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Comparative evaluation of coconut oil, sesame oil, sunflower oil and chlorhexidine mouthwash in plaque-induced gingivitis: A randomized clinical study

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Abstract:
Plaque-induced gingivitis is a reversible inflammatory condition caused by microbial biofilm and safer alternatives to chlorhexidine are being explored due to its long-term adverse effects. A randomized parallel-group trial included 40 patients assigned to coconut oil, sesame oil, sunflower oil or chlorhexidine groups (n=10 each) for 15 days. Plaque Index and Gingival Index were recorded at baseline and Day 15 and the data were analyzed using paired t-test, one-way ANOVA and Tukey's post hoc test. All groups showed significant reductions in plaque and gingival inflammation ($p<0.001$), with chlorhexidine performing best, followed by coconut oil, sunflower oil and sesame oil. Thus, coconut oil appears to be the most effective natural alternative and may serve as a safe adjunct for managing plaque-induced gingivitis.

Keywords: Plaque-induced gingivitis, oil pulling, coconut oil, sesame oil, sunflower oil, chlorhexidine, plaque index, gingival index

Background:
Optimal oral health is essential for systemic well-being and periodontal diseases have been associated with several systemic conditions, including cardiovascular disease and diabetes mellitus **[1]**. Gingivitis is an early and reversible periodontal condition initiated by dental plaque accumulation **[2]**. Effective plaque control is therefore fundamental to preventing periodontal disease progression **[3]**. Mechanical plaque removal remains the primary approach, although its effectiveness may be influenced by patient compliance, dexterity and oral hygiene practices **[4]**. Chlorhexidine gluconate is considered the gold-standard chemical plaque-control agent because of its broad-spectrum antimicrobial activity and substantivity **[5]**. However, prolonged use may cause tooth staining, taste alteration, mucosal irritation and increased calculus formation **[6]**. These limitations have encouraged interest in natural alternatives such as oil pulling, an Ayurvedic practice involving the swishing of edible oils in the oral cavity **[7].** Oil pulling may improve oral hygiene through mechanical cleansing, emulsification and antimicrobial effects **[8]**. Coconut oil contains lauric acid with antimicrobial and anti-inflammatory properties, while sesame and sunflower oils contain bioactive compounds with potential antioxidant and antimicrobial effects **[9].** Clinical studies have reported beneficial effects of individual oils on plaque and gingival inflammation **[10]**. However, direct comparative evidence among coconut, sesame and sunflower oils remains limited **[11, 12]**. Therefore, it is of interest to compare and evaluate the effectiveness of coconut oil, sesame oil, sunflower oil and chlorhexidine gluconate mouthwash in the management of plaque-induced gingivitis.

Methodology:
The present study was designed as a prospective randomized interventional clinical trial to evaluate the effectiveness of oil-pulling therapy in the management of plaque-induced gingivitis. A total of 40 systemically healthy participants aged below 35 years with clinically diagnosed plaque-induced gingivitis were recruited after obtaining written informed consent. Participants who had received systemic or topical antibiotics within the previous month, undergone dental treatment during the preceding month, or had systemic conditions that could influence periodontal health were excluded from the study. At baseline, a detailed medical and dental history was recorded, including medication use during the previous six months and routine oral hygiene practices. All participants reported brushing their teeth once or twice daily using a toothbrush and toothpaste. Clinical examinations were performed at baseline (Day 0) and after 15 days (Day 15) by a trained examiner. Plaque accumulation and gingival inflammation were assessed using the Plaque Index and Gingival Index. The participants were randomly allocated into four equal groups (n = 10 each). Group I received coconut oil, Group II received sesame oil, Group III received sunflower oil and Group IV received chlorhexidine gluconate mouthwash. Participants in the oil-pulling groups were instructed to use 10 mL of the assigned oil daily, swishing it throughout the oral cavity for 10–15 minutes each morning before breakfast before expectorating. Participants in the chlorhexidine group rinsed with 10 mL of chlorhexidine gluconate mouthwash for 30 seconds once daily in the morning. All interventions were continued for 15 consecutive days while maintaining routine oral hygiene practices. Participants were instructed not to eat or drink for at least 30 minutes after oil pulling or mouth rinsing. The collected data were entered into a computerized database and analyzed using SPSS version 25.0.

