

# Efficacy of Virgin Coconut Oil and Chlorhexidine as an Oral Antimicrobial: A Comparative Pilot Study

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## ABSTRACT

**Aim:** The present study aimed to evaluate the efficacy of oil pulling therapy using virgin coconut oil (VCO) in reducing *S. mutans* counts, plaque, and gingival indices, and to compare it with the gold standard chlorhexidine.

**Materials and methods:** Twenty subjects (study) using VCO and 20 subjects using chlorhexidine (control) visiting the outpatient department of periodontics in the institute were chosen for the study. The gingival and plaque indices (baseline) in both groups were recorded following which unstimulated whole saliva samples were collected by spit method and sent for microbial count. They were then provided either of the VCO/mouthwash to swish once daily. Three weeks post-intervention, the recording of indices was repeated for both groups along with the microbial count.

**Results:** The mean values of gingival and plaque indices pre- and post-intervention showed a statistically significant reduction in the control population compared with the study group, while there was no statistically significant reduction in the bacterial count seen. The difference in the scores of plaque index pre- and post-intervention was more in control group while the difference in the gingival index was similar in both groups, but statistically insignificant.

**Conclusion:** Virgin coconut oil may not be as effective as chlorhexidine in reducing plaque while it may be as effective as chlorhexidine in reducing gingival index.

**Clinical significance:** In comparison with newer chemical oral hygiene aids, coconut oil could still be used as a traditional adjuvant to reduce gingivitis in addition to routine brushing.

**Keywords:** Coconut oil, Gingival index, Plaque index, *Streptococcus mutans*.

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## INTRODUCTION

Oral health is of paramount importance to all individuals. Mechanical methods of tooth cleaning are the most reliable and accepted methods for oral hygiene maintenance but adjuvants for decreasing plaque formation and maintaining oral hygiene have been always sought.<sup>1</sup> In the oral cavity, indigenous bacteria are often associated with two major microbiological diseases, which are dental caries and periodontitis leading to pain, tooth loss, and infection. Chlorhexidine containing mouthwashes has been considered as the gold standard for the treatment of oral diseases (gingivitis and dental caries) but discouraged because of its unpleasant taste and undesirable side effects such as tooth staining.<sup>2</sup>

The traditional use of various oils in India as a means to reduce plaque formation in the oral cavity has been mentioned in the Vedic literature since ancient times. Oil pulling therapy also known as "Kavala Gandoosha" is a traditional procedure involving rinsing or swishing oil in the mouth, which is said to have anti-inflammatory and antimicrobial effect, thus reducing plaque formation in the oral cavity. Coconut oil is an edible oil that is highly desired and easily available in India and has an antimicrobial effect against a wide range of microorganisms found within the body.<sup>1,2</sup> Lauric acid, which is a major fatty acid in coconut oil, has been very effective against viral, bacterial, fungal, and protozoal agents, which need to be compared with proven antimicrobial agents in improving oral health. Scientific evidence shows that oil pulling therapy could reduce the plaque index, and modify gingival scores and the total oral bacteria count in gingivitis patients. Virgin coconut oil obtained from the coconut kernel by wet processing is nontoxic

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**Conflict of interest:** None

and a recently emerging potent microbicidal, which is being used for oral and other purposes.<sup>3-5</sup>

Thus, the present study aimed to evaluate the efficacy of oil pulling therapy using VCO in reducing plaque and gingival indices as well as *S. mutans* counts in comparison with the gold standard

chlorhexidine and thus acknowledging the use of traditional medicine as a supplemental oral hygiene aid.

## MATERIALS AND METHODS

On obtaining ethical clearance from institutional ethical committee, outpatients visiting the Department of Periodontics at the institution participated in this double-blinded study after prior written consent.

### Inclusion Criteria

The subjects who showed their (i) willingness to participate and (ii) above 18 years of age with at least one carious tooth and moderate-to-severe gingival inflammation were included.

