



## The Effect of Coconut Oil on Plaque Accumulation for 18-22 Years Old Dental Students

\*Manar N. Alkhatat, \*\*Saher S. Gasgoos

\*B.D.S. / Health Directorate/ Hatra Health Care Sector/ Mosul/ Iraq.

\*\*B.D.S. - M.Sc./ Assistant Professor/ Department of Pedodontics, Orthodontics and Preventive Dentistry/ College of Dentistry/ University of Mosul/ Mosul/ Iraq.

Date of Submission: 10-06-2025

Date of Acceptance: 20-06-2025

### ABSTRACT

**Amis:** To find the efficacy of virgin coconut oil mouth wash on plaque accumulation in 18-22 years old dental students, to compare between use of once and twice mouthwash with coconut oil on plaque accumulation, and to compare the effect between males and females. **Material and methods:** This study was undertaken in Mosul city during the academic year 2023-2024. The sample consisted of 60 students (30 males and 30 females) with mild to moderate plaque, who were collected from the College of Dentistry at the University of Mosul and ranged in age from 18 to 22 years. The sample was divided into two groups of 30 participants each, as follows: **Group (1):** (30 students) were instructed to swish with (10 ml) of coconut oil for (1-2) minutes once daily after having breakfast. **Group (2):** (30 students) were instructed to swish with (10 ml) of coconut oil for (1-2) minutes twice daily, the first time in the morning after breakfast and the other time in the evening after brushing before going to sleep. The period of study was 30 days. Plaque index was assessed at baseline, after 15 days, and after 30 days. **Results:** A statistically significant decrease in the plaque indices was noticed from day 15, and the scores continued to decrease during the period of study. The plaque index decreased in both groups, in Group 1 from a mean value (1.93) to (0.43) and in Group 2 from (1.97) to (0.43). No significant side effects were reported during the study, and no statistically significant difference between group (1) and group (2), and the difference between males and females was statistically significant, with males performing better than females. **Conclusion:** swishing using coconut oil is an effective adjuvant procedure in decreasing plaque formation.

**Key words:** coconut oil – dental student - mouthwash – Plaque index

### I. INTRODUCTION:

Dental plaque is the most common etiology of periodontitis. <sup>(1,2)</sup> Since plaque initially

manifests as gingivitis, effective home and professional oral hygiene to eliminate the main pathogenic factors plays a key role in maintaining oral health and preventing periodontitis and caries. <sup>(3-5)</sup> Professional mechanical removal is performed using manual, ultrasonic and sonic instruments. In addition, maintaining good oral hygiene at home is sufficient to reduce plaque formation on tooth surfaces, reduce the occurrence of various gum diseases and prevent tooth decay. <sup>(6)</sup> The correct use of manual or electric toothbrushes combined with mechanical interdental cleaning is essential for this. Toothpaste and mouthwash can also help fight plaque through chemical methods. <sup>(7)</sup> Many substances can act as adjuvants to reduce plaque formation, but scientific evidence remains scarce. <sup>(8-10)</sup>

In recent studies, people have used sunflower oil, sesame oil and coconut oil as oral rinses to reduce plaque formation. <sup>(11,12)</sup>

Coconut oil (*Cocos nucifera*) is a product obtained by cold pressing dried coconuts and is little known. It has antibacterial, antiviral and antifungal properties. It contains 92% saturated fatty acids, of which 49% is lauric acid, a medium-chain saturated fatty acid. Medium-chain saturated fatty acids and their derivatives (such as monoglycerides) are effective in destroying a wide range of bacteria (lipid-enveloped bacteria) and disrupting their lipid membranes. For example, they can fight bacteria that cause gastric ulcers, sinusitis, food poisoning, urinary tract infections and tooth decay. <sup>(13)</sup>

The aim of this study was to investigate the effect of coconut oil mouthwash/oil rinse on dental plaque formation. A prospective intervention study was conducted...

