ORIGINAL RESEARCH

To Evaluate the Efficacy of Oil Pulling on Caries Activity of *Streptococcus mutans*: An *In Vivo* Study

Harshita S Gosavi[1], Sandeep Tandon[2], Tripti S Rai[3], Rinku Mathur[4], Ambika S Rathore[5], Vijayakumar Krishnan[6]

Abstract

Aim: To evaluate efficacy of oil pulling on caries activity of *Streptococcus mutans*.

Materials and methods: A randomized controlled experiment was designed, with 60 children chosen at random. Following that, the participants were divided into three groups—group A: oil pulling using cold pressed coconut oil (Perfora*); group B: commercially available fluoridated mouthwash (Kidodent*); group C: distilled water as control. Saliva samples were collected at baseline, immediately, and 2 weeks postoperatively. To assess the effectiveness of coconut oil, fluoride mouthwash, and distilled water, microbiological examination was carried out and colonies were counted.

Results: Both group A (oil pulling with coconut oil) and group B (commercially available Kidodent mouthwash) experienced a statistically significant decrease in colony count.

Conclusion: Oil pulling is found to be as effective as commercially available fluoride mouthwash and can be used in conjunction with other aids for maintaining oral hygiene in children.

Clinical significance: Oil pulling is a natural, economical, and organic alternative to medicated mouthwashes; hence, it can be used as an aid for maintaining oral hygiene.

Keywords: Coconut oil, Oil pulling, *Streptococcus mutans*.

International Journal of Clinical Pediatric Dentistry (2024): 10.5005/jp-journals-10005-2852

Introduction

Dental caries is a disease as ancient as mankind.[1] There was a time, when it was thought that the cause of dental caries are tooth worms.[2] It is now well established that mutans streptococci are most commonly responsible for initiation of dental caries.[3]

There has been immense development in restorative treatments over the years; one cannot overemphasize the importance of preventive dentistry. Antimicrobial mouthrinses are effective means for preventing colonization by microorganisms and can be used for daily home care.[4] There has also been an upsurge in side effects related to these chemicals.

Today, the world is moving from synthetic chemicals to organic products. Ayurveda has been with us since the dawn of human civilization, yet we know far too little about it. One such age-old Ayurvedic therapy that is mentioned in the texts is oil pulling.

Charaka Samhita (Charaka Samhita, chapter V, pages 78–80) quotes the act of oil pulling as, "It is beneficial for strength of jaws, depth of voice, flabbiness of face, improving gustatory sensation, and good taste for food. One used to this practice never gets dryness of throat, nor do his lips ever get cracked; his teeth will never be carious and will be deep rooted; he will not have any toothache nor will his teeth be set on edge by sour intake; his teeth can chew even the hardest eatables."[5]

It has been used to prevent tooth decay, oral malodor, and bleeding gums. However, there is limited literature available for its use in the pediatric population. So, we decided to conduct a study with the aim to evaluate the efficacy of oil pulling on the caries activity of *S. mutans*.

Materials and Methods

A double-blind, randomized, controlled study was conducted on 45 children aged 6–12 years reporting to the Outpatient Department of RUHS College of Dental Science, Jaipur, after receiving ethical approval from the Institutional Ethics Council.

The study comprised patients who had decayed, missing, filled teeth scores of 1–2 and were in good general condition. The study did not include patients who had received fluoride treatments during the previous 2 weeks or who had used antibiotics within the previous 3 months (Flowchart 1).

The patients' personal information and medical backgrounds were noted. After thoroughly explaining the technique to them, informed consent was obtained, and the participants were divided into three groups:

- Group A: Oil pulling using virgin coconut oil (cold pressed, *Perfora mouthrinse).
- Group B: Commercially available fluoride-containing mouthwash (*Kidodent mouthwash).
- Group C: Distilled water as a control.

[1,3,4,6]Department of Pediatric and Preventive Dentistry, RUHS College of Dental Science, Jaipur, Rajasthan, India

[2,5]Department of Pedodontics and Preventive Dentistry, RUHS College of Dental Science, Jaipur, Rajasthan, India

Corresponding Author: Harshita S Gosavi, Department of Pediatric and Preventive Dentistry, RUHS College of Dental Science, Jaipur, Rajasthan, India, Phone: +91 8652262078, e-mail: hjgosavi@gmail.com

How to cite this article: Gosavi HS, Tandon S, Rai TS, *et al.* To Evaluate the Efficacy of Oil Pulling on Caries Activity of *Streptococcus mutans*: An *In Vivo* Study. Int J Clin Pediatr Dent 2024;17(5):580–584.

