

Effectiveness of Citronella (*Cymbopogon Nardus*) And Green Betel Leaf (*Piper Betle*) Mouthwash on Plaque Reduction

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Abstract:

Dental plaque is a soft layer that consists of a collection of microorganisms that multiply. Plaque is the main cause of oral diseases such as caries and gingivitis. Plaque control can be done chemically using mouthwash. This study aims to determine the effectiveness of citronella and green betel leaf mouthwash on reducing plaque scores. This is a quasi-experimental study, with pretest and posttest design. The population are children aged 8-10 years at SDN 09 North Pontianak (32 students). Sample was collected by total sampling technique. Mouthwash was made from mixture of filtered citronella juice and boiled green betel leaf. The results showed that the difference of mean plaque score before and after gargling with water was 9.09; before and after gargling using citronella and green betel leaves mouthwash was 20.06. The Wilcoxon test shows a sig value of $0.000 < (2\text{-tailed})$ or a probability value (p) of $0.000 < 0.05$. This shows that citronella and green betel leaves mouthwash can significantly inhibit plaque formation.

Keywords: Mouthwash, Citronella, Green Betel Leaves, Dental Plaque

A. Introduction

The most common dental and oral disease is dental caries, especially in school children (Purwaningsih et al., 2023). School age children are children aged 6-12 years who are still studying at elementary school (SD) level. School-aged children are very vulnerable to caries because they have a penchant for eating sweet foods containing sugar (cariogenic) which will produce acid, plaque pathogenicity and *Streptococcus mutans*. *Streptococcus mutans* is a microorganism that converts sugar into acid (Wilis & Andriani, 2017). Dental plaque is a soft layer that consists of a collection of microorganisms that multiply. Plaque is the main cause of caries (cavities) and periodontal disease. Dental caries is a chronic disease that can impact the function of eating, speaking and learning. Untreated dental caries can be a big problem because it causes pain, abscesses, difficulty speaking and swallowing, ultimately reducing physical health and disrupting aesthetics, which will

cause a lack of self-confidence and impact the economy due to expensive treatment costs (Apro et al. , 2020). Plaque control can be done by mechanical or chemical methods. Mechanical plaque control is by brushing teeth and using dental floss, while chemical plaque control can be done using mouthwash. The chemical content in mouthwash sold on the market has antiseptic or antibacterial properties which function to inhibit plaque formation. However, if used in the long term it will have an impact on the oral cavity such as dry mouth and bad breath because the mouthwash sold on the market contains alcohol. Therefore, natural mouthwash is needed from plants that contain antiseptic and antibacterial so that it is safe for the body and has minimal side effects, such as citronella and green betel leaves.

B. Materials and Methods

The research was a quasi-experimental with a single pretest & posttest design. The population are children aged 8-10 years at SDN 09 North Pontianak (32 students). Sample were collected by total sampling technique in April 2023.

The experiment was conducted in three steps. The first step was examining the plaque score before using the mouthwash. We started with administering the disclosing solution by dripped it on the tip of the tongue and then spread evenly over the surface of the teeth. Then the examiner would check the initial plaque score without gargling with water using the PHP plaque index. Respondent then brush their teeth without toothpaste thoroughly until the color of the disclosing solution disappears. After that, respondent would rinse their mouth with 50 ml of water (control liquid) for 30 seconds. The examiner would check the plaque score after 1 hour of rinsing with water, using a disclosing solution that cover the entire surface of the teeth with the help of a mouth mirror and sonde. The final plaque score was examined (PHP plaque index) after respondent gargling with water. Then results recorded on the examination form.

The second step was preparation of the mouthwash (Ernie Thioritz, 2020). We blended 75 grams of citronella leaves and 750 ml of water, then filtered it . On the other hand, 75 grams of betel leaves were added into 1500 ml of water, and heated it until boiled water becomes 750 ml. These two liquids were mixed together to become a mouthwash.

The third step was examining the plaque score after respondent was gargling their mouth using citronella and green betel leaves mouthwash. The plaque score was examined with the help of disclosing solution. The methods were similar to the first step.

C. Result and Discussion

Table 1. Plaque Score Before and After Gargling Using Mouthwash

Mouthwash		Plaque score			
		Min	Max	Mean	Std. Deviation
Water	Before	51	60	57,25	2,476
	After	32	56	48,16	5,536
Citronella and green betel leaves mouthwash	Before	23	43	33,28	5,947
	After	2	24	13,22	5,638

It showed that the mean value before gargling with water is 57.25 and after gargling with water is 48.16. Meanwhile, the mean value before gargling using citronella and green betel leaves mouthwash was 33.28 and after gargling using it was 13.22 (table 1).