### II. MATERIALS AND METHODS:

The sample:

The study was conducted in 2024 on a sample of 60 students who participated in this



study, their ages ranged between (18-22) years old from the University of Mosul College of Dentistry

The study period was 30 days. Plaque indices of the subjects were assessed at baseline, after 15, and 30 days. Any abnormal alteration in the oral cavity, such as abnormal taste sensation, burning sensation, ulceration, or disturbance in the taste, was also assessed.

#### Sample distribution:

The sample was randomly divided into two groups:

**Group (1):** (30 students) were instructed to swish with (10 ml) of coconut oil for (1-2) minutes once daily in the morning after having breakfast.

**Group (2):** (30 students) were instructed to swish with (10 ml) of coconut oil for (1-2) minutes twice daily, the first time in the morning after breakfast and the other time in the evening after brushing before going to sleep.

Each group was subdivided into two groups: 15 males and 15 females. (Figure 3-1)

All the students were given containers containing the oil (about 200 ml for group 1 and about 350 ml for group 2).

#### Inclusion Criteria of the Study:

- Age between 18 and 22 years.
- Presence of mild to moderate plaque accumulation.

#### Exclusion Criteria of the Study:

- Patients are allergic to coconut.
- Pregnant women.
- The use of systemic or topical antibiotics and the history of dental treatment in the past month.
- Smoking

#### Processing of the virgin coconut oil.

Coconut oil was prepared at home using the wet method from fresh coconut meat without chemical processing or high heat.

Wet method for coconut oil extraction: Here is a step-by-step guide :

A mature and de-husked coconut was selected (Figure 1).



Figure (1): A de-husked coconut.

The outer husk was removed, and the coconut meat was extracted by separating the white meat from the shell (Figure 2).



Figure (2): Removing the outer husk.

The coconut meat was rinsed thoroughly with water (Figure 3).



Figure (3): Rinsing with water



The coconut meat was cut into two or more pieces and grated using a motorized grater until it became watery (Figure 4).



Figure (4): Grating with a motorized grater.

The first coconut milk was extracted by hand using a muslin cloth to squeeze the grated coconut (Figure 5).



Figure (5): Squeezing the grated coconut.

The coconut milk residue from the milk extraction was mixed with water in a 1:2 ratio (two parts coconut to one part water) and squeezed again to extract the second milk.

The first and second milk extractions were mixed by stirring vigorously.

The coconut milk was placed in the container for 24-48 hours until coconut cream formed (Figure 6).



Figure (6): The coconut cream.

The coconut cream (oily part) was scooped off the top of the milk (Figure 7).



Figure (7): Scooping off the coconut cream

The coconut cream was heated using a double boiler to release the oil (Figure 8).



Figure (8): Heating the cream to release the oil.

The oil was separated from the impurities by using a stainless steel screen with fine mesh (Figure 9).



Figure (9): Separating the oil from the impurities.

The filtered coconut oil was stored in dry, sterilized bottles or containers (Figure 10).



Figure (10): The filtered coconut oil in sterilized containers.

**Clinical examination:**

The plaque index (Silness and Loe, 1964) was used as a clinical index to assess plaque formation. Clinical examinations were performed. The plaque index was measured three times at baseline and 15 and 30 days after baseline.

**Inter and intra-examiner calibration:**

Inter-examiner calibration was performed by having the researcher examine five students and compare the results with those of an experienced dentist. In contrast, intra-examiner calibration was performed by examining the same student at two different time periods (one week each). The results showed no statistically significant differences at a significant level of  $p > 0.05$ .

**Statistical Analysis:**

The data was subjected to analysis using the SPSS program (version 25), which contained the following components:

a) Descriptive statistics included measures such as mean, standard deviation, and frequency that provide information about the values of the variables.

b) All data were checked for normal distribution of values using the Shapiro-Wilks test.

c) The plaque index between baseline and day 30 was determined for both groups using the Kruskal-Wallis test.

d) The plaque index was determined using the Mann-Whitney test.

