Journal of Oral Biology and Craniofacial Research 15 (2025) 153–158

Contents lists available at ScienceDirect

Journal of Oral Biology and Craniofacial Research

journal homepage: www.elsevier.com/locate/jobcr

Evaluating the effect of virgin coconut oil pulling on viral load, bacterial load and inflammatory mediator levels in chronic periodontitis – A clinical study

Monika M [a], Rudhra K [b], Vennila K [a,*], Elanchezhiyan [c], Sri Harini P [a], S. Shakeron [a]

[a] Department of Periodontics, Vivekanandha Dental College for Women, India
[b] Department of Periodontics, Sree Balaji Dental College and Hospitals, Chennai, India
[c] Department of Periodontics, JKKN Dental College and Hospital, India

ARTICLE INFO

Keywords:
Chronic periodontitis
Virgin coconut oil
Anti-microbial property
Anti-inflammatory property

ABSTRACT

Background and objective: Periodontitis and dental caries are among the most prevalent oral diseases, with chronic periodontitis being a multifactorial, infectious condition that leads to inflammation in the supporting structures of the teeth, progressive attachment loss, and bone resorption. Chronic periodontitis is driven by a consortium of pathogenic microorganisms. This study aimed to evaluate the efficacy of virgin coconut oil (VCO) pulling in reducing the microbial load and inflammatory mediators responsible for chronic periodontitis, in comparison to chlorhexidine (CHX) mouthwash and distilled water.

Methods: Thirty patients diagnosed with chronic periodontitis were randomly allocated into three groups. Group A served as the control and used distilled water for oral rinsing, Group B used chlorhexidine mouthwash, and Group C performed oil pulling with virgin coconut oil. Pre-operative subgingival plaque samples were collected from all participants, followed by complete scaling and root planing. Post-operative samples were collected after four weeks. Both pre- and post-treatment samples were subjected to real-time PCR (rtPCR) and enzyme-linked immunosorbent assay (ELISA) to quantify viral and bacterial loads, as well as levels of key inflammatory mediators.

Results: A significant reduction in viral load, bacterial load, and inflammatory mediators was observed in both the VCO and CHX groups compared to the distilled water group. The reductions in the VCO and CHX groups were statistically significant, with comparable efficacy between the two interventions.

Conclusion: Virgin coconut oil pulling demonstrated a significant reduction in microbial and inflammatory markers in patients with chronic periodontitis, showing similar efficacy to chlorhexidine mouthwash. Given its comparable therapeutic effects and reduced side effect profile, VCO presents a viable alternative to chlorhexidine for managing chronic periodontitis.

1. Introduction

Periodontal disease is one of the most prevalent oral health conditions globally, significantly impacting overall well-being. It is well established that effective prevention and treatment of periodontal disease can markedly reduce the risk of systemic conditions such as diabetes and cardiovascular disease.[1] Chronic periodontitis, a multifactorial infectious disease, is characterized by inflammation of the supporting tissues of the teeth, resulting in progressive attachment loss and alveolar bone destruction.[2]

Maintaining optimal oral health is critical to an individual's overall health, as the condition of the oral cavity is often considered a gateway to systemic health. Consequently, periodontal therapy is aimed not only at reducing active inflammation but also at promoting the regeneration of periodontal tissues. In addition to non-surgical interventions such as scaling and root planing, the use of adjunctive therapies, including chemical plaque control methods like chlorhexidine (CHX) mouthwash and natural alternatives like oil pulling, is recommended to maintain periodontal health.[3,4]

Chlorhexidine mouthwash is one of the most widely used chemical

* Corresponding author.
E-mail addresses: monikaamarappan2000@gmail.com (M. M), rudhra.pd@sbdch.bharathuniv.ac.in (R. K), vennilamds@gmail.com (V. K), elanidr@gmail.com (Elanchezhiyan), Sriharinirameswaran@gmail.com (S.H. P), shakeron.s@gmail.com (S. Shakeron).

https://doi.org/10.1016/j.jobcr.2025.01.004
Received 28 November 2024; Received in revised form 27 December 2024; Accepted 2 January 2025
2212-4268/© 2025 The Authors. Published by Elsevier B.V. on behalf of Craniofacial Research Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

agents for plaque control, thanks to its proven antimicrobial and anti-inflammatory properties. However, its use is often associated with side effects such as tooth staining, altered taste perception, and tartar formation.[5] To address these limitations, there has been growing interest in the use of natural remedies, such as oil pulling and mouthwashes containing herbal extracts, for the treatment of periodontal disease.