### Exclusion Criteria

(i) Subjects undergoing orthodontic treatment or using an oral prosthesis, (ii) subjects using any other mouth wash, (iii) medically compromised patients and history of recent antibiotic use were excluded.

A total of 40 individuals [20 VCO (study) and 20 chlorhexidine (control)] fulfilling the inclusion criteria were chosen. Demographic detail collection and clinical examination were performed on both groups following which gingival and plaque indices (baseline) were recorded. Unstimulated whole saliva samples were collected in

sterile saliva containers (Fig. 1) by spit method from both groups and were sent to the laboratory for the analysis of *S. mutans* colony counts. Following the baseline examination and saliva collection, both groups were provided with 65 mL of either of the VCO/mouthwash (Figs 2 and 3) in containers (Fig. 4) with instructions for usage (3 mL once a day early morning for rinsing), which was procured prior to the study. The usage of both VCO and chlorhexidine was done in addition to routine once-a-day brushing method. Three weeks post-intervention, the recording of indices and microbial counts was repeated. The gingival and plaque scores along with the microbial counts for both groups were tabulated, and results were drawn based on statistical analysis performed to compare both groups.

### Estimation of *S. mutans* Count

The collected saliva samples of test and control subjects were streaked on to the prepared MSB Agar plates (Himedia) (Figs 5A and B), and the bacterial counts were recorded after 24 hours using the colony counter method of estimation.

### Estimation of Gingival and Plaque Indices

The gingival and plaque indices were recorded for test and control subjects as per modified Silness and Loe criteria with index teeth chosen in every case.



