

# Evaluation of a New Mouthwash an *In Vitro* Study

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## ABSTRACT

**Objectives:** To analysis the benefit effect of coconut as natural mouthwash.

**Methods:** This study depended on using of coconut as a main constituent in making a natural mouthwash solution. It examined some physical, chemical, biological and antibacterial properties of this mouthwash by surface tension test, pH measurement and antibacterial property of mouthwash as reduction of *Streptococcus mutans* count.

**Results:** The results for 1% coconut mouthwash showed: surface tension (42.35 dyne/cm) and pH measurements (9.6), which was the highest results, while the antibacterial inhibition zone diameter for 1% coconut mouthwash was (13 mm) which the 2nd highest result.

**Conclusions:** Coconut mouthwash plays an antibacterial effect with prevention demineralization of tooth enamel surface.

**Key words:** Coconut, Mouthwash, Surface tension, pH measurements antibacterial test

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Mycobacterium species, Gram-positive and Gram-negative bacteria [12], coconut mouthwash considered safe and effective alternative to Chlorohixidine as antibacterial [13].

## INTRODUCTION

The preservation of oral health can be accomplished by mouthwashes which are commonly used [1].

Mouthwashes are non-sterile aqueous solutions and used as an antibacterial activity which prevents the growth of bacteria in the mouth and teeth [2], and for decreasing oral malodor [3]. They are commonly used as topical solutions against plaque development [4], and they can be used frequently to prevent oral infections [5].

Natural mouthwashes having fewer undesirable effects, as an alternative to chemical ones [6]. Coconut oil used in making mouthwash in our study, it is considered as a unique physically functional food besides health and nutritional benefits [7].

Coconut oil is one of the healthiest oils on earth [8] which has been ingested in tropical nations for thousands of years [9].

In the commercial market, there are two types of coconut oil available: refined and virgin coconut oil. Virgin coconut oil used in mouthwash in this study is characterized by colourless, odorless liquid and has many health benefits which contain vitamins and antioxidants, it also has antiviral activity [10,11], besides it contained antimicrobial properties against wide range of species, as

## MATERIALS AND METHODS

Virgin Coconut is used in preparing mouthwash in this study by using different concentrations of coconut oil (0.4%, 0.8%, and 1%) was dissolved in 500 mL of water and using sodium carbonate (molar ratio equivalent) to make solubility of coconut oil in water by making coconut salt, no sweetener, or flavouring agents. Then the solution was tested after 1 month for surface tension, pH measurement and antibacterial test measurement.

### Surface tension test measurement

Surface tension measurement was done using glass capillaries which were open on both the ends. A glass capillary was immersed in a 50-mL glass beaker containing 15 mL of the product [14]. A sample of 500 ml of the following different concentration of coconut mouthwash solution: (0.4%, 0.8% and 1%) of coconut mouthwash, and 0.12% Bio fresh chlorohixidine mouthwash (positive group), besides water (negative group).

Groups as arranged in C1, C2, C3, C4, C5 and C6 were (C1: 0.4% coconut mouthwash, C2: water, C3: coconut oil, C4: 0.8% coconut mouthwash, C5: 0.12% Bio fresh chlorohixidine mouthwash and C6: 1% coconut mouthwash) as shown in Figure 1 was filled in a beaker

and a glass tube was immersed in the solution after measuring its inner diameter. Then the level of the fluid in the tube was measured by the horizontal microscope ruler the surface tension was obtained according to the following equation:

$$Ts = \frac{1}{4} d h \rho g = \text{dyne/cm. at temperature } 33 \text{ }^\circ\text{C [15].}$$

d=tube diameter in cm.

h=the height the liquid is lifted in cm.

p=the density of the liquid.

g=the acceleration due to gravity.

Ts=surface tension.



Figure 1: (a) Oil groups, (b) 0.12% Bio fresh chlorohexidine mouthwash.

**pH measurement**

This is a sample of 500 ml of the following different concentration of coconut mouthwash solution: (0. 4%, 0. 8% and 1%) of coconut mouthwash, and 0.12% Bio fresh chlorohixidine mouthwash (positive group), besides water (negative group). The probe of the pH meter Figure 2 was immersed in the solution until the reading which appears on the screen becomes stable.



Figure 2: pH meter.

**Antibacterial test measurement**

Gram positive *Streptococcus mutans* was used in this study to evaluate the antibacterial effect of different concentrations of coconut mouthwash which were studied as: (0.8%, 0. 4% and 1%,) coconut mouthwash, and antibacterial effects of 0.12% Bio fresh chlorohixidine mouthwash and water as shown in Figure 3, and by using Mueller-Hinton agar (MHA) plates.