Virgin coconut oil (VCO) is emerging as a promising alternative due to its unique composition of medium-chain fatty acids, particularly lauric acid, which constitutes approximately 50 % of its fatty acid content. Lauric acid, also found in human breast milk, and its derivative, monolaurin, possess potent antimicrobial and anti-inflammatory properties. Compared to refined coconut oil (RCO), VCO contains higher levels of free fatty acids, antioxidants, and tocopherols, which are absent in RCO.[6,7]

Lauric acid and monolaurin exert their antimicrobial effects by disrupting the lipid membranes of pathogens and inhibiting viral maturation. In oil pulling, the mechanical action of swishing the oil in the mouth leads to its emulsification, increasing the surface area and enhancing its interaction with oral structures. The resulting oil film on the teeth and gingiva may reduce bacterial adherence and plaque co-aggregation. Furthermore, the alkalis in saliva can react with the oil to produce soap-like substances, reducing plaque adhesion, while the interaction of lauric acid with sodium hydroxide in saliva forms sodium laurate, contributing to its cleansing effect.[7]

This study aims to evaluate the antimicrobial and anti-plaque effects of virgin coconut oil pulling in patients with chronic periodontitis, providing a natural alternative to conventional chemical therapies like chlorhexidine.

2. Materials and methods

2.1. Study design and participant recruitment

This study involved 60 patients diagnosed with chronic periodontitis, selected from the outpatient department of Vivekanandha Dental College. Each participant was informed about the study procedures, and written consent was obtained prior to inclusion. Participants were randomly divided into three groups of 20 each using a probability chart. Group A was assigned distilled water (5 ml), Group B was given chlorhexidine (5 ml), and Group C was provided virgin coconut oil (5 ml; Coco Soul). A total of 120 subgingival plaque samples were collected, including pre-operative and post-operative samples.

2.2. Inclusion and exclusion criteria

Patients were eligible for inclusion if they had clinical attachment loss of at least 5 mm, with three or more periodontal pockets of a depth ≥5 mm, were systemically healthy, and aged between 18 and 60 years, irrespective of gender. Patients with systemic diseases, recent periodontal treatment, or who required antibiotics were excluded. Pregnant and lactating women were also excluded.

2.3. Sample collection

Subgingival plaque samples were collected from the buccal surfaces of molars using curettes. A single stroke was applied from the distal to mesial surface, and samples were stored in Eppendorf tubes at −70 °C for further analysis.

2.4. Clinical measurements

Baseline clinical parameters were recorded for all participants. These included the plaque index, gingival index, bleeding index, probing depth, and clinical attachment level. Probing depth was measured from the gingival margin to the base of the sulcus using a William's periodontal probe [8]. Clinical attachment levels were calculated as the distance between the gingival margin and the base of the sulcus.

2.5. Initial treatment and post-operative instructions

After collecting pre-operative plaque samples, participants underwent complete ultrasonic scaling. They were instructed to brush their teeth using the Modified Bass Technique and rinse with their assigned solution twice daily for four weeks. A video demonstration was provided to ensure adherence to the protocol, and follow-up phone calls were made regularly. After four weeks, participants were recalled for post-operative sample collection, and these samples were stored for analysis.

2.6. Microbial and inflammatory load analysis

The bacterial load of *Porphyromonas gingivalis* was quantified using real-time polymerase chain reaction (PCR), a highly sensitive and rapid method for detecting nucleic acids. Similarly, viral loads of Epstein-Barr Virus (EBV) and Cytomegalovirus (CMV) were assessed using the same technique. The levels of the inflammatory mediator interleukin-1 (IL-1) were determined using enzyme-linked immunosorbent assay (ELISA), a quantitative plate-based assay.

2.7. Statistical analysis

All data were analyzed using SPSS software (version 1.0.0.1406). Intragroup comparisons were evaluated using paired t-tests, while intergroup differences were analyzed using ANOVA, depending on the normality of the data. Statistical methods ensured accurate evaluation of the differences in bacterial, viral, and inflammatory loads between groups.