The results obtained were statistically significant at a significant level of  $p < 0.05$ .

**At 15 and 30 days, students were asked if they had any abnormal alteration in the oral cavity which may be induced after using the mouthwash**

- ❖ Did you notice any changes related to oral cavity following the use the mouthwash?
  - Temporary impairment of normal taste.
  - Burning of various parts of the oral mucosa.
  - Feeling of dryness.
  - Change in the taste of food.
  - Pain in the oral mucosa, tongue and gums..

**Results:**

The mean plaque index values were 1.93 at baseline, 1.15 after 15 days, and 0.43 after 30 days (Group 1).

In Group 2, the mean plaque index values were 1.97 at baseline, 1.38 after 15 days, and 0.43 after 30 days.

In both groups, a decrease in the mean values was observed after 15 and 30 days of washout (Table 1).

Table (1): Comparison of plaque index value at baseline, day 15, and day 30.

	Mean Group (1)	Mean Group (2)
<b>Baseline</b>	1.9361 ± 0.57178	1.9736 ± 0.48981
<b>15 day</b>	1.1597 ± 0.44226	1.3819 ± 0.53522
<b>30 day</b>	0.4308 ± 0.49684	0.4375 ± 0.51024
<b>Chi-square</b>	1335.0	1329.0
<b>p-vale</b>	0.000	0.000

In table (2) Group (1), the mean plaque index score was 1.93 at baseline. A reduction occurred after 15 days to 1.15. The difference was statistically significant.

Group (2), The mean plaque index score was 1.97 at baseline. A reduction occurred after 15 days to 1.38. The difference was also statistically significant.



Table (2): Difference in mean plaque scores between baseline and 15 days for both groups.

	Mean Group (1)	Mean Group (2)
Baseline	1.9361 ± 0.57178	1.9736 ± 0.48981
15 day	1.1597 ± 0.44226	1.3819 ± 0.53522
Mann-Whitney U	9170.0	1253.0
Z-value	-23.677	-19.341
p-value	0.00	0.00

In table (3), a continuous decrease in Group (1) is observed from 15 days (1.15) to 30 days (0.43), as indicated by a low p-value (0.00), a statistically significant difference in this period.

Also in Group (2), a continuous decrease from 15 days (1.38) to 30 days (0.437), as indicated by a low p-value (0.00), a statistically significant difference in this period.

Table (3): Differences in mean plaque scores between the 15-day and 30-day for both groups.

	Mean Group (1)	Mean Group (2)
15 day	1.1597 ± 0.44226	1.3819 ± 0.53522
30 day	0.4308 ± 0.49684	0.4375 ± 0.51024
Mann-Whitney U	96240	73970
Z-value	-23.784	-25.731
p-value	0.00	0.00

So, more reduction was observed after 30 days, as compared to baseline, to 0.43 in both groups (1)

and (2). The difference was statistically significant (Table 4).

Table (4): Differences in mean plaque scores between baseline and 30 days for both groups.

	Mean Group (1)	Mean Group (2)
Baseline	1.9361 ± 0.57178	1.9736 ± 0.48981
30 day	0.4308 ± 0.49684	0.4375 ± 0.51024
Mann-Whitney U	21810	1649.0
Z-value	-31.573	-32.44
p-value	0.00	0.00

**Difference between Group (1) and Group (2)**

The mean values of plaque index scores at baseline are similar (Group (1), 1.93 and Group (2),

1.97 p = 0.514) with no significant differences between them (Table 5).

Table (5): Differences in mean plaque scores between Group (1) and Group (2) at baseline.

Baseline	Mean	Mann-Whitney U	Z-value	p-value
Group (1)	1.9362±0.5718	2.50600	1.374	0.514
Group (2)	1.9736 ± 0.4898			

Table (6) shows the differences in mean plaque scores between both groups at day 15. Mean

scores were lower in group (1) than group (2) with a significant difference.