Fig. 1: Saliva collection containers



Fig. 2: Procured VCO bottle

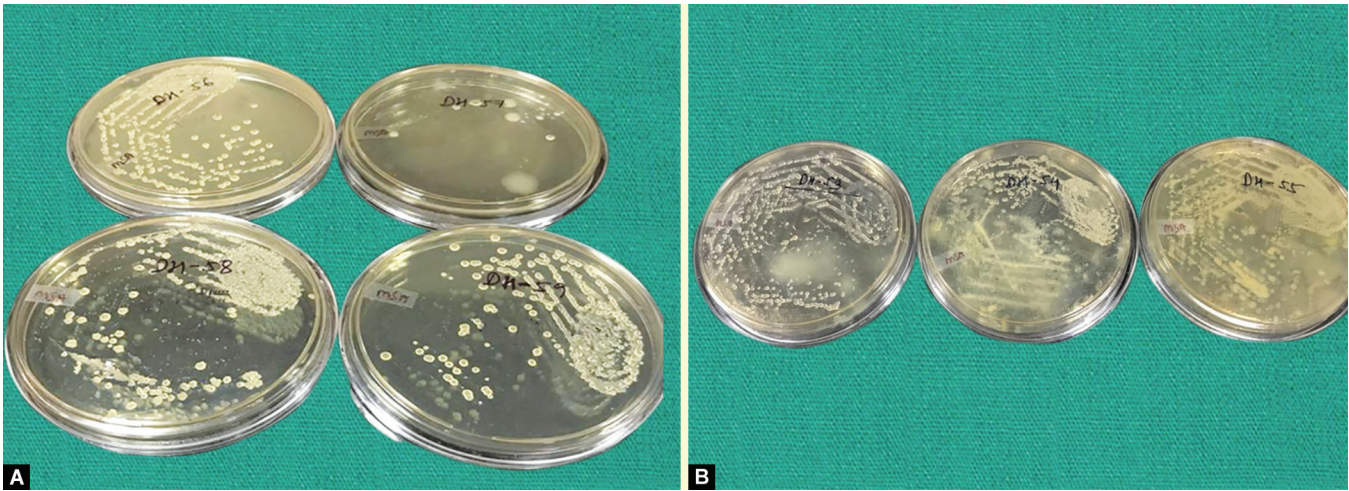


Fig. 3: Chlorhexidine mouthrinse bottle

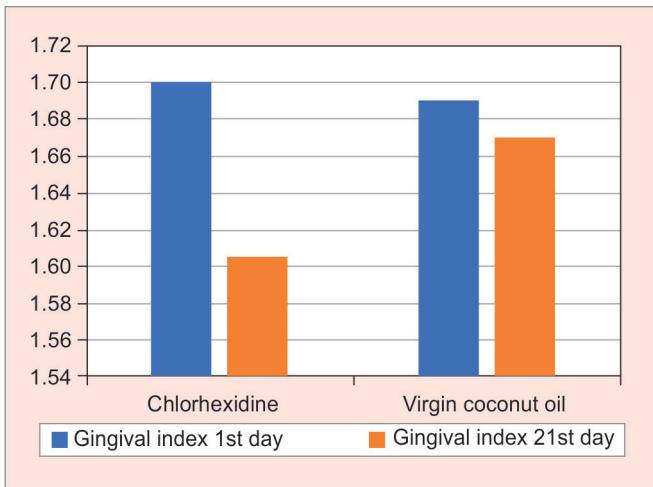


Fig. 4: Oil and mouth rinse dispensing bottles with measuring container

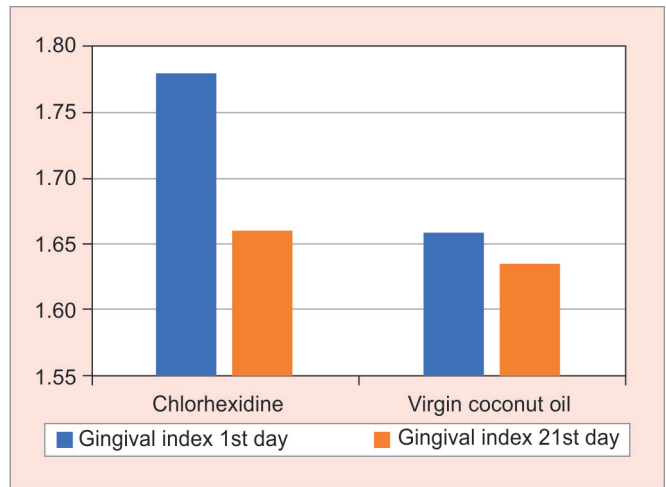




**Figs 5A and B:** (A) MSB agar culture plates with *S. mutans* colony formation in study sample; (B) MSB agar culture plates with *S. mutans* colony formation in control sample



**Fig. 6:** Gingival indices in the study and control groups on 1st day and 21st day

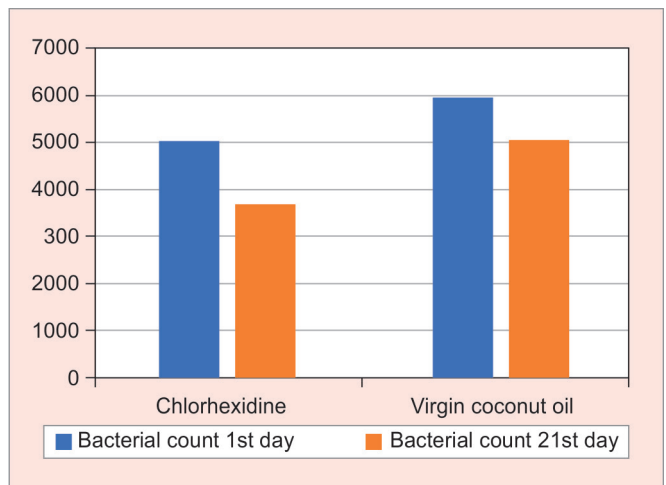


**Fig. 7:** Plaque indices in the study and control groups on 1st day and 21st day

The data were analyzed using SPSS 20.0 software (IBM, Chicago, IL, USA). Paired *t* test was used to compare the gingival and plaque indices as well as bacterial load before and after the intervention. Student's *t* test were used to compare the reduction in the gingival and plaque indices between the test and control groups.  $p < 0.05$  was considered as statistically significant.

