

EFFECT OF BAY LEAF GARGLING (*SYZYGIVM POLYANTHUM* (WIGHT) WALP.) ON SALIVARY pH OF FIXED ORTHODONTIC USERS

An'nisa Ussolihah^{a,1}, Siti Hidayati^{a,2*}, Dwi Eni Purwati^{a,3}, Mari Fujita^{b,4},

^aDepartment of Dental Health Poltekkes Kemenkes Yogyakarta,

^bHealth Sciences university of Hokkaido, Japan,

¹annisaussolihaheltara@gmail.com; ²jkg.hidayati@gmail.com*; ³dwienipurwa@gmail.com ;

⁴mfujita@hoku-iryo-v.ac.jp

*koresponden penulis: jkg.hidayati@gmail.com

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ABSTRACT

Background: The use of fixed orthodontics can affect the state of the oral cavity and salivary pH which is one of the causes of dental caries. The lower the pH of saliva, the higher the risk of dental caries. Decoction of bay leaves as a mouthwash effectively inhibits the growth of *Streptococcus mutans* bacteria which play a role in the process of dental caries. **Objective:** To determine the effect of gargling bay leaf decoction on salivary pH in users of fixed orthodontics. **Methods:** This research is a pseudo-experiment with Pretest Posttest With Control Group design. The sample of this study was 80 respondents taken by accidental technique, data analysis using Wilcoxon and Mann Whitney tests. **Results:** The degree of acidity (pH) of saliva before gargling bay leaf decoction water on acidic criteria was 35%, neutral was 50% and alkaline was 15% and after gargling acidic criteria was 2.5%, neutral was 67.5%, and alkaline was 30%. With an average before gargling 6.75 and an average after gargling 7.33. Gargling bay leaf decoction water before and after is significantly different at $p=0.000$. Between the experimental group and the control group had a significant difference of $p=0.000$. **Conclusion:** Bay leaf boiled water can increase salivary pH in users of fixed orthodontics.



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Introduction

The oral cavity is not just the entrance to food and drink, but the oral cavity has a big role in supporting a person's health and well-being¹. In the oral cavity there are teeth and tongue as organs that help the function of the oral cavity, not only that the oral cavity also has a defense system, namely saliva. Saliva is a complex liquid produced by the salivary glands and has a very important role in maintaining the balance of the ecosystem in the oral cavity. Saliva contains 99.5% H₂O and 0.5% electrolytes and proteins. The most important salivary proteins are amylase, lipase and lysozyme. These proteins have functions in the digestive process, have antibacterial properties, as a solvent to stimulate soybean buds, help speak, maintain and oral hygiene².

Saliva functions to regulate oral pH (acidity) because it contains buffering components such as the carbonic acid–bicarbonate system, urea, phosphate, and ammonia, which play a role in sugar metabolism. Salivary pH and buffer capacity are closely related to the speed of secretion which results in increased buffer capacity³. Saliva is able to remineralize early caries because it contains lots of calcium and phosphate ions. Changes in salivary pH are influenced by several factors including average salivary flow velocity, oral microorganisms, and salivary buffer capacity⁴.

The problem of tooth decay (caries) cannot be separated from the pH of saliva, because it affects the growth of bacteria that cause caries, namely *Streptococcus mutans*. According to RISKESDAS 2018, the proportion of Indonesians who have oral problems is 57.6%, and the number of people who have received treatment is 10.2%. The proportion of tooth decay in Indonesian society reached 45.3%, while in the Special Region of Yogyakarta it reached 47.7% of cases⁵. Dental caries is a process of damage to the hard tissues of the teeth due to the demineralization process caused by the metabolic activity of bacteria in plaque, dental caries that is not treated immediately will experience severe damage. Grabe (1962) states that one of the local factors for malocclusion is caries, especially in children in the period of mixed teeth⁶.