The plates were then incubated at 37 °C for 24 hours. The antibacterial activity was assessed by calculating the diameter of inhibitory zones in millimetres [16].

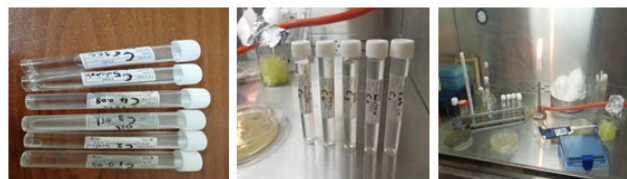


Figure 3: Preparation for antibacterial test measurement.

**RESULTS**

The Results of surface tension test, pH measurement and Antibacterial test (Inhibition zone diameter) are shown in (Table 1), and (Figures 4 and 5).

**Table 1: The results of surface tension test, pH measurement and antibacterial test (inhibition zone diameter).**

	Surface tension (dyne/cm)	PH measurement	Inhibition zone diameter (mm)
0.4% coconut mouthwash	35.643	8	3 mm
0.8% coconut mouthwash	40.057	8.1	6 mm
1% coconut mouthwash	42.35	9.6	13 mm
0.12% Bio fresh mouthwash	20.58	7.5	16 mm
Water	28.824	7	0 mm
Coconut oil	12.862	.....	.....



Figure 4: pH measurement for different solutions used in the study.

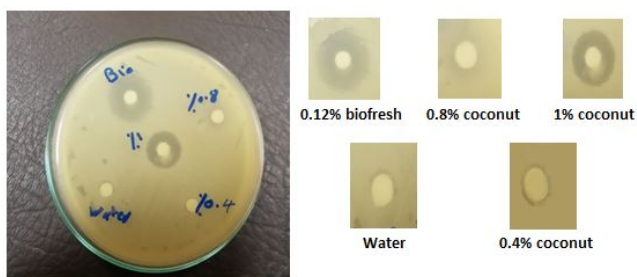


Figure 5: Antibacterial test (Inhibition zone diameter).

**DISCUSSION**

**Surface tension**

It is the contractive properties of the surface for a liquid that permit resisting an external force which is considered an important point of appropriate solution that has a low surface tension [17].

Lowering the surface tension can result in more dispersion of the mouthwash in the medium [18]. So in this study the surface tension of 0.12% Bio fresh mouthwash was (20.58 dyne/cm) which is the lowest surface tension. Then 1% coconut mouthwash which was (32.643 dyne/cm).

**pH measurement**

pH measurement results showed 1% coconut mouthwash has highest pH which is 9.6 very good then 0.8% coconut mouthwash has pH 8.1 then 0.4 % coconut mouthwash has pH 8 then 0.12% Bio fresh mouthwash pH 7.5.

The pH of 5.5 is regarded critical for teeth, as the teeth begin to demineralize below 5.5. where at a pH above 5.5, the teeth begin to remineralize [19,20], the acidic and low pH (less or equal to 5.5) mouthwashes can cause dental demineralization and significant loss of enamel within the first few minutes of contact with such acidic solution [21].

**Antibacterial test**

The antibacterial test of mouthwash achieved a noticeable positive result, %0.12 Bio fresh mouthwash produced largest zone of inhibition against *Streptococcus mutans* about (16 mm) then 1% coconut larger inhibition zone about (13 mm) then 0.8% about (6 mm) then 0.4% for (3 mm) [22-24].

So, oil coconut pulling can be explored as a safe and effective alternative to chlorohixidine [13].

In another point, in comparison of coconut oil and chlorohixidine there is no significant difference in the antibacterial efficacy. So, coconut oil is as effective as chlorohixidine in the reduction of *Streptococcus mutans* [25].

**CONCLUSION**

At the end of this study, it is found that concentration of coconut oil mouthwash increases from 0.4% to 0.8% to 1% and more benefits as alternative to other antibacterial mouthwash can be obtained. In addition, pH is more appropriate to teeth and oral cavity as it prevents demineralizing of enamel tooth surface. Besides, it is considered safe because of its natural herbal contents.

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This study received no financial support.

**CONFLICT OF INTEREST**

The authors have no conflict of interest to declare.

**ETHICAL APPROVAL**

The college of dentistry in Mosul University approved the protocol of this study.

**AUTHORS CONTRIBUTIONS**

All Authors contributed to the development of the course and the design, writing, and finalizing of the research. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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