Source of support: Nil

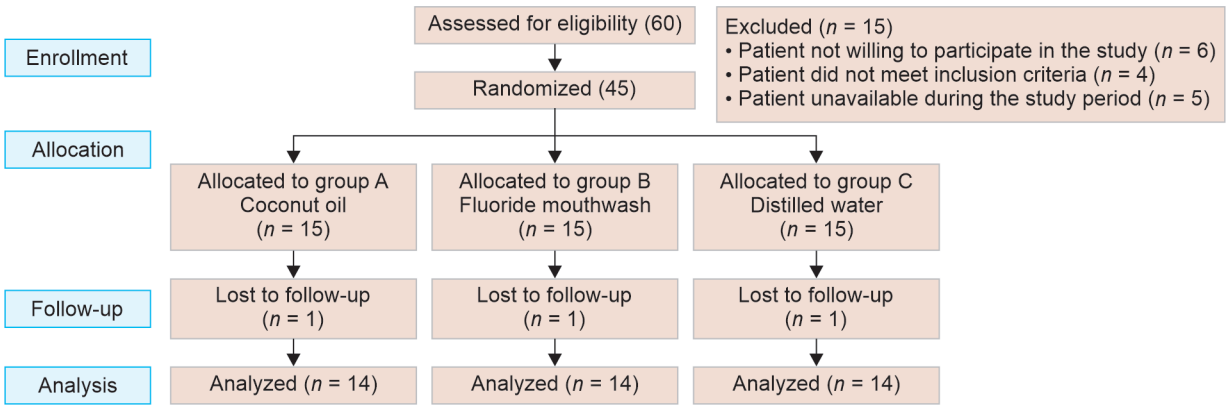
Conflict of interest: None

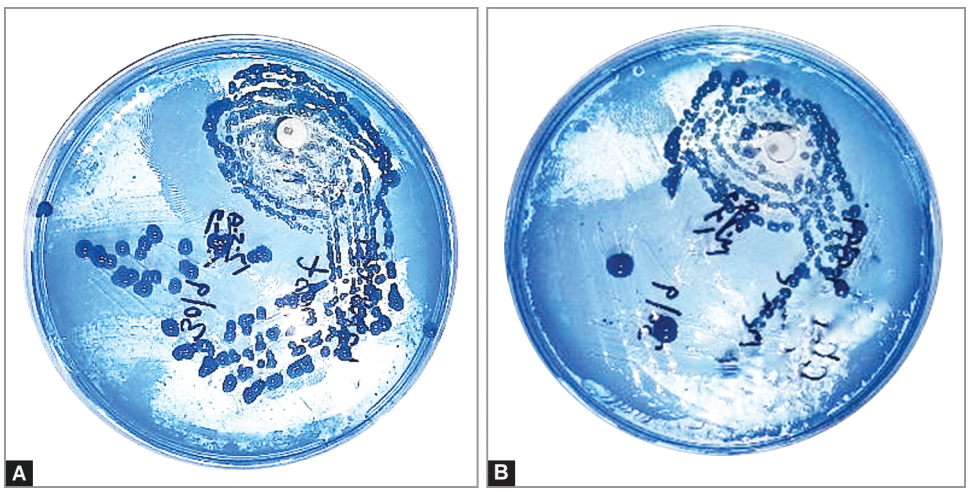
For a period of 2 weeks, the subjects were instructed to perform oil pulling once daily and use commercial mouthwash. Patients were evaluated prior to the use of mouthrinse, immediately after, and postoperatively after 2 weeks.