3. Results

This study analyzed the effects of Virgin Coconut Oil (VCO) pulling compared to chlorhexidine mouthwash and distilled water in chronic periodontitis patients across various parameters, including plaque index, gingival index, viral load, bacterial load, and inflammatory mediator levels.

3.1. Plaque index

Table 1 demonstrates a significant reduction in plaque index scores in both the VCO and chlorhexidine groups. Post-operative values showed considerable improvement, with mean reductions from baseline to post-operative values of 2.4 to 0.9 in the VCO group and 2.35 to 0.85 in the chlorhexidine group ($p < 0.05$) (Table 1, Fig. 1).

3.2. Gingival index

Table 2 highlights significant improvements in gingival health among VCO and chlorhexidine users. The VCO group showed a mean reduction in gingival index from 2.5 at baseline to 0.9 post-operatively ($p < 0.001$), whereas the chlorhexidine group decreased from 2.5 to 0.85 ($p < 0.001$) (Table 2 & Fig. 2).

Table 1
Plaque Index score in VCO, Chlorhexidine and Distilled Water.

Group	Baseline Mean	Post-Op Mean	p-Value
Virgin Coconut Oil	2.4	0.9	<0.001*
Chlorhexidine	2.35	0.85	<0.001*
Distilled Water	2.45	2.3	>0.05

*Significant at $p < 0.05$.

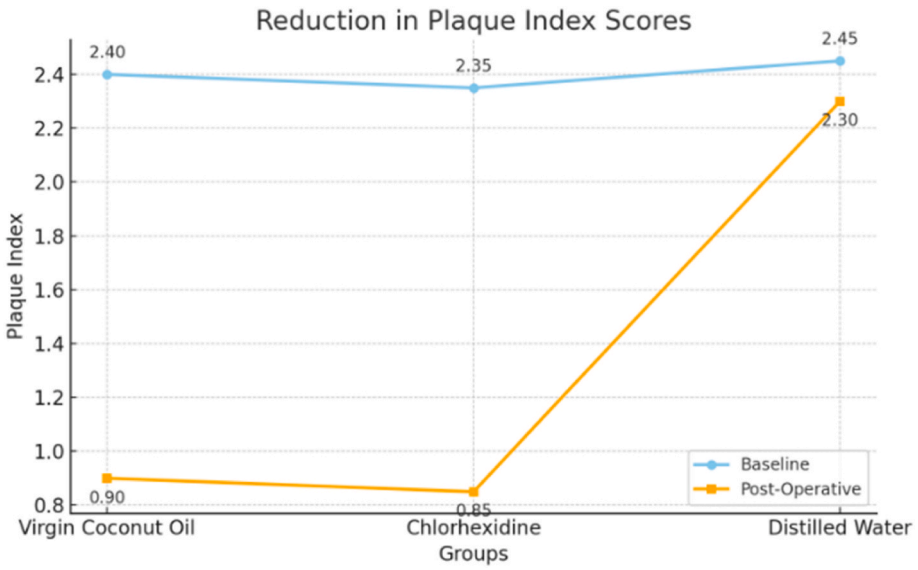

Fig. 1. Illustrates the baseline and post-operative values, with a notable reduction in plaque index scores among VCO and chlorhexidine users compared to distilled water users.

Table 2
Gingival health among the three groups.

Group	Baseline Mean	Post-Op Mean	p-Value
Virgin Coconut Oil	2.5	0.9	<0.001*
Chlorhexidine	2.5	0.85	<0.001*
Distilled Water	2.5	2.3	>0.05

3.3. Viral load

VCO demonstrated a marked antiviral effect, reducing viral loads from a baseline mean of 0.0073 to 0.0000567 post-operatively ($p < 0.05$). Similarly, chlorhexidine also showed a significant reduction, although slightly less than VCO (Table 3 & Fig. 3).

3.4. Bacterial load

VCO pulling significantly reduced bacterial loads, with baseline values dropping from 0.0128 to 0.000124 ($p < 0.05$). Chlorhexidine showed comparable efficacy but was slightly less effective than VCO in bacterial load reduction (Table 4 &Fig. 4).

3.5. Inflammatory mediators

Both VCO and chlorhexidine effectively reduced inflammatory mediator levels. In the VCO group, inflammatory mediators decreased from a baseline mean of 3.38 to 2.38 ($p < 0.001$), while the chlorhexidine group showed a reduction from 3.87 to 2.30 ($p < 0.001$) (Table 5 & Fig. 5).