Descriptive statistics were calculated for all variables. Intragroup comparisons between baseline and Day 15 were performed using the paired t-test, while intergroup differences were analyzed using one-way analysis of variance (ANOVA) followed by Tukey's post-hoc test for multiple comparisons. A p-value of less than 0.05 was considered statistically significant throughout the analysis.

Results:

The study included 40 participants equally allocated into four intervention groups (n = 10 per group). The mean age ranged from 22.10 ± 2.96 to 25.00 ± 5.98 years, with no significant difference among groups (one-way ANOVA, p = 0.293). The study population comprised 21 males (52.5%) and 19 females (47.5%), with comparable gender distribution among groups (χ^2 test, p = 0.960). Baseline Gingival Index (GI) and Plaque Index (PI) scores were also comparable among the groups (GI: p = 0.540; PI: p = 0.455), indicating baseline homogeneity. All four interventions produced significant reductions in GI and PI scores from baseline to Day 15 (paired t-test, p < 0.001). The intragroup changes in GI are presented in **Table 1**. The greatest mean reduction in GI was observed with chlorhexidine (0.564 ± 0.091), followed by coconut oil (0.456 ± 0.074), sunflower oil (0.346 ± 0.057) and sesame oil (0.263 ± 0.080) **(Table 1)**. Similarly, **Table 2** presents the intragroup changes in PI, with the greatest mean reduction observed with chlorhexidine (0.571 ± 0.097), followed by coconut oil (0.454 ± 0.080), sunflower oil (0.345 ± 0.058) and sesame oil (0.270 ± 0.066) **(Table 2)**. Intergroup comparison of mean changes in GI and PI using one-way ANOVA demonstrated significant differences among the four groups (p < 0.001). Post-hoc Tukey analysis showed significantly greater reductions in both GI and PI with chlorhexidine compared with the oil-pulling groups. Among the oil-pulling interventions, coconut oil produced greater reductions in GI and PI than sunflower and sesame oils.

Table 1: Intragroup comparison for change in gingival index

Group	Intervention	Baseline GI (Mean ± SD)	Day 15 GI (Mean ± SD)	Mean Change	t value	p value
I	Coconut Oil	2.073 ± 0.160	1.617 ± 0.203	0.456 ± 0.074	19.48	<0.001**
II	Sesame Oil	2.015 ± 0.162	1.752 ± 0.196	0.263 ± 0.080	10.39	<0.001**
III	Sunflower Oil	2.094 ± 0.144	1.748 ± 0.153	0.346 ± 0.057	19.19	<0.001**
IV	Chlorhexidine	2.045 ± 0.162	1.481 ± 0.189	0.564 ± 0.091	19.55	<0.001**

Table 2: Intragroup comparison for change in plaque index

Group	Intervention	Baseline PI (Mean ± SD)	Day 15 PI (Mean ± SD)	Mean Change	t value	p value
I	Coconut Oil	2.086 ± 0.141	1.632 ± 0.178	0.454 ± 0.080	17.94	<0.001**
II	Sesame Oil	2.139 ± 0.133	1.869 ± 0.135	0.270 ± 0.066	12.95	<0.001**
III	Sunflower Oil	2.095 ± 0.177	1.750 ± 0.178	0.345 ± 0.058	18.81	<0.001**
IV	Chlorhexidine	2.116 ± 0.157	1.545 ± 0.208	0.571 ± 0.097	18.59	<0.001**

Discussion:

