

# Differences in the Effectiveness of Herbal, Betel Leaves, and Chlorhexidine Mouthwash on Plaque Reduction in Orphanage Children

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**Abstract:** *Betel leaves, herbal (betel leaves, aloe vera, lime extracts) and chlorhexidine mouthwash could help reducing plaque on the tooth surface. This study aimed to determine the differences in the effectiveness of betel leaves, herbal and chlorhexidine mouthwash against plaque index decreased in orphanage children. Quasi-experimental research method was performed on 300 orphans consist of 160 boys and 140 girls aged between 11 and 14 years from 10 orphanages in Bandung, West Java Province. The three hundred children were divided into two groups, 150 people in each group. Group 1 rinsed with betel leaves mouthwash and group 2 rinsed with chlorhexidine. One week later, both groups were given different mouth rinses. Group 1 rinsed with herbal mouthwash. Group 2 rinsed with placebo mouthwash. Rinsing was done twice a day for 5 days. Plaque index scores were recorded daily. The results showed all three mouthwashes equally effective in lowering plaque over a period of 5 days. There are significant differences among the three mouthwashes ( $P < 0.05$ ). This study concludes that there is significant difference in the effectiveness of betel leaves, herbal and chlorhexidine mouthwash against plaque index in children.*

**Keywords:** herbal mouthwash, chlorhexidine, plaque index, children

## 1. Introduction

Indonesia is rich in medicinal plants. The plant has been developed extensively in Indonesia. Almost every Indonesian ever use medicinal plants to treat diseases of the body<sup>[1]</sup>. One of the utilization of medicinal plants is the manufacture of mouthwash as an anti-plaque agent of herbal ingredients.

Plaque that is not controlled can disrupt the ecological balance in the mouth. If left unchecked and untreated, plaque can cause gingivitis, which is inflammation of the gum tissue. It is characterized by the presence of inflammatory exudate, edema, collagen fiber damage of the gums, ulcerated and epithelial proliferation that is attached directly to the teeth. Poor diet and hormonal changes during puberty increase the risk of gingivitis<sup>[2]</sup>.

Plaque can be reduced through mechanical action, such as brushing and flossing. Good brushing technique is needed for optimal plaque removal, but most people have not been able to do a good brushing technique. Additional media required to reduce the accumulation of plaque, one of which is a mouthwash. Mouthwash can help reduce plaque that can not be cleaned by brushing teeth<sup>[3]</sup>. Chemicals in the mouthwash is proven to reduce the number of bacteria in plaque<sup>[4]</sup>.

Chlorhexidine is an antiseptic agent from bis-biguanide class that is widely regarded as one of the ingredients that are quite effective in controlling plaque<sup>[5]</sup>. Chlorhexidine mouthwash with a concentration of 0.12 % can work quite effectively as plaque control<sup>[6]</sup>. Recently, several studies have been conducted to verify the wealth of herbal mouthwashes, as they contain naturally occurring ingredients called as Phytochemicals that have the desired antimicrobial and anti-inflammatory effects. Herbal formulations can be

more appealing because they do not contain alcohol, artificial preservatives, flavors or colors<sup>[7]</sup>.

The purpose of this study is to determine the differences in the effectiveness of betel leaves, herbal and chlorhexidine mouthwash against plaque index decreased in orphanage children.

## 2. Materials and Methods

This study was a quasi-experimental study. Population and sample were children from 10 orphanages in Bandung, West Java Province. Orphanage children were chosen because they have the same diet. This can reduce confounding factors in the formation of plaque. Moreover, the orphanage children also rarely gets health care. This research can introduce them to the use of mouthwash and also provide knowledge about the maintenance of oral health.

Purposive sampling technique is used with the following criteria: aged 11 to 14 years old, have a good general health, the gums and periodontal tissues in healthy condition, and not being on antibiotics. Total sample in accordance with the criteria obtained 300 children consisting of 160 boys and 140 girls.

These three hundred children were divided into two groups, each numbering 150 children. The first group rinsed with betel leaf mouthwash and the second group rinsed with chlorhexidine. One week later the three hundred children are redivided into 2 groups. Group 1 gargle with herbal mouthwash, which consists of betel leaf, aloe vera, and lime. Group 2 rinsed with placebo mouthwash, which is a mixture of water and glycerin.

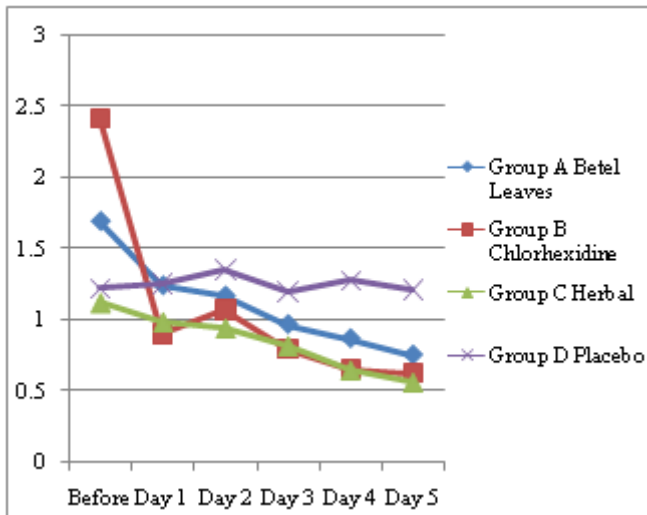
This research was carried out for 5 days. The entire sample was asked to rinse 2 times a day. Plaque index measurement was done every day for 5 consecutive days. Rinsing process

is supervised by researchers. The method used for the measurement of plaque index is Turesky et al Modified Quigley Hein Plaque Index ( TQHPI ).