Table 3
Antiviral effects of VCO compared to chlorhexidine and distilled water.

Group	Baseline Mean	Post-Op Mean	p-Value
Virgin Coconut Oil	0.0073	0.0000567	<0.05*
Chlorhexidine	0.0017	0.000035	<0.05*
Distilled Water	0.0082	0.0065	>0.05

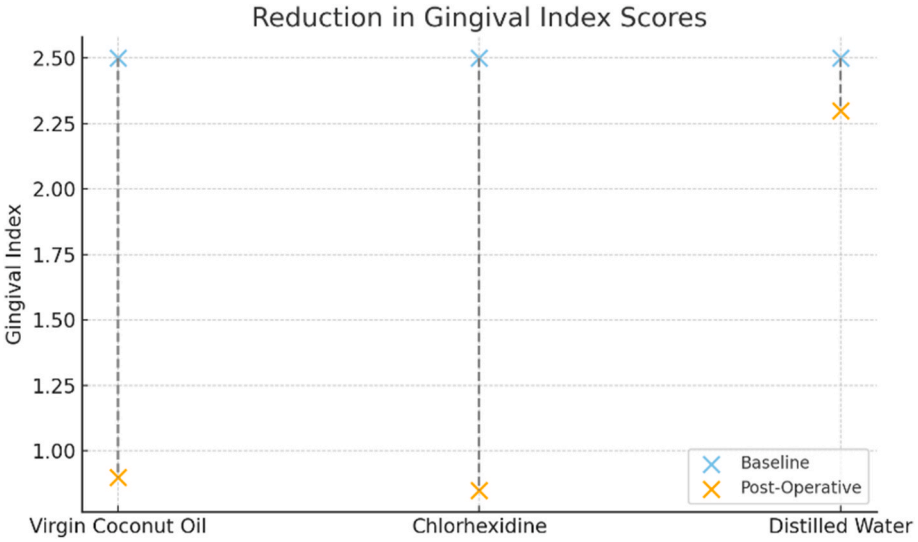

Fig. 2. Depicts the substantial reduction in gingival index values for VCO and chlorhexidine users, confirming their effectiveness in mitigating gingival inflammation.

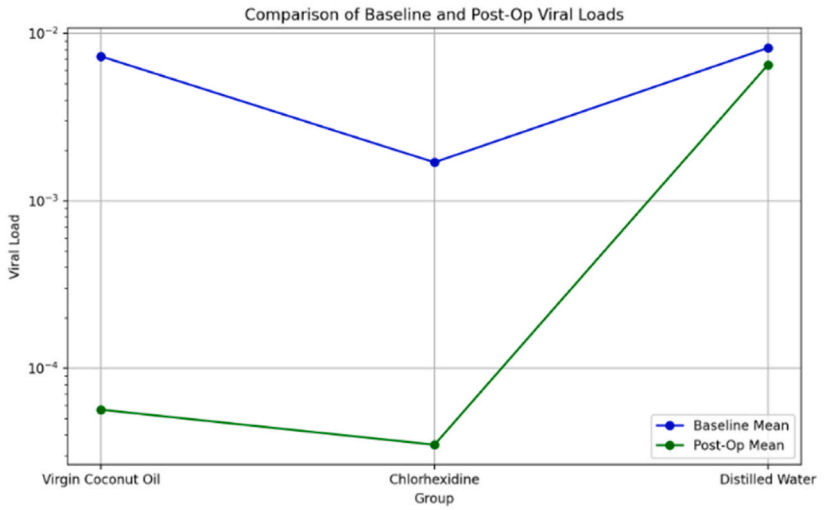

Fig. 3. Illustrates the significant antiviral effects of VCO compared to chlorhexidine and distilled water.

Table 4
Bacterial load reduction among the study groups.

Group	Baseline Mean	Post-Op Mean	p-Value
Virgin Coconut Oil	0.0128	0.000124	<0.05*
Chlorhexidine	0.0078	0.000178	>0.05
Distilled Water	0.0142	0.0081	>0.05

4. Discussion

This clinical study evaluated the effectiveness of Virgin Coconut Oil (VCO) pulling, which contains lauric acid, a potent antimicrobial agent, in managing chronic periodontitis. The study assessed clinical parameters such as plaque index, gingival index, and bleeding index, along with microbiological and inflammatory markers, including bacterial and viral loads and inflammatory mediator levels. Chlorhexidine mouthwash, widely regarded as the gold standard in periodontal therapy, served as a control for comparison. The results demonstrated that VCO pulling was comparable to chlorhexidine in improving clinical outcomes, reducing microbial loads, and lowering inflammatory mediator levels.