Table (6): Differences in mean plaque scores between group (1) and group (2) on day 15.

15 day	Mean	Mann-Whitney U	Z-value	p-value
Group (1)	1.1597±0.4432	206300	-8.359	0.00
Group (2)	1.3819±0.535			

Table (7) shows the differences in mean plaque scores between Group (1) and Group (2) at day 30. Group (1) had slightly lower scores than Group (2),

but there was no statistically significant difference between them.

Table (7): Differences in mean plaque scores between group (1) and group (2) on day 30.

30 day	Mean	Mann-Whitney U	Z-value	p-value
Group (1)	0.4208±0.4968	255700	-0.514	0.607
Group (2)	0.4375±0.510			

#### Differences between males and females

Table (8) shows the differences in the mean plaque scores between males and females at mean scores than females, there was no statistically significant difference between them.

baseline examination for both groups. Although males have slightly higher

Table (8): Differences in mean plaque index between males and females in group (1) and group (2) at baseline.

	Mean Group (1)	Mean Group (2)
Male	1.9694±0.6033	2.111± 0.53187
Female	1.9028 ±0.53719	1.8361± 0.39962
Mann-Whitney U	61452.000	62012.500
Z-value	-1.450-	-1.395-
p-value	0.147	0.163

After 15 days, mean scores were greatly reduced for both males and females in both groups. In group (1), scores for females were lower than

males, but without a significant difference. While for group (2), the opposite was true, and with a significant difference (Table 9).

Table (9): Differences in mean plaque index between males and females in group (1) and group (2) at 15 days.

	Mean Group (1)	Mean Group (2)
Male	1.1808±0.49303	1.300±0.52672
Female	1.1389± 0.0.38443	1.4639± 0.53180
Mann-Whitney U	60770.000	49213.500
Z-value	-1.689-	-7.478-
p-value	0.091	0.000

After 30 days, mean scores continued to decrease for both males and females in both groups. scores for males became better than

females, with a significant difference for both groups. (Table 10).



Table (10): Differences in the mean plaque index between males and females in group (1) and group (2) at 30 days

	Mean Group (1)	Mean Group (2)
Male	0.3889±0.48818	0.3194±0.47284
Female	0.4528±0.50402	0.5556±0.51951
Mann-Whitney U	55344.000	49910.000
Z-value	-3.973-	-6.206-
p-value	0.000	0.000

In the current study, participants reported no significant changes in their taste after using coconut oil as an oral rinse. This suggests that coconut oil does not adversely affect function when used in this manner.

### III. DISCUSSION:

Effective plaque control measures are essential for the recovery of patients with gum disease. Plaque not only causes gum inflammation but is also one of the many factors that contribute to tooth decay. <sup>(14-16)</sup> Various mechanical and chemical plaque control methods are used to inhibit plaque formation. <sup>(17)</sup>

Oil pulling is a traditional technique that is effective in controlling dental plaque. Various oils such as sesame oil, coconut oil, sunflower oil, and olive oil are suitable for this purpose. The oil is held in the mouth and used as a mouthwash. It has been used as a folk remedy for gingivitis in India for many years.

In developing countries and rural areas, access to oral care is limited and toothbrushes, toothpaste, and mouthwashes are often difficult to obtain. Therefore, oil mouth washing is a cost-effective alternative to improve oral health. <sup>(18)</sup>

The aim of this study was to investigate the comparative effectiveness of coconut oil as a supplement to toothbrushing in reducing plaque formation.

The coconut oil used in this study is inexpensive, easily available, and can be found in most households. It can be used to prevent dental disease and is suitable for this target group. Previous studies have highlighted the significant antimicrobial properties of coconut oil. This is mainly because it contains monolaurin. It is believed to have antimicrobial properties against a wide range of microorganisms. <sup>(19,20)</sup>

The study used the plaque index for clinical evaluation because it is the most commonly used index in therapeutic drug research.