Data were analyzed using SPSS version 21. The statistical analysis used was ANOVA and post - hoc LSD. P values of <0.05 were considered significant.

### 3. Results

This study shows that betel leaves, herbal and chlorhexidine mouthwash were proven to reduce plaque attached to the tooth surface. The chart (Figure 1) shows the average reduction of plaque index for 5 days.



**Figure 1.** The average plaque of betel leaves, herbal, and chlorhexidine mouthwash

The average plaque score of children who rinsed with betel leaves, herbal and chlorhexidine mouthwash decreased from

**Table 2:** Post-hoc LSD test for multiple comparison

	(I) Mouthwash	(J) Mouthwash	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Betel leaves	Chlorhexidine	.19120	.14406	.193	-.1010	.4834
		Herbal	.20480	.14406	.164	-.0874	.4970
		Placebo	-.26180	.14406	.078	-.5540	.0304
	Chlorhexidine	Betel leaves	-.19120	.14406	.193	-.4834	.1010
		Herbal	.01360	.14406	.925	-.2786	.3058
		Placebo	-.45300*	.14406	.003	-.7452	-.1608
	Herbal	Betel leaves	-.20480	.14406	.164	-.4970	.0874
		Chlorhexidine	-.01360	.14406	.925	-.3058	.2786
		Placebo	-.46660*	.14406	.003	-.7588	-.1744
Placebo	Herbal	.26180	.14406	.078	-.0304	.5540	
	Chlorhexidine	.45300*	.14406	.003	.1608	.7452	
	Herbal	.46660*	.14406	.003	.1744	.7588	

### 4. Discussion

In this study, we compared the effectiveness of betel leaf, chlorhexidine, herbal, and placebo mouthwash. We did not use non brushing model for plaque accumulation prior to the study. During the 5-day period, there was a significant decrease in plaque scores occurred in four groups. Research conducted by Haq et al (2010)<sup>[8]</sup> also showed a decrease in plaque scores over a period of 5 days.

before the study until day 5 of the study. The average plaque score of children who rinse with mouthwash placebo relatively the same before and after the study. Children who rinsing with chlorhexidine has the highest average plaque score prior to the study and the lowest average plaque score was owned by the children in the herbal group. After day 5, children rinsing with chlorhexidine mouthwash and herbs have the lowest average plaque score.

ANOVA (Table 1) was used to test for differences in mean (average ) of the data obtained from four mouthwashes. With a degree of confidence of 95% it can be concluded that there are significant differences of four mouthwash. The decrease in plaque scores occurred for 5 days at four mouthwash.

**Table 1:** Analysis of variance for plaque score in four mouthwashes

Analyses of Variance	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.425	3	.475	4.579	.008
Within Groups	3.736	36	.104		
Total	5.161	39			

Post-hoc LSD (Table 2) was utilized to obtain multiple comparison. On LSD test output, sig. Number of less than 5 % indicates that the mouthwash has a significant effect on reducing plaque index. From the output of LSD it can be seen that the sig number of less than 5 % is chlorhexidine and herbal mouthwash. This demonstrated that the mouthwashes that have statistically different effects on plaque reduction are chlorhexidine and herbal mouthwash ( P <0.05 ).



This study shows that betel leaves and herbal mouthwash have good potential as an anti-plaque agent. Research by Subashkumar et al (2013)<sup>[11]</sup> demonstrated the ability of betel leaf extract in inhibiting the growth of *Streptococcus viridans*, *Staphylococcus aureus*, and *Streptococcus mutans* which are the pathogenic bacteria in the oral cavity. Research conducted by Aggarwal et al (2011)<sup>[12]</sup> demonstrated that aloe vera has the ability to cure swollen, bleeding gums, antiseptic for periodontal pocket and antifungal for thrush. Arkayi et al (2013)<sup>[13]</sup> showed that lime contains phenols, coumarins and tannins. The content of phenol can damage the integrity of the bacterial cell membrane.

In terms of effectiveness, chlorhexidine is still superior than betel leaves and herbal mouthwash. Research by Chandrasah et al (2012)<sup>[14]</sup> showed that chlorhexidine significantly lowers the plaque than aloe vera mouthwash. Chlorhexidine is able to block the acid component of salivary glycoproteins that will reduce the absorption of these components on the surface of hydroxyapatite and pellicle formation. The resulting affinity bond between chlorhexidine with acid protein pellicle, plaque, calculus, oral mucosa and bacterial surface is greater than with hydroxyapatite. Plaque formation and reduced the number of bacteria can optimally (Mathur, 2011)<sup>[15]</sup>.

However, the use of chlorhexidine in the long term can cause some side effects. Chlorhexidine is less preferred because it tastes bitter and can cause changes in taste perception. Chlorhexidine can also cause staining on the surface of the tooth and restoration. The use of chlorhexidine also trigger the onset of supragingival calculus. Suppression of asidogenic bacteria and increase in the oral pH causes the precipitation of calcium and phosphate. The inorganic salts will precipitate on the surface of the tooth pellicle layer<sup>[16]</sup>.

## 5. Conclusion

Based on the results and the discussion that have been described previously, it can be concluded there is a significant difference in the effectiveness of betel leaves, herbal and chlorhexidine mouthwash to decrease plaque scores in the orphanage children. Betel leaves and herbal mouthwash have potential in reducing plaque, but still less effective than chlorhexidine.

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