

## Research Article

## The Effectiveness of Siwak in Reducing Oral Cavity Bacteria

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### Abstract

Dental plaque is the primary etiology of periodontal disease. Plaque is a soft layer composed of a collection of microorganisms that proliferate and adhere tightly to the surfaces of teeth that are not adequately cleaned. Plaque control can be performed mechanically and chemically. Brushing the teeth with siwak or conventional toothbrushes with toothpaste is a mechanical method of plaque control. Siwak contains substances that can prevent plaque formation. The aim of this study is to test the effectiveness of using siwak in reducing bacterial colony counts. Bacterial colony counts were measured before and after using siwak. The study samples included users of siwak, and the control group consisted of users of conventional toothbrushes with toothpaste. Group I (test) used siwak, while Group II (control) used conventional toothbrushes with toothpaste. Saliva samples were taken from both groups before and after the procedure. Group I had saliva samples collected before and after using siwak, while Group II had saliva samples collected before and after brushing with a conventional toothbrush. Results: The study results showed a reduction in the mean bacterial colony count in both the siwak group and the conventional toothbrush group with toothpaste. There was a statistically significant reduction in the mean bacterial count before and after using siwak, as well as a statistically significant reduction in the bacterial count after brushing with a conventional toothbrush. However, the difference in the mean bacterial count after using siwak and after using the conventional toothbrush was not statistically significant.

**Keywords:** Siwak, bacterial colony count, conventional toothbrush



## INTRODUCTION

Periodontal disease is a condition affecting the tissues surrounding the teeth, including diseases of the gingiva and the supporting structures of the teeth. This disease is characterized by inflammation of the gingiva, causing it to turn red, swell, bleed easily, and lead to gingival recession, the formation of periodontal pockets, and potentially result in bone loss (Kulkarni et al., 2023).

Periodontal disease is one of the leading dental diseases in the human population worldwide, with a high prevalence rate. The World Health Organization (WHO) reports that 10-15% of the global population suffers from severe periodontitis. According to the Centers for Disease Control and Prevention (CDC) in the United States, the prevalence of periodontal disease in 2009 and 2010 was estimated at 47.2%, affecting approximately 64.7 million adults. In Indonesia, periodontal disease ranks as the second most common dental issue still prevalent in society (Susanto et al., 2020).

Plaque plays a crucial role in the etiology of oral diseases, particularly caries and periodontal diseases (Mira et al., 2017). The main composition of dental plaque consists of microorganisms, with around 500 bacterial and non-bacterial species present in plaque. There are approximately  $2 \times 10^8$  bacteria per 1 mg of dental plaque. Among the 700 types of bacteria found in the oral cavity, more than 400 species are located in the subgingival biofilm area. Plaque is found on the supragingiva and is predominantly made up of Gram-positive bacteria, including Streptococcus species (*S. sanguis*, *S. oralis*, and *S. mitis* as pioneer species), Neisseria, Nocardia, and Actinomyces. Over the course of several weeks, plaque develops and matures, transitioning from being predominantly composed of Gram-positive bacteria to Gram-negative bacteria, from facultative anaerobic species to anaerobic species, with an increased presence of motile bacteria (Azzawi & Abdul-Rahman, 2018).

Plaque control can be performed mechanically and chemically. Mechanically, it is done through tooth brushing. One alternative for tooth brushing is using siwak. Siwak is a plant from the Salvadoraceae family that is traditionally used by Muslims for oral hygiene. Siwak (*Salvadora persica*) contains a wide range of beneficial substances for the oral cavity. It contains trimethylamine, salvadorine, chloride, fluoride, silica, sulfur, mustard oil, vitamin C, resins, tannins, saponins, flavonoids, and sterols. One of the key compounds in siwak (*Salvadora persica*) that helps prevent plaque formation is trimethylamine (TMA), a substance that is water-soluble and acts as a flotation agent, preventing the deposition of particles and food debris in the oral cavity, particularly between the teeth. It is also a potential antibacterial agent (Khalil et al., 2019).

One of the components of siwak also contains tannins and saponins, which have antibacterial and antifungal effects and can stimulate saliva production (Djais & Tope, 2017).

Based on the explanation above, the author is interested in conducting research to assess the effectiveness of using siwak in reducing the number of oral cavity bacteria in the Al Jihad Mosque community in Medan.

## METHODS

This research is a quasi-experimental study with a pre- and post-test control group approach. The research samples were the congregation of Al Jihad Mosque in Medan, divided into two groups and selected using a random sampling technique. Group I (test) consisted of participants using siwak, and Group II (control) consisted of participants using a conventional toothbrush with toothpaste. The total sample size for both groups was 60 individuals, with 30 people in the siwak group and 30 people in the conventional toothbrush with toothpaste group. Saliva samples were collected from each group before and after the procedure. For Group I, saliva samples were taken before and after using siwak, while for Group II, saliva samples were taken before and after brushing with a conventional toothbrush. The saliva samples were immediately transported to the Microbiology Laboratory of the Faculty of Pharmacy, University of North Sumatra, for bacterial count analysis, no later than one hour after sample collection.

Data processing was carried out using computer software, with univariate tests to calculate the mean bacterial count before and after using siwak and conventional tooth brushing. A bivariate test was used to determine the significance of the differences before and after the treatment, with paired t-tests applied for the siwak and conventional toothbrush groups. To assess the effectiveness of both treatments, an ANOVA test was used.

