial substances, and various enzymes. Saliva has several functions, including lubrication, protection against dehydration, and acting as a buffer to protect the oral cavity from bacterial colonization

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and neutralize salivary pH.⁶

The degree of acidity (pH) is an indicator used to determine the acidity or alkalinity of a solution, including saliva. Normal salivary pH is in the range of 6.7-7.3.⁷ If the salivary pH value is low, with a range of 4.5-5.5, this condition will support the growth of bacteria such as *Streptococcus mutans* and *Lactobacillus*.⁶ These caries-causing microorganisms can be effectively controlled through antimicrobial therapy, one of which is by using mouthwash.⁵

Mouthwash has two functions: a therapeutic function aimed at reducing plaque, gingival inflammation, caries, and stomatitis, and a cosmetic function specifically designed to treat bad breath (halitosis).⁸ Mouthwash is classified into three categories based on its composition: alcohol-containing mouthwash, alcohol-free mouthwash, and herbal mouthwash.⁹ Alcohol is the most commonly used active ingredient in many commercial mouthwash products. Alcohol content varies from 6% to 26.9%. Alcohol concentrations in mouthwash exceeding 20% can have negative impacts on the oral cavity, including keratosis, epithelial detachment, gingivitis, mucosal ulceration, and pain in the mouth.⁸ Therefore, the use of natural ingredients is needed as one of the best options.¹⁰

The use of natural ingredients such as herbal plants is still widely used by Indonesian people as a solution to various health problems, including in maintaining dental and oral health.^{11,12} One of the widely used medicinal plants is peppermint leaves (*Mentha piperita* L.).¹³ Peppermint leaves contain various active compounds such as essential oils, flavonoids, mentofuran, phenolic acid, menthol, and others that have antibacterial effects against several gram-positive

and gram-negative bacteria. Strong antibacterial properties against *Streptococcus mutans* and *Lactobacillus* are shown by essential oils. Menthol is effective against *Staphylococcus pyogenes*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Serratia marcescens*, *Escherichia coli*, and *Mycobacterium avium*. In addition, the combination of menthol and essential oils has antifungal properties against *Aspergillus albus*, *Candida albicans*, and dermatophyte fungi. Not only is it antibacterial and antifungal, peppermint leaves also provide a refreshing aroma, have a cool, calming sensation, and freshen the breath.¹⁴

Based on this description, researchers are interested in exploring further the effect of gargling with peppermint tea leaves (*Mentha piperita* L.) on oral health.

MATERIALS AND METHODS

The research data obtained were analyzed using the SPSS (Statistical Package for the Social Science) program with the application of the Shapiro Wilk Test normality test because the data group was small, namely less than 50 ($n < 50$). The purpose of the Shapiro Wilk Test is to determine whether the data is normally distributed or not. In this study, the data or research results were proven to be normally distributed with a significance value ($p > 0.05$). Furthermore, a Parametric Statistical Test was carried out, namely the Paired T-Test (Paired T-Test) to test whether there were significant changes in salivary pH before and after gargling with peppermint tea leaf infusion. Meanwhile, the Independent T-Test was used to compare whether there were significant differences in salivary pH changes between the group gargling with peppermint tea leaf infusion and the group gargling with mineral water.

RESULTS AND DISCUSSION

The research results can be seen in the following table:

Table 1. Frequency distribution of salivary acidity (pH) before and after mineral water treatment

	N	Min.	Max.	Mean	Std. Deviation
Salivary pH before treatment (control)	16	6.70	7.19	6.9462	0.14872
Salivary pH after treatment (control)	16	6.75	7.21	6.9894	0.14830

Based on the results of descriptive data analysis in table 1, it shows that the salivary pH before receiving mineral water treatment had a mean value of 6.94 with a minimum value of 6.70 and a maximum value of 7.19. The salivary pH value after receiving mineral water treatment increased with a mean value of 6.98, a minimum value of 6.75 and a maximum value of 7.21. The standard deviation of salivary pH before mineral water treatment was 0.14872 and the standard deviation of salivary pH after mineral water treatment was 0.14830.

Table 2. Frequency distribution of salivary acidity (pH) before and after peppermint tea leaf infusion treatment

	N	Min.	Max.	Mean	Std. Deviation
Salivary pH before treatment (peppermint tea)	16	6.72	7.18	6.9800	0.14464
Salivary pH after treatment (peppermint tea)	16	7.19	7.54	7.3519	0.10496

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Based on the results of descriptive data analysis in table 2, it shows that the salivary pH before receiving peppermint tea treatment had a mean value of 6.98 with a minimum value of 6.72 and a maximum value of 7.18. The salivary pH value after receiving peppermint tea treatment

increased with a mean value of 7.35, a minimum value of 7.19 and a maximum value of 7.54. The standard deviation of salivary pH before peppermint tea treatment was 0.14464 and the standard deviation of salivary pH after peppermint tea treatment was 0.10496.

Table 3. Data Normality Test (Shapiro Wilk)

Kelompok	<i>SapHiro Wilk</i>		
	<i>Statistic</i>	<i>df</i>	<i>P(Sig.)</i>
Salivary pH before treatment (mineral water)	.967	16	.788
Salivary pH after treatment (mineral water)	.951	16	.504
Salivary pH before treatment (peppermint tea)	.932	16	.265
Salivary pH after treatment (peppermint tea)	.958	16	.621

*SapHiro Wilk, $p > 0.05$ normally distributed data

The data normality test is a statistical procedure to determine whether data from a population is normally distributed. This test was chosen because the sample size was

less than 50 ($n < 50$), making the Shapiro-Wilk method more appropriate than other normality tests. The results of the Shapiro-Wilk test can be seen in table 3.