Microbiological Analysis

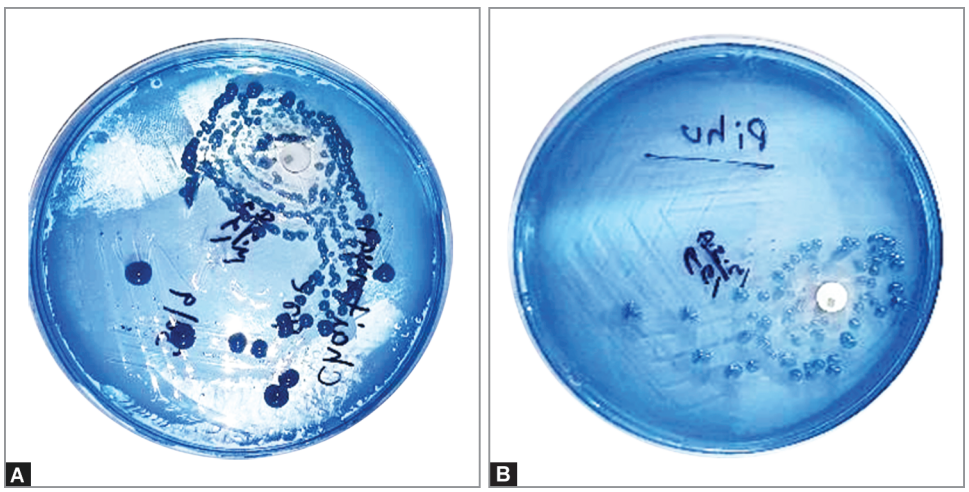
Mitis Salivarius Bacitracin Agar (Himedia M259, India) was prepared according to the instructions on its bottle, and 1% potassium tellurite solution (Himedia FD052, India) was used for isolating streptococci microorganisms. Saliva samples were serially diluted. The Mitis Salivarius Agar-cultured Petri plates were then streaked with one loop of the final sample. Subsequently, the Mitis Salivarius Bacitracin agar culture plates underwent a 24-hour incubation (Figs 1 and 2). Examination of postincubation colonies revealed morphological traits specific to *S. mutans* (Fig. 3). The colonies were further confirmed by biochemical tests such as Gram staining,

Flowchart 1: Consolidated standards of reporting trials (CONSORT) flow diagram presenting the stream of patients through the study





Figs 1A and B: *S. mutans* culture of group I—oil pulling using virgin coconut oil: (A) Preoperative; (B) 2 weeks postoperative



Figs 2A and B: *S. mutans* culture of group II—fluoridated mouthwash (Kidodent*): (A) Preoperative; (B) 2 weeks postoperative

catalase test, and mannitol and sucrose fermentation tests. Colony counts were performed manually using a colony counter. They were semiquantified by multiplying by 1×10^3 as a dilution factor and expressed as colony-forming units per milliliter (CFU/mL) of saliva.

Statistical Analysis

The data were analyzed using the social sciences statistical package [Statistical Package for the Social Sciences (SPSS) v 26.0, IBM]. Descriptive statistics for categorical data, such as frequencies and percentages, as well as mean and standard deviation for numerical data, were presented. Normality of numerical data was assessed using the Shapiro–Wilk test, which indicated that the data followed a normal distribution. Parametric tests were employed for comparisons. A significance level of 0.05 was used for all statistical tests, with error rates set at 5 and 20%, and the study had a power level of 80%.

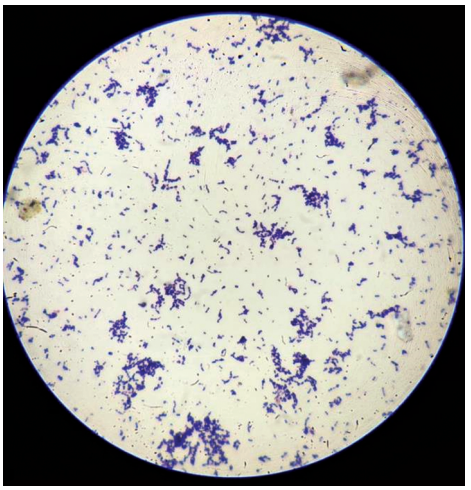


Fig. 3: Microscopic view of *S. mutans* by Gram staining

Results

Demographic Data

The average age of the 42 children chosen for the study was 8.5 ± 0.3 years, with 23 females and 19 males.

Intergroup Comparison

In a 2-week postoperative culture, group C outperformed group A and group B in terms of colony counts ($p < 0.01$) (Tables 1 and 2). Additionally, there was no statistically significant difference between group A and group B (Fig. 4).

Intragroup Comparison

Group C showed no change in the colony counts in the preoperative, immediate postoperative, as well as 2-week postoperative culture (Fig. 5).

Groups A and B showed no change in colony count in preoperative and immediate postoperative cultures. However, a statistically significant decrease in colony count is seen in the 2-week postoperative cultures ($p < 0.05$).