Malocclusion is a dental abnormality that often occurs, malocclusion is a dental abnormality that is considered neither aesthetically nor functionally unsatisfactory and far from ideal. Malocclusion has different degrees of severity for each individual. Many individuals who are aware of the severity of malocclusion already use fixed orthodontic. However, there are things that are not realized, namely the side effects of using orthodontics, one of which is not optimal dental and oral hygiene. Saliva regulates oral pH through its buffering capacity, while malocclusion impairs plaque reduction by limiting effective plaque

removal. Such as the onset of halitosis (bad breath). Fixed orthodontic appliance users also need plaque control in addition to brushing, one of which is by using mouthwash⁷.

Bay leaf (*Eugenia polyantha* Wight) is a leaf that is widely used by Indonesians as a spice, or a mixture in processed dishes. Bay leaves are used in traditional medicine to treat various conditions, such as stomach pain and excessive defecation, and they contain flavonoids, tannins, and essential oils that can reduce salivary acidity by inhibiting acid-producing bacteria. Bay leaves contain dyes, tanning agents and essential oils that are antibacterial. Tannin substances contained are shrinking (astringent)⁸.

The results of previous research on the use of a combination of bay leaf extract (*Eugenia polyantha* wight) with mint leaves (*Mentha piperita*) have an effect as an antiseptic on users of fixed orthodontics it is because bay leaves contain several active compounds such as flavonoids, tannins and essential oils, phenol compounds such as antibacterial tannins and flavonoids that suppress the growth of *Streptococcus mutans* bacteria which are the main cause of tooth decay such as caries and dental plaque.⁷ Previous research, namely the application of bay leaf decocta in the inhibition of erythematous Candidiasis in acrylic removable denture users. The results of this study showed that the application of bay leaf decoction to respondents, caused 75% of respondents to experience changes in the type and extent of lesions from type I to normal (no lesions)⁹.

Preliminary studies were conducted at Radia Clinic which is located on Brigjend Katamso street, No. 173 keparakan kec. Margangsan. Radia Clinic opens many services, one of which is for orthodontic treatment, there are already many patients who take treatment and those who are routinely recorded as doing periodic checks are 100 people. It is known that after checking the pH of saliva in 15 patients, 66% of them have acidic saliva pH criteria, and the results of interviews from 15 people 50% use mouthwash. Based on the previous description, the researcher is interested in examining the effect of gargling with bay leaf boiled water (*Eugenia polyantha* Wight) on salivary pH in users of fixed orthodontics.

Research Method

This research is a quasi experiment or pseudo experiment with a pretest posttest with control group research design. Measurement of salivary pH in this study using pH strips. The population in this study were users of fixed orthodontics who took care of 100 people at the

Redia Clinic, determining the number of samples using the Slovin formula so that 80 respondents were sampled, 40 respondents as the experimental group and 40 respondents as the control group, determining the sample using the Accidental sampling technique.¹⁰ This study uses bay leaf decoction (*Syzygium polyanthum* (Wight) Walp.) which is made using bay leaves that are dried at room temperature for approximately 4 days, boiled with distilled water as much as 500 ml at a temperature of 100 °C and let stand until the water shrinks to 250 ml, after cooling the boiled water used to gargle as much as 10 ml and gargle 3 times and let stand for \pm 30 seconds in the oral cavity.

The uncontrolled variables in this study are saliva rate, saliva volume and bacteria in the oral cavity. Primary data collection was carried out by observation using an examination format instrument containing name, gender, age, occupation, and latest education. Data analysis in this study used the Wilcoxon test to determine differences in salivary pH before and after gargling, and the mann- whitney test to determine differences in influence between the experimental group and the control group. This study has received ethical approval from the Health Research Ethics Committee (KEPK) of the Poltekkes Kemenkes Yogyakarta with No.DP.04.03/e-KEPK.1/678/2024 with an ethical eligibility date of July 08, 2024.