Table 4. Paired T-Test Results of Mineral Water Treatment

	N	P(Sig.)
Salivary pH before and after mineral water treatment	16	.000

*t-test, CI 95% $p < 0.05$ (significant)

Table 4 shows the results of the Paired T-Test statistical test on the group that gargled with mineral water, obtaining a p-value of < 0.05 , namely 0.000. These results

indicate a significant difference in salivary pH before and after gargling with mineral water.

Table 5. Paired T-Test Results for Peppermint Tea Treatment

	N	P(Sig.)
Salivary pH before and after peppermint tea treatment	16	.000

*t-test, CI 95% $p < 0.05$ (significant)

Table 5 shows the results of the Paired T-Test statistical test on the group that gargled with peppermint tea leaf infusion, obtained a p value < 0.05 , namely 0.000. The

results of this study indicate a significant difference between salivary pH before and after gargling with peppermint tea leaf infusion

Table 6. Independent T-Test Results of Mineral Water and Peppermint Tea Leaf Infusion Treatment

			Value	
			<i>Equal variances assumed</i>	<i>Equal variances not assumed</i>
<i>Levene's Test for Equality of Varie</i>	<i>Test</i>	<i>F</i>	40.988	
		<i>Sig.</i>	.000	
<i>T-Test for Equality of Means</i>	<i>for</i>	<i>t</i>	-19.284	-19.284
		<i>df</i>	30	16.297
		<i>Sig. (2-tailed)</i>	.000	.000
		<i>Mean Difference</i>	-.32000	-.32000

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<i>Std. Error Differencea</i>		.01659	.01659
<i>95% Confidence Interval of the Differencea</i>	<i>Lowera</i>	-.35389	-.35513
	<i>Upper</i>	-.28611	-.28487

*Independent test, CI 95% p < 0.05 (significant)

Table 6 shows the results of the Independent T-Test conducted on the groups that gargled with mineral water and peppermint tea leaf infusion, obtained a p value <0.05, namely 0.00. The results of the Independent T-Test showed that the increase in salivary pH of the treatment group that gargled with peppermint tea leaf infusion was significantly greater than the group that gargled with mineral water, so the hypothesis of this study can be accepted. Therefore, it can be concluded that gargling with peppermint tea leaf infusion (*Mentha piperita* L.) can increase salivary pH.

Based on the research conducted, the results of statistical tests using Paired T-Test in both groups, namely the treatment group that gargled peppermint tea leaves (*Mentha piperita* L.) and the control group that gargled with mineral water, showed an increase in the average salivary pH. In the treatment group, the average salivary pH increased significantly from 6.9800 before the intervention to 7.3519 after gargling, with an increase of 0.3719. Meanwhile, in the control group that gargled with mineral water, there was also an increase in the average salivary pH from 6.9462 to 6.9894, with an increase of 0.0432. In the Paired T-Test results for both groups, the P value was obtained = 0.000 (P <0.05), indicating that the change in the average salivary pH in both groups was statistically significant. However, although both groups experienced a significant increase in mean salivary pH, the increase in mean salivary pH in the group gargling with peppermint tea infusion was significantly greater than in the control group using mineral water. This suggests that the intervention using peppermint tea infusion was more effective in increasing salivary pH than mineral water.

The increase in salivary acidity (pH) in this study may be caused by mechanical stimulation during gargling. The gargling process stimulates the autonomic nervous system, resulting in increased saliva production. This increased salivary secretion then strengthens the buffering capacity of saliva, causing salivary pH to rise.¹⁵ Furthermore, the increase in pH is also influenced by phytochemical compounds contained in peppermint tea leaves, such as menthol, menthone, flavonoids, tannins, triterpenoids, and other compounds. Menthol, the main compound in peppermint, provides a distinctive fresh and cool sensation in the oral cavity. This cool sensation stimulates sensory

receptors in the mouth, thereby increasing salivary secretion.^{13,14} This increased salivary secretion rate then increases salivary buffering capacity, contributing to an increase in salivary pH. This is in line with the results of a 2014 study by Ani Subekti et al., which showed that gargling with boiled peppermint leaves can increase salivary pH by stimulating a cool and spicy sensation that triggers salivary secretion. Furthermore, in a 2018 study by Khamisli et al., an increase in salivary secretion rate increases salivary buffering capacity, which impacts salivary pH.¹⁶

In addition to menthol, peppermint contains various other phytochemical compounds, including flavonoids, tannins, and triterpenoids, which have antibacterial and anti-plaque activities.¹³ The essential oil content in peppermint, which includes menthol and other bioactive components, has been shown to be effective in inhibiting the growth of plaque- and caries-causing bacteria, such as *Streptococcus mutans*.¹⁴ Research by Manurung et al. in 2024 showed that peppermint extract was able to inhibit the formation of *Streptococcus mutans* biofilms, thereby helping to reduce the plaque index and maintain stable salivary pH.¹⁷ In addition, the essential oil in peppermint tea leaves also has a broad antibacterial effect against various pathogenic bacteria, including *Staphylococcus pyogenes*, *Staphylococcus aureus*, *Serratia marcescens*, *Escherichia coli*, and *Mycobacterium avium*. This antibacterial activity is supported by phenolic and flavonoid compounds that can damage bacterial cell membranes and disrupt their metabolism.^{14,18}

CONCLUSION

1. There was a significant difference between salivary pH before and after gargling in the peppermint (*Mentha piperita* L.) tea infusion treatment group.
2. There was no significant difference between salivary pH before and after gargling in the mineral water control group.
3. There was a significant difference in salivary pH measurements after gargling between the peppermint (*Mentha piperita* L.) tea infusion treatment group and the mineral water control group.

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