The present randomized clinical trial compared the effectiveness of coconut oil, sunflower oil, sesame oil and 0.2% chlorhexidine gluconate mouthwash in the management of plaque-induced gingivitis. All four interventions produced statistically significant reductions in plaque accumulation and gingival inflammation after 15 days of use, showing that both conventional mouthrinses and natural oil-pulling therapies can effectively complement routine mechanical plaque control. These findings support the growing interest in adjunctive therapies that improve periodontal health while minimizing the adverse effects associated with prolonged chemical mouthwash use. Among all interventions, 0.2% chlorhexidine gluconate demonstrated the greatest reduction in both Plaque Index and Gingival Index scores. This finding is consistent with recent evidence showing that chlorhexidine remains the gold standard for chemical plaque control because of its broad-spectrum antimicrobial activity, high substantivity and prolonged antibacterial effect on oral tissues. Chlorhexidine effectively suppresses plaque biofilm formation, inhibits bacterial colonization and reduces gingival inflammation, resulting in superior clinical outcomes when compared with other mouthrinses or natural alternatives **[13]**. Among the natural interventions, coconut oil demonstrated the greatest clinical efficacy and consistently outperformed sunflower and sesame oils. The superior performance of coconut oil is largely attributed to its high lauric acid content, which possesses antimicrobial, anti-inflammatory and antioxidant properties. Lauric acid disrupts bacterial cell membranes, reduces microbial adhesion and interferes with biofilm formation, thereby limiting plaque accumulation**.** Furthermore, the mechanical cleansing action of oil pulling through emulsification assists in removing food debris and loosely attached microorganisms from oral surfaces. These findings are consistent with the systematic review by Zürcher *et al.* (2020) **[14]**, which concluded that coconut oil pulling significantly reduces plaque scores and improves gingival health, although further high-quality clinical trials are required to strengthen the available evidence. The present findings also agree with the randomized clinical trial by Peedikayil *et al.* (2025) **[15]**, which directly compared coconut, sesame and sunflower oils for oil pulling. Their study demonstrated that all three oils significantly improved gingival health, with coconut oil producing the greatest reduction in plaque accumulation and gingival inflammation, followed by sunflower and sesame oils. The authors attributed the superior efficacy of coconut oil to its stronger antimicrobial activity and greater ability to disrupt oral biofilms. Sunflower oil also produced statistically significant improvements in both plaque and gingival scores; although its effectiveness was lower than

that of coconut oil. Its therapeutic benefits may be related to the presence of vitamin E, polyunsaturated fatty acids and antioxidant compounds that reduce oxidative stress and modulate inflammatory responses within gingival tissues **[16]**. Sesame oil likewise showed significant clinical improvement despite showing the smallest reduction among the tested interventions. Sesame oil contains lignans, tocopherols and unsaturated fatty acids that possess antioxidant and anti-inflammatory properties capable of improving gingival health and reducing inflammatory mediators. These findings are supported by Zürcher *et al.* (2021) **[17]**, who reported that coconut and sesame oil exhibited comparable plaque-regrowth inhibition, confirming that both oils can serve as useful adjunctive oral hygiene measures. The increasing preference for natural healthcare products has renewed interest in oil-pulling therapy because it is inexpensive, widely available and simple to perform and associated with minimal adverse effects. Unlike chlorhexidine, which may cause tooth staining, altered taste sensation, mucosal irritation and increased calculus formation during prolonged use, natural oils are generally well tolerated and may improve long-term patient compliance. A recent systematic review and meta-analysis by Bhatnagar *et al.* (2023) **[18]** further concluded that oil pulling significantly improves plaque and gingival indices and may represent a useful adjunct to conventional oral hygiene practices, although chlorhexidine continues to demonstrate superior antimicrobial efficacy. The present study has certain limitations, including a relatively small sample size, a short intervention period of 15 days and the absence of microbiological analysis to identify changes in specific periodontal pathogens. Future multicenter randomized controlled trials with larger study populations, longer follow-up periods, microbiological investigations and patient-reported outcome measures are required to establish the long-term effectiveness of different oil-pulling therapies. Overall, the findings indicate that while chlorhexidine remains the most effective antiplaque and antigingivitis agent, coconut oil represents the most promising natural alternative because of its favorable clinical efficacy, safety profile, affordability and ease of use. These characteristics support its incorporation as an adjunctive measure in the management of plaque-induced gingivitis.

Conclusion:
Chlorhexidine showed the greatest efficacy in reducing plaque and gingival inflammation, while oil pulling also showed beneficial effects. Coconut oil exhibited greater therapeutic efficacy than sunflower and sesame oils, supporting its potential as a natural adjunct to routine oral hygiene practices.

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