Table 2. Mean Difference of Plaque score Before and After Gargling Using Mouthwash

Variable		Mean	Mean Diff	Wilcoxon	Sig. (2-tailed)	
Plaque	Water	Before	57,25	9,09	-4,746 ^b	0,000
		After	48,15			
	Citronella and green betel leaves mouthwash	Before	33,28	20,06		
		After	13,21			

From table 2, the difference in plaque index before and after gargling citronella and green betel leaves mouthwash is greater than the difference in plaque index before and after gargling water so that there is a decrease in the plaque score for gargling using citronella and green betel leaves mouthwash. The Wilcoxon test results obtained a value of -4.746b and a Sig (2-tailed) value of $0.000 < 0.05$.

Based on the results, it showed that gargling using citronella and green betel leaves mouthwash can inhibit the formation of plaque on the teeth. It can be seen from the mean different values before and after gargling using citronella and green betel leaves mouthwash, which is 20.06. Wilcoxon test results showed that citronella and green betel leaves mouthwash caused a change in plaque formation from the mean plaque score before (Mean = 33.28) and after gargling using citronella and green betel leaves mouthwash which was left for a period of time (Mean = 13.21). The alternative hypothesis was accepted, which means there was a change in plaque formation before and after gargling using citronella and green betel leaves mouthwash. This showed that the results of the research are the same as previous research conducted by Soraya Tanjung et al., (2022) and Mayasari & Sapitri (2019) that citronella has antibacterial activity which can inhibit plaque formation by inhibiting the growth of *S. mutans*. Research (Ernie Thioritz, 2020) stated that saliva flow increases after gargling with red citronella mouthwash, resulting in an increase in salivary pH. Another study compared green betel, citronella and red citronella, discovering that citronella was more

effective in inhibiting *Streptococcus mutans* (Rizkita, 2017).

The research by Deynilisa & Zainur (2020) on green betel support the results of this study with changes in plaque scores before and after gargling with green betel leaf decoction, with the result that green betel leaf decoction can reduce the development of plaque on teeth. Mouthwash containing ethanol extract of betel leaves has high antiseptic effectiveness (Sundari & Almasyhuri, 2019).

Plaque formation is inhibited after gargling with citronella and green betel leaves mouthwash due to the essential oil content in citronella which is composed of monoterpane compounds such as citral and geraniol. The essential oil contains antibacterial and anti-fungal properties so it can inhibit the development of bacteria. is in the oral cavity. (Ulfayani and Alfi, 2019). Apart from that, betel leaves also contain antiseptic substances which play a role in killing bacteria so they can inhibit the growth of *S. mutans* which has an important role in the formation of dental plaque. (Mathematics, 2016).

Dental plaque is one of the main factors that causes dental and oral health problems. Dental plaque is a soft deposit that adheres tightly to the surface of the teeth, consisting of microorganisms that multiply in an intercellular matrix if a person neglects dental and oral hygiene. Plaque that sticks to the surface of the teeth or gingiva, the main control in preventing plaque from forming is by brushing your teeth regularly and can be supplemented with mouthwash. One way to control plaque chemically is to use mouthwash because it has antiseptic and

antibacterial properties which are useful for inhibiting the development of plaque on teeth (Hawwa et al., 2021).

The formation of dental plaque is the result of the activity of lactic acid bacteria, which are *S.mutans*, *Staphylococcus aureus*, *Lactobacillus sp*, *Escherichia coli*. These bacteria have an important role in dental caries. The bacteria found in large numbers in the plaque of caries sufferers is *S. mutans*. *S.mutans* in the oral cavity produces an acidic surface by lowering the pH to 5.5 or lower. This condition makes the enamel dissolve easily and then bacteria build up, resulting in the formation of dental caries. Citronella liquid and green betel leaves can inhibit gram-positive bacteria because citronella contains phytochemicals, namely tamins, flavonoids, phenols and essential oils (Mayasari & Sapitri, 2019). This compound has antimicrobial activity and is an alternative traditional treatment for diseases caused by bacteria and fungi, so the active compound content of citronella indicates that citronella has quite large antibacterial activity. Apart from that, the citronella plant contains saponin compounds. Saponin has been proven to be effective in inhibiting bacterial growth (Astuti, 2019). Citronellal, geraniol, and citronellol are the main ingredients in citronella oil which can be used as an antibacterial (Bota et al., 2015). Meanwhile, green betel leaves are a medicinal plant that is used as an antiseptic in the community. The green variant of betel leaf contains alkaloids, flavonoids, saponins, phenols, tannins and essential oils. The kavicol derivative is the most abundant essential oil found in green betel leaves. Flavonoids and kavicol have the ability to act as antiseptics

because of their ability to kill bacteria. Betel leaf decoction has the effective ability to inhibit the growth of *Streptococcus sp*. Essential oils and extracts are also able to fight several gram-positive and gram-negative bacteria. (Mathematics, 2016).

D. Conclusion

The mean plaque index before gargling with water was 57.25, while the mean plaque index after gargling with water was 48.15. The mean plaque index before gargling using citronella and green betel leaves mouthwash was 33.28, while the mean after gargling using citronella and green betel leaves mouthwash was 13.21. Citronella and green betel leaves mouthwash significantly caused a change in plaque formation.

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