**RESULTS**

The mean values of gingival (1.69, 1.67) and plaque indices (1.66, 1.635) and bacterial counts (5950, 5050) pre- and post-intervention showed no statistically significant reduction in the study population. The mean values of gingival (1.7, 1.605) and plaque indices (1.78, 1.66) pre- and post-intervention showed a statistically significant reduction in the control population while there was no statistically significant reduction in the bacterial count (5,050, 3,700) seen (Table 1 and Figs 6 to 8) . Numerically, the difference in the mean values of plaque index pre- and posttest between the two groups showed that it was significantly more in chlorhexidine



**Fig. 8:** *Streptococcus mutans* counts in the study and control groups on 1st day and 21st day

**Table 1:** Comparison of the pre- and the postvalues of gingival and plaque indices and bacterial count in each group

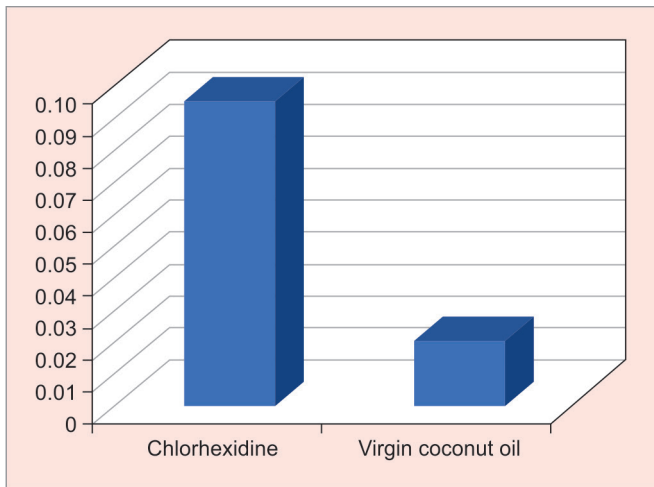
Group	N	Mean	Std. deviation	Paired differences		t	df	p value
				Mean difference	Std. deviation			
Chlorhexidine	20	1.7	0.309499	0.095	0.109904	3.866	19	<b>0.001</b>
	Pair 1	Gingival index 1st day						
	20	1.605	0.260516					
	Pair 2	Gingival index 21st day						
	20	1.78	0.293078	0.12	0.182382	2.942	19	<b>0.008</b>
	Pair 3	Plaque index 1st day						
Virgin coconut oil	20	1.66	0.360409					
	Pair 1	Plaque index 21st day						
	20	5050	4593.76	1350	6037.384	1	19	0.33
	Pair 2	Bacterial count 1st day						
	20	3700	4231.461					
	Pair 3	Bacterial count 21st day						
Virgin coconut oil	20	1.69	0.304181	0.02	0.139925	0.639	19	0.53
	Pair 1	Gingival index 1st day						
	20	1.67	0.352584					
	Pair 2	Gingival index 21st day						
	20	1.66	0.250053	0.025	0.091047	1.228	19	0.234
	Pair 3	Plaque index 1st day						
Virgin coconut oil	20	1.635	0.239022					
	Pair 1	Plaque index 21st day						
	20	5950	4593.76	900	6463.664	0.623	19	0.541
	Pair 2	Bacterial count 1st day						
	20	5050	4593.76					
	Pair 3	Bacterial count 21st day						

The bold values are >0.05 showing that they are significant

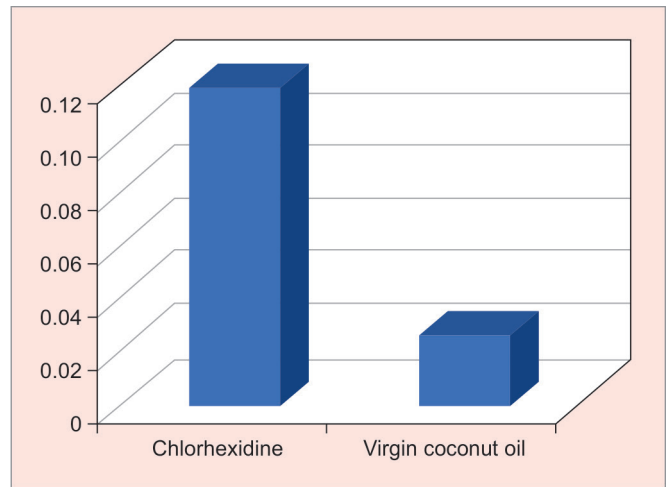
**Table 2:** Comparison between the two groups using independent t test

