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ORIGINAL RESEARCH

Effect of a 10% Forest Honey Mouth Rinse on Plaque Index Scores in Children Aged 9–12 Years

Mudiah, Fairuz[1]; Asri, Budi[2]; Yasmin, Ulfa[2]; Dewi, Siti Rusdiana Puspa[3]*

[1] *Dentistry Study Program, Faculty of Medicine, Universitas Sriwijaya*
[2] *Departement of Pedodontics, Dentistry Study Program, Faculty of Medicine, Universitas Sriwijaya*
[3] *Department of Biomedical Science, Dentistry Study Program, Faculty of Medicine, Universitas Sriwijaya*

**Corresponding author: sitirusdiana@fk.unsri.ac.id*

KEYWORDS

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Oral hygiene;
Mouthwash.

ABSTRACT

Mechanical plaque control through toothbrushing is the primary method of maintaining oral hygiene, while mouthwash is commonly used as an adjunct. Because conventional mouthwashes may cause oral side effects, natural alternatives such as forest honey have gained attention due to their antibacterial properties. This study evaluated the effect of a 10% forest honey mouthwash on dental plaque scores in children aged 9–12 years. A quasi-experimental study with a pretest–posttest control group design was conducted. Participants were assigned to a control group (distilled water) or an intervention group (10% forest honey mouthwash). They rinsed with 10 mL of the assigned solution for 30 seconds, three times daily, for four consecutive days. Plaque scores were recorded before and after the intervention. Data were analyzed using paired and independent t-tests. The intervention group showed a significant reduction in plaque score from 2.22 ± 0.59 to 1.51 ± 0.57 ($p < 0.05$), whereas no significant change was observed in the control group ($p > 0.05$). It can be concluded that a 10% forest honey mouthwash effectively reduced dental plaque scores in children aged 9–12 years.

1. INTRODUCTION

Dental plaque is the primary etiological factor in the development of dental caries and periodontal diseases.[1] It is a structured biofilm composed of microorganisms embedded in an extracellular matrix that adheres to tooth surfaces and other hard tissues in the oral cavity. Dental plaque contains a complex microbial community, organic components, and inorganic substances.[2] Among the predominant microorganisms associated with plaque are Streptococcus mutans, Streptococcus sobrinus, Lactobacillus acidophilus, and Staphylococcus species.[3]

Effective plaque control relies primarily on regular and proper toothbrushing. However, maintaining adequate oral hygiene in school-aged children can be challenging because their brushing technique and compliance are often inadequate.[4] Therefore, mouthwash is commonly used as an adjunct to mechanical plaque control. Conventional mouthwashes containing chemical agents may produce adverse effects with prolonged use, including tooth discoloration, taste alteration, and disruption of the normal oral microbiota.[5] These limitations have encouraged the exploration of natural products as safer alternatives for oral healthcare.

Honey is a natural product with well-documented antimicrobial, antioxidant, and anti-inflammatory properties.[6] Multiflora honey, commonly known as forest honey, is produced by bees collecting nectar from multiple plant species. Because most honey production in Indonesia originates from natural forests, forest honey is widely available throughout the country.[7] Compared with cultivated honey, forest honey contains higher antioxidant levels, which may enhance its biological activity.[6,7] Honey is composed mainly of sugars and water, together with amino acids, vitamins, minerals, and enzymes.[6] Its antibacterial activity is attributed to high osmotic pressure, low pH, and the enzymatic production of hydrogen peroxide, which inhibit the growth of oral microorganisms.[8]

Children aged 9–12 years were selected because this period represents a critical stage for establishing oral hygiene habits, yet plaque accumulation remains common due to insufficient oral health knowledge and inconsistent plaque control practices.[9] Preliminary observations at SD Negeri 16 Palembang also indicated that no previous oral health education or plaque assessment programs had been conducted.

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Previous studies have demonstrated the antibacterial potential of forest honey. Deglovic *et al*. reported that a honey application had antibacterial and antibiofilm effect.[10] Whereas Halimeh *et al*. found that rinsing with honey mouthwash 12.5% inhibited *Staphylococcus aureus* and *Pseudomonas aeruginosa* on the fourth day of the intervention.[11] Despite these findings, evidence regarding the effect of lower concentrations of forest honey on dental plaque remains limited. Therefore, this study aimed to evaluate the effect of rinsing with a 10% forest honey solution on dental plaque scores among children aged 9–12 years.

2. METHODOLOGY

This quasi-experimental study employed a single-blind, pretest–posttest control group design. The study was conducted at SD Negeri Palembang, Indonesia. The study population comprised fourth-, fifth-, and sixth-grade students, while eligible participants were children aged 9–12 years who fulfilled the inclusion criteria. Based on the sample size calculation, a minimum of 26 participants was required for each group. Participants were recruited using purposive sampling.

The inclusion criteria were children aged 9–12 years who provided written informed consent from their parents or guardians, were free from systemic and periodontal diseases, had not used mouthwash within the previous two weeks, did not wear orthodontic appliances, and were cooperative during the study. Children with crowded teeth, caries involving the labial, buccal, lingual, or palatal surfaces, partially erupted teeth, or unilateral chewing habits were excluded.

The independent variable was rinsing with a 10% forest honey solution, whereas the dependent variable was the dental plaque score. Ethical approval was obtained from the Ethics Committee of Dr. Mohammad Hoesin General Hospital and the Faculty of Medicine, Universitas Sriwijaya, before participant recruitment.