Table 1: Intergroup comparison of values using analysis of variance (ANOVA) at different time intervals

		N	*Mean*	*Standard deviation*	*Standard error*	*95% lower bound*	*95% upper bound*	*Minimum*	*Maximum*	*F-value*	*p-value of RM ANOVA*
Preop ($\times 10^3$/mL)	A	14	5.657	0.5827	0.1557	5.321	5.994	4.5	6.5		
	B	14	5.686	0.8198	0.2191	5.212	6.159	4.3	7.0	0.511	0.604#
	C	14	5.957	1.1134	0.2976	5.314	6.600	4.0	8.0		
	Total	42	5.767	0.8559	0.1321	5.500	6.033	4.0	8.0		
Immediate postop ($\times 10^3$/mL)	A	14	5.593	0.6120	0.1636	5.239	5.946	4.4	6.5		
	B	14	5.650	0.8131	0.2173	5.181	6.119	4.3	7.0	0.709	0.499#
	C	14	5.957	1.1134	0.2976	5.314	6.600	4.0	8.0		
	Total	42	5.733	0.8647	0.1334	5.464	6.003	4.0	8.0		
Postop (2 weeks) ($\times 10^3$/mL)	A	14	4.086	0.7102	0.1898	3.676	4.496	2.5	5.1		
	B	14	3.921	0.6216	0.1661	3.563	4.280	3.0	5.1	25.213	0.000**
	C	14	5.957	1.1134	0.2976	5.314	6.600	4.0	8.0		
	Total	42	4.655	1.2445	0.1920	4.267	5.043	2.5	8.0		

**, statistically highly significant; #, nonsignificant

Table 2: Intergroup pairwise comparison using Tukey honestly significant difference *post hoc* tests at different time intervals

Dependent variable	*(I) Group*	*(J) Group*	*Mean difference (I–J)*	*Standard error*	*p-value*	*Lower bound*	*Upper bound*
Preop ($\times 10^3$/mL)	1	2	–0.0286	0.3274	0.996#	–0.826	0.769
		3	–0.3000	0.3274	0.633#	–1.098	0.498
	2	3	–0.2714	0.3274	0.687#	–1.069	0.526
Immediate postop ($\times 10^3$/mL)	1	2	–0.0571	0.3292	0.984#	–0.859	0.745
		3	–0.3643	0.3292	0.516#	–1.166	0.438
	2	3	–0.3071	0.3292	0.623#	–1.109	0.495
Postop (2 weeks) ($\times 10^3$/mL)	1	2	0.1643	0.3185	0.864#	–0.612	0.940
		3	–1.8714*	0.3185	0.000**	–2.647	–1.095
	2	3	–2.0357*	0.3185	0.000**	–2.812	–1.260

*, statistically significant; **, statistically highly significant; #, nonsignificant

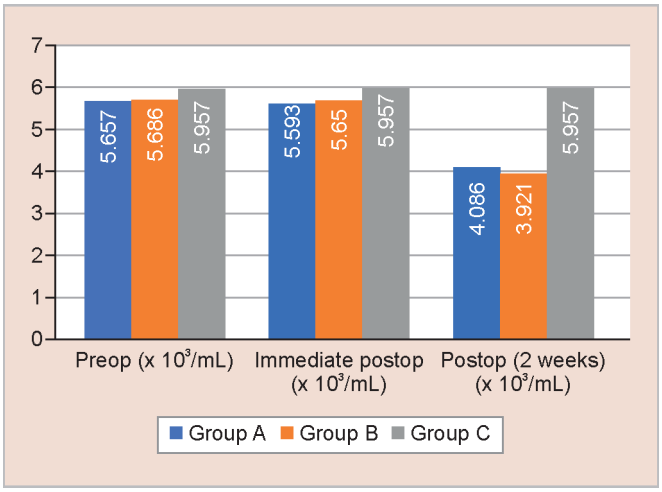


Fig. 4: Intergroup comparison of mean CFU/mL of *S. mutans* in saliva pre- and postoperatively