	Group	N	Mean	Std. deviation	t	df	p value
Gingival index difference	Chlorhexidine	20	0.095	0.109904	1.885	38	0.067
	Virgin coconut oil	20	0.02	0.139925			
Plaque index difference	Chlorhexidine	20	0.12	0.182382	2.084	27.916	<b>0.046</b>
	Virgin coconut oil	20	0.025	0.091047			
Bacterial count difference	Chlorhexidine	20	1350	6037.384	0.228	38	0.821
	Virgin coconut oil	20	900	6463.664			

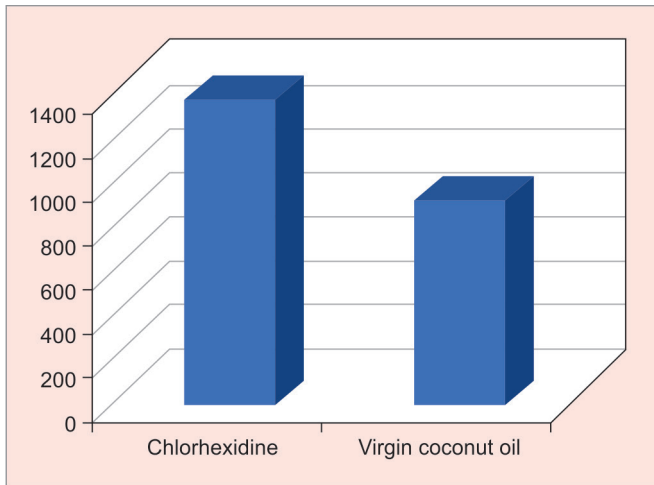
The bold values are >0.05 showing that they are significant



**Fig. 9:** Difference in the mean values of gingival indices on 1st day and 21st day in the study and control groups



**Fig. 10:** Difference in the mean values of plaque indices on 1st day and 21st day in the study and control groups



**Fig. 11:** Difference in the mean values of *S. mutans* counts on 1st day and 21st day in the study and control groups

group compared with VCO group, indicating that coconut oil may not be as effective as chlorhexidine in reducing plaque. On the contrary, the difference in the mean values of gingival index pre- and posttest between the two groups was higher in chlorhexidine but numerically close, indicating that coconut oil may be as effective as chlorhexidine in reducing gingival index. The difference in

mean values of *S. mutans* counts pre- and posttest was higher in control group as compared with test group although statistically insignificant, indicating that coconut oil may not be as effective antimicrobial as chlorhexidine (Table 2 and Figs 9 to 11).

## DISCUSSION

Plaque is the primary cause of gingival inflammation, which, in turn, is the result of an interaction between plaque, tissues, and inflammatory response of the host. Chemical means of plaque control involve the use of mouth rinses, which reduce the incidence of plaque-related diseases by decreasing the plaque accumulation.<sup>1</sup> Oil pulling or oil swishing as mentioned in our Vedic literature is an age-old traditional remedy to prevent most of the diseases involving teeth and gums and could be used for the same purpose as above.<sup>6</sup> Our study aimed at checking the effectiveness of oil pulling with VCO as an adjuvant to brushing, in decreasing the plaque accumulation, plaque-induced gingivitis, and *S. mutans* counts, as compared with the gold standard, chlorhexidine. Plaque Index by Sillness and Loe and modified gingival index were used for clinical assessment as they are widely used indices.<sup>1,7</sup> Various edible oils that have been used by authors in previous studies include sesame oil, groundnut oil, corn oil, olive oil, mustard oil, rice bran oil, palm oil, sunflower oil, soya bean oil, and coconut oil.<sup>6,8,9</sup> The efficacy of coconut oil as an antimicrobial and as an antiplaque agent has been tested by Ogbolu et al. Taheri et al.

