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Original Research Article

Investigation on the effectiveness of mouth-washing using laban leaves (*Vitex pinnata*) steeping water in reducing plaque accumulation: a study in state elementary school 1 Pagar Air, Aceh Besar

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ABSTRACT

Background: Dental and oral diseases that are commonly suffered by Indonesian people, are dental caries and periodontal disease. Dental plaque is the primary cause of the periodontal disease and dental caries. The diseases can be prevented by inhibiting the formation of dental plaque using a mouthwash. One of the ways in removing dental plaque is by mouth washing using laban leaves (*Vitex pinnata* Linn) steeping water. Laban leaves contain alkaloids, flavonoids, saponins, and tannins which can inhibit the growth of *Streptococcus mutans* so that it capable of removing dental plaque naturally. Bio-ingredients have been long used in health sector for preventive, curative, and rehabilitative treatments.

Methods: Experimental research with pre- and post-tests design using proposing sampling technique, where 56 people were taken as samples. The samples were divided into 2 groups which receiving different treatments. Group 1 was instructed to do mouth washing with laban leaves steeping water, while Group 2 was with water. Each of students did the mouth washing for 30 s (20 ml).

Results: based on the comparison of the dental plaque index (before and after the mouth washing using laban leaves steeping water) it is revealed that the steeping water of laban leaves was effective in reducing the plaque index with p value of 0.000 ($<\alpha=0.05$).

Conclusions: mouth washing using the laban leaves steeping water was effective in reducing the plaque accumulation. We then recommend a further study to investigate the potential of laban leave to be used in a mouthwash.

Keywords: Mouth washing, Laban leaves steeping water, Plaque accumulation

INTRODUCTION

Aceh Province is blessed with many medicinal plants, which has been used widely in traditional practices. One of which is laban leaves (*Vitex pinnata* Linn) having a synonym of *Vitex pubescens* Vahl. Laban or in Acehnese language is known as "Mane" is a tropical plant in Asia, known for its potential medicinal properties.¹ The entire

part of laban plant can be used to treat diseases; the leaves have been used for fever, and hypertension, the barks are for wound healing, abdominal pains, and dysentery, while the roots are utilized as herbal tea for fatigue elimination, lower back pain, and body pains.^{2,3} The phytochemical test of the laban plant, collected from geothermal area in Aceh Besar, revealed that the leaves contained alkaloids, flavonoids, saponins, terpenoids,

tannins, whilst the barks contained alkaloids, saponins, triterpenoids, and tannins.^{4,5} The extracted compounds of the laban leaves are potential as antimicrobial, anti-inflammatory, antidiabetic, antioxidant, antitumor, antifungal, and antibacterial.^{6,7} Methanolic extract of laban leaves was found to have antibacterial activities against *Streptococcus mutans*.^{8,10} The bacteria is the main cause of dental caries due to its acidogenic and aciduric properties (acidity resistant).^{11,12} In addition, the caries was also affected by the level of the bacteria, saliva, plaque, time and oral hygiene.^{13,15}

A report on the fundamental health research, stated that the prevalence of Indonesian citizens suffering from oral and dental health problems was 25.9%.¹⁶ Aceh province, especially, had the prevalence of 30.5% from the 21 regencies. Among them, Bener Meriah regency had the highest prevalence of 44.7%.^{17,18} Oral and dental diseases commonly suffered by Indonesian people include dental caries and periodontal diseases. Dental caries and dental supporting tissue (periodontal) disease can be associated with the presence of dental plaque, which up to these days, it is still a major problem in oral and dental health sector. Dental plaque is sticky film adhering to the tooth surface containing bacteria and other oral solid structures.^{19,20}

Aim and objectives

This study aims to determine the effectiveness of the plaque index on students of SD Negeri 1 Pagarair Subdistrict of Want Jaya Aceh Besar before and after gargling with laban leaf tea solution in children aged 8-10 years.