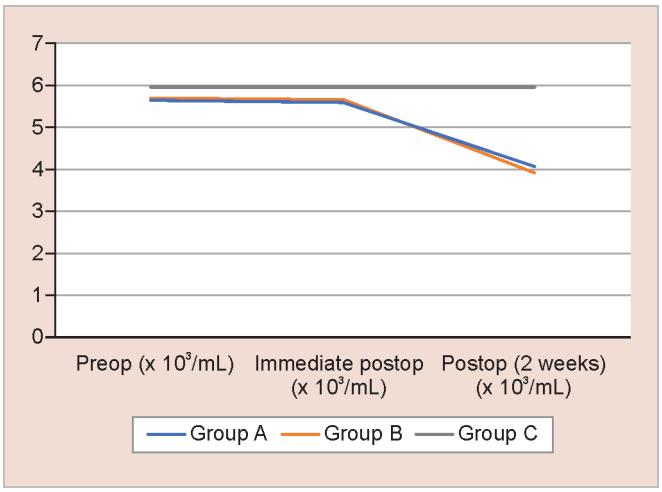


Fig. 5: Intragroup comparison of mean CFU/mL of *S. mutans* in saliva pre- and postoperatively

Discussion

Some studies have been conducted on oil pulling in adults, which have shown promising results. However, this study provides insight into the use of oil pulling in the pediatric population. In this study, oil pulling and fluoride mouthwash—each with a distinctive mode of action—were compared.

Due to the production of fluorapatite, fluoride changes the physicochemical makeup of teeth, strengthening them against acid breakdown. It enhances remineralization, prevents demineralization, accelerates posteruptive maturation, and inhibits enzymes like enolase, which block the transfer of glucose.[6]

Fluoride-containing mouthwashes are instrumental in decreasing the colonies of *S. mutans*. Fluoride blocks the enolase enzyme essential for sugar uptake by microorganisms, thus aiding in caries prevention. Hydrofluoric acid dissociates into H+ and F– in cells, increasing intracellular acidity, which further reduces microbial metabolic activity. Fluoride inhibits the lower half of the glycolytic pathway, while xylitol inhibits the upper half. Therefore, xylitol and fluoride work together to inhibit the acids produced by *S. mutans*. Additionally, xylitol enhances the inhibitory effect of fluoride.[7]

Oil pulling is effective because it causes saponification and emulsification of oil, increasing its surface area and coating the teeth, thus preventing adhesion of *S. mutans*. Sesame oil and sunflower oil are just two examples of the many oils used for oil pulling. According to Amith et al., plaque scores were significantly reduced after 45 days of oil pulling therapy using sunflower oil.[8] Peedikayil et al.[9] and Asokan et al.[10] conducted another trial demonstrating the clinical and microbiological effectiveness of coconut oil pulling therapy against plaque-induced gingivitis found reduction plaque index scores and modified gingival scores. According to research cited by the British Dental Association, oil pulling using coconut oil can reduce the risk of caries. According to their findings, "coconut oil strongly inhibited the growth of most strains of *Streptococcus* bacteria, including *S. mutans*—a causative organism of dental caries."[11] To be most effective, coconut oil may need to be predigested using an enzyme.[12] Hierholzer et al. reported antimicrobial activity of coconut oil.[13] It has a high saponification index and is palatable. Cold-pressed oils are preferred as they do not contain trans fats. An entire teaspoon of oil is swished, dragged, or pushed between the teeth. The oil should turn milky white and thin if done correctly. After spitting out the oil, the mouth is rinsed with warm water.[14] It is usually performed in the morning, in a sitting position, on an empty stomach. Patients aged 6–12 were selected for the study due to the risk of aspiration in children below the age of 5.

In this study, it is found that oil pulling is effective in reduction of *S. mutans*. Also, it is as efficient as commercially available fluoridated mouthwash. Efficacy of oil pulling in reduction of *S. mutans* was demonstrated by Anand et al.,[15] Thaweboon et al.,[16] Asokan et al.,[17] and Kaushik et al.[18] Efficacy of oil pulling in reduction of *S. mutans* was demonstrated by Anand et al.,[15] Thaweboon et al.,[16] Asokan et al.,[17] and Kaushik et al.[18] However, the findings of this study were contradictory to a study done by Jauhari et al. which didn't show promising results for oil pulling.[4]

Coconut oil is allergy-free, does not leave a residual aftertaste, and does not stain. It is affordable and widely accessible. Apart from the longer duration of the therapy compared to mouthwash, there are no drawbacks to oil pulling. Oil pulling therapy has not yet been employed as an addition but rather as a home preventive therapy for maintaining oral hygiene.[18]

Conclusion

In the current scenario, there is a trend toward shifting from chemically treated products to more natural, unprocessed, and economical options. Oil pulling can be one such alternative. The following conclusions can be drawn from this study:

- Both mouthwashes with fluoride and oil pulling showed a statistically significant decrease in the number of *S. mutans*.
- Statistically insignificant difference was seen in reduction of *S. mutans* count between oil pulling and fluoridated mouthwash.