At baseline, all participants were instructed to perform their usual toothbrushing routine. Dental plaque was then disclosed using a disclosing solution, which was placed beneath the tongue, mixed with saliva, and distributed over all tooth surfaces. Plaque scores were assessed using a mouth mirror and headlamp according to the modified Turesky–Gilmore–Glickman modification of the Quigley–Hein Plaque Index.

After baseline assessment, participants were allocated into two groups with comparable plaque scores. The intervention group rinsed with 10 mL of a 10% forest honey solution for 30 seconds, whereas the control group rinsed with 10 mL of distilled water for the same duration. Participants were instructed to rinse three times daily for approximately four consecutive days (10 rinsing sessions). Plaque scores were reassessed after the intervention using the same examination protocol.

Primary data were obtained through direct clinical examination. Data normality was evaluated using the Shapiro–Wilk test. Normally distributed data were analyzed using paired t-tests to compare pre- and post-intervention plaque scores within each group and independent t-tests to compare outcomes between the intervention and control groups.

3. RESULTS

The Shapiro–Wilk normality test indicated that plaque scores measured before and after the intervention in both groups were normally distributed ($p > 0.05$). Therefore, parametric statistical analyses were applied. Paired t-tests were used to compare pre- and post-intervention plaque scores within each group, whereas independent t-tests were performed to compare outcomes between the intervention and control groups. The comparison of plaque scores before and after rinsing with distilled water (control group) and 10% forest honey solution (intervention group) using the paired t-test is presented in Table 1.

Group	Mean Plaque Score ± SD		Paired t-test P value	Independent t-test P value
	Before	After		
10% Forest Honey Mouthwash	2.22 ± 0,59	1.51 ± 0,57	0,00*	0,00*
Aquadest	2.18 ± 0,73	2.22 ± 0,89	0,70	

Table 1. Comparison of Plaque Scores Before and After the Intervention

4. DISCUSSION

The present study demonstrated that rinsing with a 10% forest honey solution for approximately four days (10 rinsing sessions) significantly reduced dental plaque scores compared with baseline. In contrast, no significant change was observed in the distilled water group, indicating that distilled water alone did not inhibit plaque accumulation. The slight increase in plaque scores among control participants may be explained by uncontrolled factors, particularly differences in toothbrushing technique and oral hygiene practices, which are known to influence plaque accumulation.

The reduction in plaque scores observed in the intervention group can be attributed to the antibacterial properties of forest honey. Honey exerts antimicrobial activity through multiple mechanisms, including its high osmotic pressure, acidic pH, hydrogen peroxide production, and flavonoid content.[12] These mechanisms inhibit bacterial growth and reduce biofilm formation, thereby limiting dental plaque accumulation.[8]

The high sugar concentration of honey creates a hyperosmotic environment that withdraws water from bacterial cells, resulting in dehydration and impaired bacterial survival.[13] In addition, flavonoids disrupt bacterial cell membranes, increase membrane permeability, denature cellular proteins, and inhibit essential bacterial enzymes involved in metabolism and biofilm formation.[14] Honey also produces hydrogen peroxide through the enzymatic oxidation of glucose after dilution. Hydrogen peroxide damages bacterial proteins, lipids, nucleic acids, and enzymes, suppressing the growth of oral microorganisms, including Streptococcus mutans, one of the primary colonizers of dental plaque.[15] Furthermore, the naturally acidic pH of honey (approximately 3.2–4.5) creates an unfavorable environment for several oral pathogens, including Porphyromonas gingivalis.[16]

The findings of this study are consistent with previous reports demonstrating the beneficial effects of honey on oral health. Savitri *et al*. observed that gargling a solution of forest honey is effect-tive in reducing plaque and gingivitis index scores in the oral cavity of adolescents.[17] Similarly, Husna *et al*. reported rinsing with 10% forest honey solution for 6 days and 8 days is effective in reducing plaque accumulation in fixed orthodontic appliance patients.[18] Whereas Abid *et al*. found that a 10% honey mouthwash effective reduce dental plaque and increase gingival health.[19] Reduan demonstrated that gargling with honey can inhibit dental plaque growth.[20] Singal *et al*. Also reported that honey decreased on plaque and gingival scores of 12-15-year-old school children.[21]

The present findings suggest that a 10% forest honey solution may serve as a safe, natural adjunct to mechanical plaque control in school-aged children. Forest honey is widely available, inexpensive, and generally well accepted because of its pleasant taste. Nevertheless, this study has several limitations. The antibacterial effects were inferred from plaque reduction without microbiological analysis, and gingival health was not evaluated. Future studies should investigate changes in plaque microbiota, gingival indices, and the long-term effectiveness of forest honey mouthwash in larger populations.

5. CONCLUSION

A 10% forest honey solution significantly reduced dental plaque scores in children aged 9–12 years compared with baseline and demonstrated greater effectiveness than distilled water ($p < 0.05$). Therefore, a 10% forest honey mouth rinse has the potential to be used as a natural adjunct for dental plaque control in school-aged children.

Conflict of Interest

The authors declare no conflicts of interest in this study.

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Authors Contribution

Conceptualization: FM**,** Methodology: FH, UY**,** Formal Analysis: BA**,** Funding Acquisition: FM**,** Data Curation: FM**,** Original Draft Writing: SRPD**,** Supervision and Editing: BA, UY, FM**,** and Administration: SRPD**.**

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