METHODS

The type of research used is quasi-experimental research with a pretest-posttest design. This study used a pre-test-post-test before and after the intervention of gargling with laban leaf tea, and pre-test and post-test before and after gargling using plain water as a control group in reducing plaque accumulation in students of SDN I Pagar Air Aceh Besar. Research on making laban leaf tea powder and phytochemical tests was carried out in the laboratory of the Faculty of Mathematics and Natural Sciences, Syiahkuala University (FMIPA), research on plaque index examination was carried out on children at SDN I Pagar Air Aceh Besar. The research was conducted from June 2019 to September 2019. The number of samples in this study were 56 people using proportional sampling technique, taking the number of samples using the Slovin formula, with criteria; Elementary school children are 8-10 years old, have index teeth 16, 11, 26, 36, 31, 46, the index teeth are in good health and not caries.

Procedure

The tools and materials used include; diagnostic tools, dappen glass, masks, gloves, glass, nierbeken, digital

scales, index value forms, and informed consent. The ingredients used are laban leaf steeping water and 800 grams of drinking water, menthol, saccharin. Preparation of sample collection of fresh laban leaves 1 kg, washed and air-dried at room temperature without sunlight for 21 days. After drying the laban leaves are finely ground into simplicia. Alkaloid Compound Test, prepare 1 gram of laban leaf, then add 1 ml of concentrated ammonia, add 10 ml of 0.5 N hydrochloric acid, shake vigorously, and let stand until it separates. The hydrochloric acid layer was taken and divided into three tubes and each tube was tested for the presence of alkaloids. The addition of Mayer's reagent will cause a white precipitate, the addition of Dragendorff's reagent will cause a reddish precipitate, the addition of Wagner's reagent will cause a brown precipitate, indicating a positive presence of alkaloid compounds. Test for steroid compounds, terpenoids and saponins; prepare 10 grams of laban leaves, add distilled water and shake vigorously. The presence of foam which is stable for 30 minutes indicates the presence of saponin compounds, if positive for the presence of saponin compounds, the solution is hydrolyzed with HCl and tested with Liebermann-Burchard reagent. Green or blue color indicates the presence of steroidal saponin compounds and red color indicates the presence of triterpenoid saponin compounds. Flavonoid compound test; prepare 10 ml of laban leaf tea, add 10 ml of 80% ethanol, then add 0.5 g of magnesium metal, add 0.5 M HCl. A pink or purple color indicates the presence of flavonoids. Laban leaf brewing tea: water in the ratio (8 g/800 ml) is boiled until it reaches 100°C. Refrigerate until the temperature drops to 70-80°C. Then added simplicia powder. Covered and cooled to 30°C, then filtered.²¹ Add menthol 1 gram. Add saccharin 1 gram. Each student gets 20 ml of steeping water to wash his mouth for 30 seconds. Plaque accumulation measurement: the first measurement of plaque accumulation, the students were divided into two groups, group 1, gargling using laban leaf tea steeped water and group 2, gargling using plain water as a control group. Intervensi group 28 students, randomly selected students aged 8-10 years amounted to 56 people. Each student was assigned a random number, number 1 was the intervention group, and number 0 was the control group. Divided into 2 groups, 1 intervention group 23 people, 2 control groups 23 people. On Day-1, the plaque index was examined in group 1 before the intervention. On Day-2, gargle with laban leaf tea as much as (20 ml) for each child for 30 seconds according to the recommended use of mouthwash, then check the plaque index. Giving disclosing solution to make it easier to identify plaque (Satryadi, et al, 2016). Then the plaque index was checked. Value 0=no plaque, Value 1=plaque. Group II control 28 students. On Day-3, the plaque index was checked in group 1 before gargling with water. On Day-4, rinse the mouth with as much as 20 ml of water for each child for 30 seconds according to the recommendation for using mouthwash, then check the plaque index. Giving disclosing solution to make it easier

to identify plaque. Then the plaque index was checked. Value 0=no plaque, Value 1=plaque

Data analysis

Data analysis was carried out by statistical dependent t-test using the SPSS application.