The study also showed a significant reduction in the plaque index after 30 days.

There are many hypotheses as to how oil rinsing reduces the plaque index. When oil is rinsed, mechanical shear forces act on the oil, causing it to be emulsified and its surface area to increase significantly. The oil layer formed on the teeth and gums can reduce the adhesion of plaque and the accumulation of bacteria. It is also believed that the alkali in saliva may react with the oil, causing saponification and the formation of a soap-like substance, which reduces the adhesion of plaque. <sup>(21)</sup>

Applying coconut oil once a day is very effective in reducing plaque formation and is more effective than applying it twice a day. This eliminates the need for double rinsing and avoids stress for the patient. Coconut oil contains bioactive components such as lauric acid, which have anti-inflammatory and antimicrobial properties. It is speculated that once a day application is sufficient to achieve a therapeutic dose to achieve clinical improvement. Increased frequency may not increase treatment efficacy proportionately and may result in reduced efficacy. Rinsing with coconut oil twice daily may lead to fatigue that impairs technique or reduces rinse time, which in turn reduces efficacy. These results suggest that using coconut oil as a mouthwash once daily may achieve the best balance between efficacy and compliance.

The results of this study indicate that male participants responded more strongly to rinsing with coconut oil in reducing dental plaque formation compared with female participants. This observed difference can be attributed to several interrelated physiological, behavioral, and microbial factors: Hormonal and physiological differences, especially sex hormones, play a crucial role in regulating immune and inflammatory responses. In women, hormonal fluctuations, especially estrogen and progesterone levels during the menstrual cycle, increase gingival vascular permeability and inflammatory responses to dental plaque, which may reduce the effectiveness of therapeutic interventions. In contrast, more stable



hormone levels in men may contribute to a more consistent and predictable immune response.

#### IV. CONCLUSION:

Oil has been demonstrated to be effective in reducing the formation of dental plaque. This research suggests that coconut oil is simple to utilize, safe, and cost-effective as a supplement to conventional dental hygiene. Further research on the antibacterial effects of coconut oil against microorganisms that cause dental diseases is necessary to demonstrate the effectiveness of coconut oil as an dental cleansing. Future investigations with larger samples of coconut oil and comparative studies with different chemotherapy agents would augment the quality of the evidence..