Results and Discussion

Research with the title “The Effect of Gargling Salam Leaf Decoction (*Syzygium polyanthum* (Wight) Walp.) on Salivary pH of Fixed Orthodontic Users” has been carried out in the period July - August 2024 at Redia Clinic. The results of the study are as follows:

1. Frequency distribution of Respondents

Table 1. Frequency distribution of respondents based on gender, age, latest education and occupation

Respondent Characteristics	Experiment Groups		Control Groups	
	n	%	N	%
Gender				
Male	14	35	12	30
Female	26	65	28	70
Amount	40	100	40	100
Last education				
Elementary School	1	2,5	2	5
Junior High School	13	32,5	10	25
Senior High School	15	37,5	14	35
First Diploma	1	2,5	0	0

Third Diploma	2	5	2	5
Undregraduate	8	20	12	30
Amount	40	100	40	100
Occupation				
Learner	12	30	11	27,5
Students	17	42,5	13	32,5
Housewife	2	5	2	5
Private employee	8	20	13	32,5
Government employee	1	2,5	1	2,5
Amount	40	100	40	100

Based on Table 1. It is known that the characteristics of respondents based on gender in the experimental group and control group are dominated by women, each group has a percentage of 26 (65%) for the experimental group and 28 (70%) for the control group. The characteristics of respondents based on age are divided into two age groups, namely, the age group 15-30 years and 31-45 years. Both treatment groups were dominated by the 15-30 age group with a percentage of 35 (87.5%) respondents for the experimental group and 30 (70%) respondents for the control group.

Characteristics of respondents based on the latest education for both groups were dominated by high school, with each percentage of 15 (37.5%) for the experimental group and 14 (35%) for the control group. The characteristics of respondents based on occupation for the experimental group and control group were each dominated by students as many as 17 (42.5%) for the experimental group and as many as 13 (32.5%) for the control group.

Tabel 2. Frequency distribution of salivary pH before and after gargling in the experimental group and control group.

Groups	Criteria <i>pH</i> Saliva	<i>pH</i> Saliva Before		<i>pH</i> Saliva After	
		N	%	N	%
Exsperimen	acid	14	35	1	2,5
	Neutral	20	50	27	67,5
	Alkaline	6	15	12	30
Amount		40	100	40	100
Control	Asam	18	45	18	45
	Netral	21	52,5	21	52,5
	Alkaline	1	2,5	1	2,5
Amount		40	100	40	100

Based on Table 2, it is known that the pH of saliva before and after gargling in the experimental group and control group. In the experimental group before rinsing the acidic criteria were 14 respondents (35%), neutral were 20 respondents (50%), and for alkaline criteria were 6 (15%). Whereas after gargling the acid criteria were 1 respondent (2.5%), Neutral as many as 27 (67.5%) respondents and alkaline as many as 12 (30%) respondents. The results of this study

are in accordance with the opinion of previous researchers, which shows the effect of bay leaf boiled water on salivary pH. The content contained in bay plants can inhibit *Streptococcus mutans* bacteria because it has antibacterial power.⁸ The antibacterial power of bay leaves is due to the presence of flavonoids, essential oils, eugenol and tannins, tannins and flavonoids are active ingredients that have anti-inflammatory and antimicrobial effects.⁷ Gargling with bay leaf extract boiled water can also inhibit plaque formation, it happens because bay leaves contain active compounds.⁷

In the control group before and after there was no difference, namely acidic as many as 18 (45%) respondents, neutral as many as 21 (52.5%), and alkaline as many as 1 (2.5%). The results of this study are in accordance with the opinion of previous researchers, this is due to the absence of antibacterial substances in Aquades so that there is no effect on salivary pH.¹¹

1. Prerequisite test results analysis

Table 3. Normality Test Results

Saliva Data Distribution	Kolmogrove Smirnov	Sig	Description
Experimental Group Before Gargling	0,263	0,000	abNormal
Experimental group After gargling	0,401	0,000	abNormal
Control Groups Before Gargling	0,285	0,000	abNormal
Control Groups after Gargling	0,285	0,000	abNormal

Table 3 shows that the Kolmogrove Smirnov value for each group of data is 0.263 before gargling and 0.401 after gargling, while for the control group before and after gargling is 0.285, and the significance value of each variable is smaller than 0.05 (5% level), thus concluding that all data are not normally distributed.