RESULTS

Phytochemical test

This phytochemical test aims to determine the secondary metabolite compounds contained in a plant. Phytochemical tests include tests for alkaloids, steroids, terpenoids, saponins, flavonoids and phenolics. Laban leaf phytochemical test results are presented in (Table 1). The results of the secondary metabolite content in spider leaves contain alkaloids, steroids, terpenoids, saponins, flavonoids and phenolics.

Table 1: Phytochemical test of Laban leaf extract.

Secondary metabolites	Laban leaves
Alkaloid	
Mayer	+
Dragendrof	+
Wagner	-
Steroid	+
Terpenoid	+
Saponin	+
Flavonoid	+
Fenolik	+
Tanin	+

(+) positive for secondary metabolic content, (-) negative no secondary metabolite content.

General data

Data collection was carried out from June to September 2019 at SD Negeri 1 Pagar Air Aceh Besar. Based on the results of data processing is presented in the form of tables and narration as follows: Gender: based on (Table 1), it can be seen that of the 28 students, most of them are female, as many as 17 people (65%). Age: based on (Table 1), it can be seen that of the 26 students, most of them are 12 years old (43%).

Effect of mouth washing using laban leaves steeping water

Based on the statistical test (Table 4), it was revealed that the p -value was 0.000, in which the p value (0.000) $< \alpha$ (0.05); indicating mouth washing using laban leaves steeping water gave an effect on the plaque accumulation. Therefore, there was a significant different on the plaque indices between before and after the mouth washing using laban leaves steeping water on the students of Public Elementary School 1 Pagar Air, Jurong Peujeura Sub-district, Aceh Besar Regency. By other mean, the

mouth washing using laban leaves steeping water (20 ml) can significantly reduce the dental plaque index of the students of Public Elementary School 1 Pagar Air, Aceh Besar.

Effect of mouth washing using drinking water

The characteristics of the research samples with drinking water mouth washing treatment is depicted in (Table 2). Based on the statistical test (Table 5) was obtained with p value of 0.592, where p value (0.592) $> \alpha$ (0.05); no effect took place on the plaque indices due to the mouth washing using drinking water on the students of public elementary school 1 Pagar Air, Jurong Peujeura Sub-District, Aceh Besar. By other mean, mouth washing with 20 ml drinking water cannot reduce the dental plaque index of the students attending public elementary school 1 Aceh Besar.

Table 2: Frequency distribution of respondents by gender in SD Negeri 1 Pagar Air.

Gender	N	%
Male	11	35
Female	17	65
Total	28	100

Table 3: Frequency distribution of respondents by age at SD Negeri 1 Pagar Air.

Age percentage	N	%
8	10	36
9	6	21
10	12	43
Total	28	100

DISCUSSION

Based on gender, the percentage of girls is higher than boys, namely 65% girls and 35% boys. And based on age the percentage of 10 years old is more (43%), compared to 8 years (36%) and 9 years (21%). Gender determines the state of dental and oral hygiene. Girls pay more attention to dental and oral hygiene than boys.²¹ Children's age affects dental plaque, where older people usually have a higher level of independence in maintaining dental health compared to children aged below. The increasing age of the child is not followed by an increase in the severity of the child's dental hygiene.²² Based on the secondary metabolite test positive laban leaves contain, alkaloids with Mayer, Dragendroff, steroids, terpenoids, saponins, flavonoids, phenolics. This is in accordance with previous research.²¹ The mechanism of action of secondary metabolites can reduce the dental plaque index of tannins as antibacterial by inhibiting the reverse transcriptase enzyme and DNA topoisomerase so that bacterial cells cannot be formed, and the antimicrobial mechanism of phenolic compounds by damaging lipids in the plasma membrane. microorganisms that cause cell contents to come out

which causes a decrease in the number of plaque on the teeth.²²

Table 4: Effect of mouth washing using laban leaves steeping water.