Clinical Significance

Oil pulling can be considered a natural and economical substitute for chemically treated mouthwashes to prevent caries in children. It can also serve as an adjunct for maintaining oral hygiene.

Future Research

Further research should be undertaken with a bigger sample size and a longer follow-up period.

Manufacturer Name

Perfora Vedic rinse, India.

Kidodent* mouthwash, Indoco Remedies Ltd., India.

Mitis Salivarius Bacitracin Agar (Himedia M259, India).

Potassium tellurite solution (Himedia FD052, India).

Orcid

Harshita S Gosavi https://orcid.org/0000-0003-2380-0847
Rinku Mathur https://orcid.org/0000-0002-8687-3632

References

1. Usha C, R S. Dental caries - a complete changeover (part I). J Conserv Dent J 2009;12(2):46–54. DOI: 10.4103/0972-0707.55617
2. Rathee M, Sapra A. Dental Caries. Treasure Island (Florida): StatPearls Publishing; 2022.
3. Tanzer JM, Livingston J, Thompson AM. The microbiology of primary dental caries in humans. J Dent Educ 2001;65(10):1028–1037.
4. Jauhari D. Comparative evaluation of the effects of fluoride mouthrinse, herbal mouthrinse and oil pulling on the caries activity and *Streptococcus mutans* count using Oratest and Dentocult SM Strip Mutans Kit. Int J Clin Pediatr Dent 2015;8(2):114–118. DOI: 10.5005/jp-journals-10005-1295
5. H K S, Sushant Sukumar B. Charaka Samhita. Vol. I, Sutra Sthana. 2017.
6. Marinho VCC, Higgins JPT, Logan S, et al. Fluoride mouthrinses for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2003;7(7):CD002284. DOI: 10.1002/14651858.CD002284.pub2
7. Subramaniam P, Nandan N. Effect of xylitol, sodium fluoride and triclosan containing mouthrinse on *Streptococcus mutan*s. Contemp Clin Dent 2011;2(4):287–290. DOI: 10.4103/0976-237X.91790
8. Hv A, Ankola AV, Lakshminarayan N. Effect of oil pulling on plaque and gingivitis. J Oral Health Comm Dent 2007;1(1). DOI: 10.5005/johcd-1-1-12
9. Peedikayil FC, Sreenivasan P, Narayanan A. Effect of coconut oil in plaque related gingivitis - a preliminary report. Niger Med J 2015;56(2):143–147. DOI: 10.4103/0300-1652.153406
10. 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;20(1):47–51. DOI: 10.4103/0970-9290.49067
11. Coconut oil inhibits caries | British Dental Journal. 2022.
12. Asokan S, Kumar RS, Emmadi P, et al. Effect of oil pulling on halitosis and microorganisms causing halitosis: a randomized controlled pilot trial. J Indian Soc Pedod Prev Dent 2011;29(2):90–94. DOI: 10.4103/0970-4388.84678
13. Hierholzer JC, Kabara JJ. *In vitro* effects of monolaurin compounds on enveloped RNA and DNA viruses. J Food Saf 1982;4(1):1–12. DOI: 10.1111/j.1745-4565.1982.tb00429.x
14. Lakshmi T, Rajendran R, Krishnan V. Perspectives of oil pulling therapy in dental practice. Dent Hypotheses 2013;4(4):131. DOI: 10.4103/2155-8213.122675
15. Anand TD, Pothiraj C, Gopinath RM, et al. Effect of oil-pulling on dental caries causing bacteria. Afr J Microbiol Res 2008;2(3):63–66.
16. Effect of Oil-Pulling on Oral Microorganisms in Biofilm Models | Semantic Scholar. 2022.
17. Asokan S, Rathan J, Muthu MS, et al. Effect of oil pulling on *Streptococcus mutans* count in plaque and saliva using Dentocult SM Strip mutans test: a randomized, controlled, triple-blind study. J Indian Soc Pedod Prev Dent 2008;26(1):12–17. DOI: 10.4103/0970-4388.40315
18. Kaushik M, Reddy P, Sharma R, et al. The effect of coconut oil pulling on *Streptococcus mutans* count in saliva in comparison with chlorhexidine mouthwash. J Contemp Dent Pract 2016;17(1):38–41. DOI: 10.5005/jp-journals-10024-1800