#### REFERENCES:

- [1]. Robinson PG, Deacon SA, Deery C, et al. Manual versus powered toothbrushing for oral health. *Cochrane Database Syst Rev.* 2005;18(2):CD002281. doi:10.1002/14651858.CD002281.
- [2]. Ripari F, Cera A, Freda M, Zumbo G, Zara F, Vozza I. Tea tree oil versus chlorhexidine mouthwash in treatment of gingivitis: A pilot randomized, double-blinded clinical trial. *Eur J Dent.* 2020;14(1):55-62.
- [3]. Deacon SA, Glenny AM, Deery C, et al. Different powered toothbrushes for plaque control and gingival health. *Cochrane Database Syst Rev.* 2010;2010(12):CD004971. doi:10.1002/14651858.CD004971.
- [4]. Al-Nuaimi NH, Gasgoos SS. Effect of Chicken Eggshell Paste on Enamel Surface Microhardness and Colour Change of Artificial Carious Lesions Created on Permanently Extracted Teeth. *Georgian Medical News.* 2023; 7(340): 107-112.
- [5]. Badran IB, Gasgoos SS. Tensile bond strength of self-adhesive flowable composite as pit and fissure sealant bonded to enamel surface in comparison with fissure sealants (An in vitro study). *Al-Rafidain Dent J.* 2021; 21(1): 135-145.
- [6]. Yaseen HA, Gasgoos SS. Dental caries and body mass index in Mosul City schoolchildren. *Dental Journal (MajalahKedokteran Gigi).* 2025; 58(1): 30-36.
- [7]. Fadhil RA., Gasgoos SS. Effect of Different Mouthwashes on Gingival Health of Dental Students. *Al-Rafidain Dent J.* 2021; 21(2):251-259.
- [8]. Meto A, Colombari B, Castagnoli A, Sarti M, Denti L, Blasi E. Efficacy of a copper-calcium-hydroxide solution in reducing microbial plaque on orthodontic clear aligners: A case report. *Eur J Dent.* 2019;13(3):478-484. doi:10.1055/s-0039-1693975.
- [9]. Chatterjee D, Kapoor A, Vijay S, Sobti G, Kara D, Thanvi J. Efficacy of locally administered 1.2% rosuvastatin gel in patients with periodontitis: A randomized placebo-controlled clinical trial. *Eur J Dent.* 2019;13(1):29-35. doi:10.1055/s-0039-1689935.
- [10]. Fadhil RA., Gasgoos SS. Effect of Different Mouthwashes and Text Messages on Plaque Accumulation for Dental Students. *Al-Rafidain Dent J.* 2021; 21(2): 260-269.
- [11]. Vadhana VC, Sharath A, Geethapriya PR, Vijayasankari V. Effect of sesame oil, ozonated sesame oil, and chlorhexidine mouthwash on oral health status of adolescents: A randomized controlled pilot trial. *J Indian Soc Pedod Prev Dent.* 2019;37(4):365-371. doi:10.4103/JISPPD.JISPPD\_150\_18.
- [12]. Sezgin Y, Memis Ozgul B, Alptekin NO. Efficacy of oil pulling therapy with coconut oil on four-day supragingival plaque growth: A randomized crossover clinical trial. *Complement Ther Med.* 2019;47:102193. doi:10.1016/j.ctim.2019.102193.
- [13]. DebMandal M, Mandal S. Coconut (*Cocos nucifera* L.: *Arecaceae*): In health promotion and disease prevention. *Asian Pac J Trop Med.* 2011;4(3):241-247. doi:10.1016/S1995-7645(11)60062-1.
- [14]. Al-Nuaimi NH, Gasgoos SS. Impact of Hydroxyapatite Tooth Paste on Enamel Surface Roughness of Artificially Demineralized Permanent Teeth (An in vitro study). *Al-Rafidain Dental Journal.* 2025; Vol 25(1): 95-105.
- [15]. Mohammed SA, Gasgoos SS. Influence of Er,Cr:YSGG and Diode Lasers on The Surface Roughness of Enamel at Fissure area: An in vitro Study. *Al-Rafidain Dental Journal.* 2023; Vol. 23(2): 312-320.
- [16]. Mohammed SA, Gasgoos SS. Influence of Er,Cr:YSGG and Diode Lasers on The Microhardness of Enamel at Fissure area:



- (An in vitro Study). Al-Rafidain Dental Journal. 2023; Vol. 23(1): 211-219.
- [17]. Newman G, Takei H, Klokkevold R, et al. Carranza's clinical periodontology. 2nd ed. South Asia: Saunders Elsevier; 2016. p. 3, 51, 383.
- [18]. Naseem M, Khiyani MF, Nauman H, et al. Oil pulling and importance of traditional medicine in oral health maintenance. Int J Health Sci (Qassim). 2017;11(4):65-70.
- [19]. Ogbolu DO, Oni AA, Daini OA, Oloko AP. In vitro antimicrobial properties of coconut oil on Candida species in Ibadan, Nigeria. J Med Food. 2007;10(2):384-387.
- [20]. Verallo-Rowell VM, Dillague KM, Syah-Tjundawan BS. Novel antibacterial and emollient effects of coconut and virgin olive oils in adult atopic dermatitis. Dermatitis. 2008;19(6):308-315.
- [21]. 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:10.4103/0300-1652.154756.