## RESULT AND DISCUSSION

Table 1 shows the difference in the mean bacterial count before and after using siwak. The results indicate that before using siwak, the mean bacterial count was  $636.40 \pm 278.54$  CFU/ml, and after using siwak, it was  $418.70 \pm 178.04$  CFU/ml. A significant difference was found in the mean bacterial count before and after using siwak ( $p$ -value  $< 0.05$ ).

**Table 1.** Difference in the mean bacterial count before and after using siwak

Treatment	n	Mean $\pm$ SD	p
Before using siwak	30	$636.40 \pm 278.54$	0.000*
After using siwak	30	$418.70 \pm 178.04$	

Note: Paired t-test,  $p$ -value  $< 0.05$

Table 2 shows the difference in the mean bacterial count before and after brushing teeth with toothpaste. The results indicate that before brushing, the mean bacterial count was  $796.00 \pm 516.87$  CFU/ml, and after brushing with toothpaste, it was  $467.00 \pm 378.30$  CFU/ml. A significant difference was found in the mean bacterial count before and after brushing with toothpaste ( $p$ -value  $< 0.05$ ).

**Table 2.** Difference in the mean bacterial count before and after brushing with a conventional toothbrush and toothpaste

Treatment	N	Mean $\pm$ SD	P
Before brushing with a conventional toothbrush and toothpaste	30	$796.00 \pm 516.87$	0.000*

After brushing with a conventional toothbrush and toothpaste	30	467.00 ± 378.30
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Note: Paired *t*-test, *p*-value < 0.05

Table 3 shows the difference in the mean bacterial count between the treatment groups. The results indicate that there was no significant difference (*p*-value > 0.05) between the group after using siwak, with a mean bacterial count of 418.70 ± 178.04 CFU/ml, and the group after brushing with a conventional toothbrush, with a mean bacterial count of 467.00 ± 378.30 CFU/ml.

**Table 3.** Difference in the mean bacterial count between the treatment groups

Treatment	N	Mean ± SD	p
After using siwak	30	418.70 ± 178.04	
After brushing with a conventional toothbrush and toothpaste	30	467.00 ± 378.30	0.574

Note: Mann-Whitney *U* test, *p*-value > 0.05

## Discussion

In this study, the subjects were the congregation members of Al Jihad Mosque in Medan, divided into two groups: Group I (siwak group) as the test group consisting of 30 individuals, and Group II (conventional toothbrush with toothpaste group) as the control group, also consisting of 30 individuals. The results indicated a significant difference in the mean bacterial count before and after using siwak. The effectiveness of siwak in cleaning teeth and the mouth is attributed to the mechanical effect of the fibers of the siwak stick as well as its ability to release beneficial active compounds (Ramli et al., 2021).

Siwak (*Salvadora persica*) contains trimethylamine, salvadorine, chloride, fluoride, silica, sulfur, mustard oil, vitamin C, resins, tannins, saponins, flavonoids, and sterols. One of the compounds in siwak (*Salvadora persica*) that helps prevent plaque formation is trimethylamine (TMA), which functions as a flotation agent, thereby preventing the deposition of particles and food debris in the oral cavity, particularly in the spaces between the teeth. It also has potential as an antibacterial agent (Arifin et al., 2022). The compounds in siwak also include tannins and saponins, which have antibacterial and antifungal effects and can stimulate saliva production (Djais & Tope, 2017).

The study results also showed a significant difference in the mean bacterial count before and after brushing with a conventional toothbrush and toothpaste. However, the results indicated that there was no significant difference between the siwak group and the conventional toothbrush group with toothpaste (*p* < 0.05).

Based on a study by Djais and Tope, it was found that a solution of siwak extract could inhibit the growth of *Streptococcus mutans*, with a 50% concentration of siwak extract being the lowest effective concentration to inhibit its growth (Djais & Tope, 2017). *Streptococcus mutans* is a major plaque bacterium, forming stable extracellular polysaccharides and having the ability to colonize at the relatively low pH of tooth surfaces. The tannins in siwak inhibit the action of glucosyltransferase

enzymes produced by *Streptococcus mutans*, ultimately preventing plaque formation (Dewi, 2025).

Furthermore, according to another study by Zulfikri, the average plaque score before and after brushing with siwak toothpaste in fourth and fifth-grade students showed a decrease (Zulfikri, 2017). This result could be attributed to the use of siwak extract toothpaste, which helps remove plaque and food debris. Additionally, the ingredients in siwak toothpaste assist in releasing plaque without damaging tooth enamel, and the antimicrobial properties of siwak extract toothpaste inhibit plaque growth.

## CONCLUSION

This study found a significant decrease in the mean bacterial count in both the siwak group and the conventional toothbrush with toothpaste group. The results showed a significant reduction in bacterial colony counts before and after using siwak. A similar significant reduction was observed in the group using conventional toothbrushes with toothpaste. However, no statistically significant difference was found between the group after using siwak and the group after brushing with a conventional toothbrush, indicating that both methods are effective in reducing oral cavity bacteria.

## Recommendations for Future Research

Future research could consider testing the effectiveness of siwak over a longer period and on a more diverse population to obtain more representative results. Additionally, further studies could explore different concentrations or doses of siwak extract to evaluate its antibacterial effects more thoroughly. Research with a larger sample size and a more detailed analysis of the specific bacterial species involved in dental plaque could provide deeper insights into the potential of siwak as an effective oral hygiene alternative.

## Acknowledgement

This research is part of the young lecturer research scheme funded by the University of North Sumatra under the "Academic Excellence Research (TALENTA) USU" program.

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