Significant reductions in plaque index were observed in the VCO group, consistent with earlier findings by Sarath Asokan et al.[9] who

Table 5
Inflammatory mediators levels among the study groups.

Group	Baseline Mean	Post-Op Mean	p-Value
Virgin Coconut Oil	3.38	2.38	<0.001*
Chlorhexidine	3.87	2.30	<0.001*
Distilled Water	4.21	4.15	>0.05

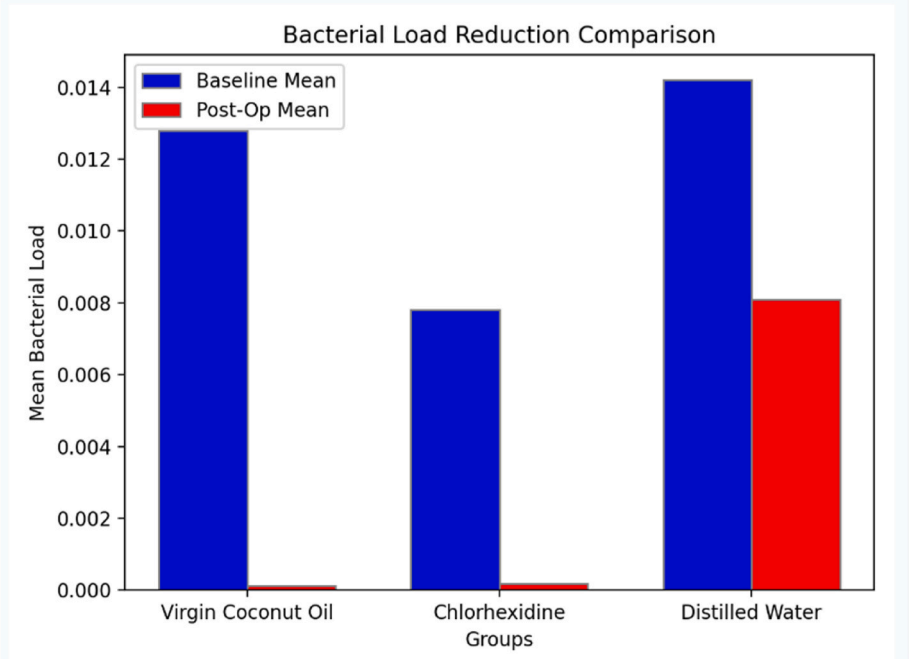

Fig. 4. Highlights the comparative reduction in bacterial loads between the groups.

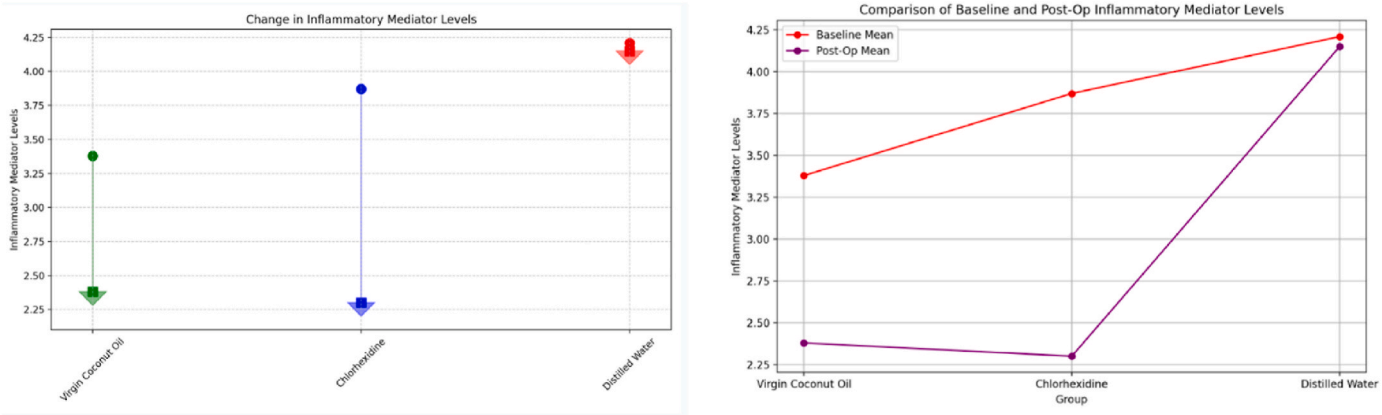

Fig. 5. Demonstrates the reduction in inflammatory mediators, further validating the anti-inflammatory effects of VCO and chlorhexidine.