1. Statistic Analysis

Table 4. Uji Wilcoxon Analysis for Experimental and Control Groups

		N	Mean Rank	Sum Of Rank	After-Before gargling	
					Z	Sig.(2-tailed)
Post test- pre test experimental Groups	<i>Negative ranks</i>	5	13,00	65,000	-3,582	0,000
	<i>Positive ranks</i>	24	15,42	370,00		
	<i>Ties</i>	11				
	<i>Amounts</i>	40				
Post test- pre test Control Groups	<i>Negative ranks</i>	0	00	00	00	1,000
	<i>Positive ranks</i>	0	00	00		
	<i>Ties</i>	40				
	<i>Amounts</i>	40				

Table 4 shows that the sig value. (2-tailed) for the experimental group $p = 0.000$, then $p < 0.005$ can be concluded that there is a significant difference in salivary pH before and after

gargling bay leaf decoction water while, in the control group the sig. (2-tailed) value is $p = 0.000$, then $p > 0.05$ can be concluded that there is no difference before and after gargling using aqudest. The results of the Wilcoxon test conducted there are several points found, namely positive rank, negative rank and ties. In the experimental group there were still negatives as many as 5 respondents, this occurred because of uncontrolled variables, namely the rate of saliva and bacteria in the respondent's oral cavity. This is in line with previous research which says, Increasing the speed of salivary secretion will increase sodium and bicarbonate levels. Bicarbonate is an effective defense against acid production from cariogenic bacteria that will maintain a buffer system in the oral cavity, so as to maintain pH, so that the decrease in pH can be inhibited because in saliva there is a bicarbonate buffer which is an effective defense against acid production from cariogenic bacteria in the oral cavity.¹² From the averages, it is also very clear that the changes before and after gargling using bay leaf decoction water, and after testing using the Wilcoxon test, the Sig. (2-tailed) value is $0.000 < 0.005$, so it can be concluded that there is an effect of the treatment given, namely gargling using bay leaf decoction water.

Table 5. Mann – whitney Test Analysis Results

	<i>Mann- whitney U</i>	<i>Wilcoxon</i>	<i>Z</i>	<i>Asymp.Sig. (2- tailed</i>
Salivary pH examination results between groups	1459,000	4699,000	-6,272	0,000

Based on Table 5, the significance value is $0.000 < 0.05$ so it can be concluded that there are differences in the results before and after treatment between the experimental group and the control group.

The Mann Whitney test results showed $p=0.000$ ($p < 0.05$) meaning that there was an effect of the treatment given to the group. The results indicate that bay leaf decoction water reduces the number of bacterial colonies in saliva. The results of this study showed that an increase in salivary pH in the group that gargled using bay leaf decoction water. Meanwhile, in the group that gargled with distilled water there was no increase. The results of the study are in accordance with the hypothesis that gargling using bay leaf cooking water can affect salivary pH.

The content contained in bay leaves can inhibit the growth of *Streptococcus mutans* because it has anti-bacterial power. Anti-bacterial power in bay leaves is due to the content of flavonoids, essential oils, eugenol and tannin. The results of this study are in line with research conducted by previous researchers, the content of bay leaves can inhibit bacterial growth, the greater the concentration, the greater the inhibition. Bay leaves have several ingredients, one of which is flavonoids and essential oils that can increase the work of salivary buffers so as to increase salivary pH⁴. Whereas in the control group that was given treatment by gargling using distilled water, there was no increase or decrease in pH, because distilled water does not contain ingredients that can change the pH of saliva and this is in line with the research conducted.¹¹

Conclusion

Gargling using bay leaf boiled water (*syzygium polyanthum* (wight) Walp.) can increase the pH of the saliva of users of fixed orthodontics, seen from the average difference before gargling and after gargling water, namely from 6.75 to 7.33, especially thanks to respondents who are willing to become research respondents.

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