Thaweboon et al., Hughes, Singla et al., Peedikayil et al., Shino et al., and Salian et al., and the results have shown that coconut oil is effective in reducing oral microbial load and decreasing plaque and gingival indices.<sup>1,2,5,9-13</sup> Chlorhexidine-containing mouthwashes provide a “gold standard” by which to assess the efficacy of other agents that are used as clinical adjuvants in the treatment of both caries and periodontal diseases.<sup>8</sup> They have been extensively used as clinical adjuvants but have been recently discouraged because of their unpleasant taste and undesirable side effects such as tooth staining. Additionally, chlorhexidine might not be easily accessible and affordable to low socioeconomic group of people.<sup>2</sup> In our study, the control population using chlorhexidine mouthwash showed a statistically significant decrease in plaque and gingival indices pre- and post-intervention, while the bacterial counts remained unchanged. However, it did not show any statistically significant reduction in plaque and gingival indices or bacterial counts in the study population performing coconut oil pulling. This could be attributed to the fact that oils do not directly inhibit microorganisms, and the fatty acid content in these oils, which are present as triglycerides, when in free form show an inhibitory action.<sup>12</sup> Monolaurin is the monoglycerides of lauric acid, which in turn is the free fatty acid found in coconut oil. Monolaurin is shown to have antimicrobial activity against various Gram-positive and Gram-negative organisms.<sup>9</sup> In our case, since monolaurin was not used in its free fatty acid form, the antimicrobial action of coconut oil may not have been executed to its full potential. Various studies in the past such as by Thaweboon et al., Asokan et al., Singla et al. have demonstrated oil pulling using different oils, which were shown to reduce the oral microorganisms especially *S. mutans*.<sup>2,11,14</sup> However, the study by Jauhari et al. showed no significant reduction in the bacterial counts.<sup>15</sup> Kaushik et al. compared the saliva samples for *S. mutans* count on participants using coconut oil, chlorhexidine, and distilled water for 15 days.<sup>16</sup> A statistically significant reduction in *S. mutans* was seen in both study and control groups. Our study did not show any statistically significant reduction in these bacterial counts in both groups. Our study, however, showed differences in the numerical values of gingival and plaque scores as well as *S. mutans* counts, pretest, and posttest, in both study and control groups, although statistically insignificant. Singla et al. in their study used sesame oil, olive oil, and coconut oil along with chlorhexidine as gum massage agents and showed that there was a significant reduction in the values of *S. mutans*, plaque scores, and gingival scores among the four groups.<sup>2</sup> However, the difference in percentage reduction of the measured parameters among the four groups was not statistically significant.<sup>2</sup> Thus, this shows that there could be many more factors that may influence the action of oil pulling procedure other than the oil on its own.

### Limitations of the Study

The minimum sample size required to carry out the study was calculated keeping in mind the time constraints. The taste of oil during oil pulling makes it unacceptable for certain individuals, thus making it difficult to be used for a larger sample size. The lack of significance between the groups could be due to the smaller sample size. Similarly, longer periods of follow-up may have an effect on the significance of the study. Monitoring of patients in addition to giving instructions for usage must be done, which could affect the assessment parameters in the study.

## CONCLUSION

Considering the limitations of the present study, it can be concluded that oil pulling may not be a replacement for existing oral hygiene aids but can be an adjuvant to tooth brushing. Coconut oil pulling may not be as effective as chlorhexidine in reducing plaque index and *S. mutans* counts in saliva, but it seems that it may be as effective as chlorhexidine in reducing gingival index. However, oils may be valuable preventive agents in maintaining and improving oral health in the low socioeconomic group in society.

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