attributed the reduction to the emulsification process during oil pulling. The protective oil film formed during swishing appeared to reduce plaque adhesion effectively. Similarly, the gingival index showed notable improvement, aligning with the study[10] by Peedikayil highlighting coconut oil's ability to reduce inflammation and improve gum health. Bleeding index reductions were consistent with findings by Khaw et al.[11] suggesting that the anti-inflammatory properties of lauric acid play a vital role in reducing gingival inflammation.

The study also revealed a significant decrease in bacterial load postoperatively in the VCO group. This effect aligns with research,[12] which demonstrated the antimicrobial activity of coconut oil, likely due to its ability to disrupt bacterial cell membranes and increase permeability. Additionally, a decline in viral loads of Epstein-Barr Virus (EBV) and Cytomegalovirus (CMV) was observed, possibly resulting from the virucidal activity of VCO, which disrupts the lipid membranes of enveloped viruses, leading to disintegration.

VCO pulling also demonstrated its ability to reduce levels of inflammatory mediators such as interleukin-1 (IL-1). The suppression of these mediators can be attributed to the fatty acids in VCO, which modulate the activity of polymorphonuclear leukocytes and reduce inflammation. These findings are consistent with research,[13] who reported similar anti-inflammatory effects of coconut oil in animal studies.

Beyond its clinical and microbiological benefits, VCO pulling offers additional advantages, such as improved oral hydration, reduced halitosis, and systemic health benefits due to its bioactive fatty acids. Furthermore, as a natural and cost-effective alternative to chlorhexidine, VCO avoids potential side effects like staining and altered taste associated with prolonged use of chemical agents.[14,15]

Despite its promising outcomes, this study has limitations. The sample size was relatively small, and the duration of the intervention was limited to four weeks, which may not reflect the long-term efficacy of VCO pulling.[16] Additionally, while the study used reliable clinical and laboratory methods, factors such as variations in participants' compliance with the intervention could influence the results. Future research should include larger, multicenter trials with extended follow-up periods to confirm these findings and explore the broader applications of VCO in periodontal therapy.

Virgin Coconut Oil pulling proved to be an effective adjunct to mechanical plaque control in chronic periodontitis patients, demonstrating significant antimicrobial, anti-inflammatory, and plaque-reducing properties. Its comparable efficacy to chlorhexidine, coupled with its safety and patient-friendly nature, positions it as a promising natural alternative for managing periodontal disease. Further studies are warranted to validate its long-term benefits and expand its application in both oral and systemic health management.

5. Conclusion

The present study demonstrated that the use of coconut oil in chronic periodontitis patients resulted in a significant reduction in microbial load, improved clinical parameters, and decreased levels of inflammatory mediators, with minimal side effects. Coconut oil offers distinct advantages over chlorhexidine mouthwash, including the absence of tooth staining, no alteration in taste, easy availability, greater cost-effectiveness, and better patient compliance. Its natural composition and favorable safety profile make it a promising, patient-friendly alternative for long-term periodontal management, providing comparable efficacy to conventional therapeutic agents while minimizing adverse effects.

Patient consent

The patient consent was obtained.

Ethical clearance

Ethical clearance was obtained from the Institutional Review Board.

Source of funding

Nil.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Nil.

References

1. Li X, Kolltveit KM, Tronstad L, Olsen I. *Systemic Diseases Caused by Oral Infection. Clinical Microbiology Reviews*. 2000;13(4):547–558. https://doi.org/10.1128/cmr.13.4.547.
2. Naseem M, Khiyani MF, Nauman H, Zafar MS, Shah AH, Khalil HS. Oil pulling and importance of traditional medicine in oral health maintenance. *Int J Health Sci*. 2017 Sep-Oct;11(4):65–70. PMID: 29085271; PMCID: PMC5654187.
3. Scully C, Ettinger RL. *Oral Health in America: A Report of the Surgeon General*. Washington, DC, USA: Department of Health and Human Services, US Public Health Service; 2000.
4. Trombelli L, Farina R, Pollard A, et al. Efficacy of alternative or additional methods to professional mechanical plaque removal during supportive periodontal therapy: a systematic review and meta-analysis. *J Clin Periodontol*. 2020;47(S22):144–154. https://doi.org/10.1111/jcpe.13269.