Plaque index	N	Mean±SD	Mean difference±SE	CI : 95%	P value	t test
Before mouth washing	28	3.232±0.9775	1.3357±0.2357	0.8632 to 1.8082	0.000	5.668
After mouth washing	28	1.896±0.7743	1.3357±0.2357	0.8626 to 1.8088	0.000	5.668

Table 5: Effect of mouth washing using drinking water.

Plaque index	N	Mean±SD	Mean difference± SE	CI: 95%	P value	t test
Before mouth washing	28	3.946±1.1606	0.1714±0.3181	-0.4663 to 0.8091	0.592	0.539
After mouth washing	28	3.775±1.2189	0.1714±0.3181	-0.4663 to 0.8092	0.592	0.539

Based on the results of the statistical test (Table 4), it was obtained (from the output table) that the p value was 0.000, where it was $< \alpha$ (0.05). Thus, the H_0 was rejected and H_a was accepted. It means the treatment with laban leaves steeping water gave an effect on the plaque indices. It can be concluded that the difference in plaque accumulation was significant between before and after the mouth washing using laban leaves steeping water on the students attending public elementary school 1 Pagar Air, Jurong Peujeura Sub-District, Aceh Besar Regency. By other mean, the mouth washing using laban leaves as much as 20 ml can reduce the dental plaque index of the students of public elementary school 1 Pagar Air, Aceh Besar. The effectiveness of laban leaves steeping water in reducing the plaque index can be attributed to the secondary metabolites contained in the laban leaves, including alkaloids, steroids, terpenoids, saponins, flavonoids, and phenolics (detected using phytochemical analysis). The activity mechanism of flavonoids as antibacterial agents was associated to its ability forming complex compounds with extracellular and dissolved proteins, so that it can cause a damage on the cell membrane of the bacteria, followed by the release of intracellular compounds.²³

The inhibition of the growth of *S. mutans* bacteria in dental plaque is thought to be due to the presence of compounds in laban leaves, such as compounds, alkaloids, flavonoids, tannins, saponins, polyphenols that can cause bacterial death and thus inhibit the formation of dental plaque. Alkaloid compounds have the ability as antibacterial by interfering with the peptidoglycan constituent components in bacterial cells causing the cell wall layer to not form intact and causing cell death so that the growth of *S. mutans* stops and inhibits the formation of dental plaque.²⁴ The saponin compounds contained in laban leaves act as strong surfactant agents such as soap that can clean the surface of the teeth so that the essential ingredients needed by bacteria are lost causing cell death so that it can reduce the dental plaque index.²⁵

Based on the statistical test (Table 5), it was revealed that the p-value was 0.592, where it was $> \alpha$ (0.05). Therefore, H_0 cannot be rejected. This means there was no effect given by the treatment of mouth washing using drinking

water on the plaque indices. Hence, the difference in plaque index, before and after the mouth washing using drinking water, was not significant (based on this study on the students of public elementary school 1 Pagar Air, Jurong Peujeura Sub-District, Aceh Besar Regency). By other mean, the mouth washing with drinking water (20 ml) cannot reduce the dental plaque index of the students attending Public Elementary School 1 Pagar Air, Aceh Besar. This is in accordance with research that has been done previously that plain water cannot reduce the formation of dental plaque.²⁶

Limitations

Limitations of current research were; the lack of theory that can enrich the results of the research. Limited time and other activities that take up the time and thoughts of researchers. The two technical obstacles in the field made researchers feel that this research was not optimal. The third is the lack of focus in doing this research, because the researcher is still active in several organizational fields and busy in the clinic. This indirectly makes researchers aware of the totality in conducting a study.

CONCLUSION

Mouth washing with laban leaves steeping water was found to be effective in reducing plaque. There was an effect on the dental plaque index observed in the students of public elementary school 1 Pagar Air, before and after the treatment of mouth washing using laban leaves steeping water, in which the p value was found to be 0.000, where it was $< \alpha$ (0.05). This gives a conclusion that there was a significant difference in plaque accumulation, based on the calculation before and after the mouth washing using laban leaves steeping water.

Recommendations

Further studies are encouraged to investigate the potential of laban leaf as an ingredient in mouthwash.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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