5. Dayrit FM. The properties of lauric acid and their significance in coconut oil. *JAOCS (J Am Oil Chem Soc)*. 2014;92(1):1–15. https://doi.org/10.1007/s11746-014-2562-7.
6. Dayrit FM, Dimzon IKD, Valde MF, Santos JER, Garrovillas MJM, Villarino BJ. Quality characteristics of virgin coconut oil: comparisons with refined coconut oil. *Pure Appl Chem*. 2011;83(9):1789–1799. https://doi.org/10.1351/pac-con-11-04-01.
7. Bartolotta S, Garcí CC, Candurra NA, Damonte EB. Effect of fatty acids on arenavirus replication: inhibition of virus production by lauric acid. *Arch Virol*. 2001;146(4):777–790. https://doi.org/10.1007/s007050170146.
8. Peedikayil F, Sreenivasan P, Narayanan A. Effect of coconut oil in plaque related gingivitis - a preliminary report. *Niger Med J*. 2015;56(2):143. https://doi.org/10.4103/0300-1652.153406.
9. Asokan S, Emmadi P, Chamundeswari R. Effect of oil pulling on plaque induced gingivitis: a randomized, controlled, triple-blind study. *Indian J Dent Res*. 2009 Jan-Mar;20(1):47–51. https://doi.org/10.4103/0970-9290.49067. PMID: 19336860.
10. Peedikayil FC, Remy V, John S, Chandru TP, Sreenivasan P, Bijapur GA. Comparison of antibacterial efficacy of coconut oil and chlorhexidine on Streptococcus mutans: an in vivo study. *J Int Soc Prev Community Dent*. 2016 Sep-Oct;6(5):447–452. https://doi.org/10.4103/2231-0762.192934. Epub 2016 Oct 24. PMID: 27891311; PMCID: PMC5109859.
11. Khaw KT, Sharp SJ, Finikarides L, et al. Randomised trial of coconut oil, olive oil or butter on blood lipids and other cardiovascular risk factors in healthy men and women. *BMJ Open*. 2018 Mar 6;8(3), e020167. https://doi.org/10.1136/bmjopen-2017-020167. PMID: 29511019; PMCID: PMC5855206.
12. Sezgin Y, MemisOzgul B, Maraş ME, Alptekin NO. Comparison of the plaque regrowth inhibition effects of oil pulling therapy with sesame oil or coconut oil using 4-day plaque regrowth study model: a randomized crossover clinical trial. *Int J Dent Hyg*. 2021 Jun 14. https://doi.org/10.1111/idh.12532. Epub ahead of print. PMID: 34124840.
13. Zicker MC, Silveira ALM, Lacerda DR, et al. Virgin coconut oil is effective to treat metabolic and inflammatory dysfunction induced by high refined carbohydrate-containing diet in mice. *J Nutr Biochem*. 2019 Jan;63:117–128. https://doi.org/10.1016/j.jnutbio.2018.08.013. Epub 2018 Sep 1. PMID: 30359861.
14. Nadkarni MA, Hunter N, Jacques NA, Martin FE. Determination of bacterial load by real-time PCR using a broad-range (universal) probe and primers set. *Microbiology*. 2002;148(1):257–266. https://doi.org/10.1099/00221287-148-1-257.
15. Bhullar SS, Chandak NH, Purohit HJ, Taori GM, Daginawala HF, Kashyap RS. Determination of viral load by quantitative real-time PCR in herpes simplex encephalitis patients. *Intervirology*. 2014;57(1):1–7. https://doi.org/10.1159/000351521.
16. Leng SX, McElhaney JE, Walston JD, Xie D, Fedarko NS, Kuchel GA. ELISA and multiplex technologies for cytokine measurement in inflammation and aging research. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 2008;63(8):879–884. https://doi.org/10.1093/gerona/63.8.879.