



### The Gargling Lime Juice (*Citrus aurantifolia*) and Plaque Index in Adolescent Girls Aged 18-20 Years: A Pseudo-Experimental Study

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#### ABSTRACT

**Background:** Plaque is a soft deposit that sticks tightly to the surface of the teeth. Plaque can be controlled by regular brushing and the use of mouthwash. Plaque control by gargling can use traditional plant materials, one of which is lime (*Citrus aurantifolia*). Lime contains compounds that are antibacterial, namely essential oils that can inhibit the growth of bacteria plaque formation. One of the populations with dental and oral health problems is adolescents. The purpose of this study is to measure the effect of gargling lime juice (*Citrus aurantifolia*) on plaque index in adolescent girls aged 18-20 years. **Methods:** This is a pseudo-experimental research. The pre-experimental design used is one group pre testpost test design. This research was carried out in May 2024 in Manado City. A total of 42 female remakami aged 18-20 years were sampled in this study. The variable measured was the plaque index. The treatment given is gargling with lime juice. The instruments of this research are a set diagnostic tool, and a plaque index examination format. The research material is lime juice. The data obtained, tabulated and then analyzed using the paired sample t-test. **Research Results:** The results showed that the average plaque index before gargling with lime juice is 2.1809 and after gargling is 0.3357. There was a difference in the decrease in plaque index before and after gargling lime juice, which was 1.8452. The results of the paired t-test sample obtained a significance value of 0.000. This value shows that there is a significant difference in plaque index between subjects who gargle with orange leaf decoction and those who do not. **Conclusion:** It can be concluded that the habit of gargling with lime juice can reduce plaque index in adolescent girls aged 18-20 years in Manado city.

**Keywords:** Gargle, Lime juice, Plaque Index

#### INTRODUCTION

Dental health is one aspect of all health that is the result of the interaction between physical, mental, and social conditions. What is meant by dental and oral hygiene is the state of teeth that are in the oral cavity in a clean state free from plaque and other dirt that is on the surface of the teeth such as debris, tartar, and food waste (Setyaningsih, 2019).

Dental and oral hygiene is a condition that shows that in the oral cavity a person is free of dirt or plaque (Pariati & Lanasari, 2021). The biggest problem faced by the

population of Indonesia and developed countries in the field of dental and oral health is tooth decay or cavities, which are caused by the loss of the hard tissue structure of the teeth (enamel and dentin) due to acid deposits produced by plaque bacteria on the surface of the teeth. Dental plaque is a thin, yellowish-white layer that attaches to the surface of the tooth, containing a collection of germs. (Amaliya et al., 2020).

The way to prevent cavities or the process of tooth demineralization is if you consume sugary foods and drinks, then brush your teeth afterwards or by gargling (Maramis et al, 2023). Gargling with mouthwash can also reach more surfaces of the oral cavity, so the effectiveness of plaque control is increased. Mouthwash with plant-based ingredients that are believed to have antibacterial properties with minimal side effects. Mouthwashes with natural ingredients provide more advantages because they are safe, rarely cause adverse side effects and can be used and prepared at home (Adam et al., 2024). There are several types of plant-based mouthwashes that have been tested for their efficacy on the hygiene and health of teeth and mouth, such as cloves (*Syzygium aromaticum*), mangosteen (*Garcinia mangostana* Linn.), lime (*Citrus aurantifolia*) and others (Maramis and Ratuela 2022; Adam et al. 2024)

Lime (*Citrus aurantifolia*) is a plant that has many health benefits. Lime contains Attrition oil and the compound works by damaging the bacterial cell membrane. Lime juice in addition to helping the health of the body can also maintain dental and oral health. Water from lime juice can help clean food debris that sticks between our teeth by gargling. (Kurniawati et al., 2021).

Research conducted by Wulansari et al., (2020) showed that based on the average plaque index criteria, there was a change in the average plaque index before and after gargling lime fruit extract with concentrations of 20%, 40%, and 60%. In the plaque index score, the good criteria were from 54.4% to 8.9%, the moderate criteria from 80.0% to 38.9%, and the bad criteria from 11.1% to 6.7%. This shows that there is a decrease in plaque index scores after gargling with lime extract concentrations of 20%, 40%, and 60% where the higher the concentration level, the greater the decrease in dental plaque and able to inhibit the growth of bacteria.

The results of Basic Health Research (2018), stated that the proportion of dental and oral problems in Indonesia is 57.6%, daily brushing behavior is 94.7% and the proportion of correct brushing behavior is 2.8%, while for the people of North Sulawesi province the proportion of dental and oral problems is 66.5%, daily brushing behavior is 96.3% while the correct brushing behavior is 3.5% and especially in the city of Manado the proportion of dental health problems and mouth by 56.9%, daily brushing behavior by 98.7% while correct brushing behavior by 5.3%.

An initial survey conducted on several adolescent girls aged 18-20 years showed that plaque was found on the surface of the teeth with good criteria of 20%, moderate criteria as much as 50%, and bad criteria of 30%. The results of interviews with several young women found that on average they brush their teeth only when bathing and do not have the habit of gargling using mouthwash or gargling using lime juice (*Citrus aurantifolia*). The purpose of this study is to measure the effect of gargling lime juice (*Citrus aurantifolia*) on plaque index in adolescent girls aged 18-20 years.

## RESEARCH METHODS

This is a pseudo-experimental method with a one-group pre-post test design. The treatment given was gargling with lime juice (*Citrus Aurantifolia*) and the variable measured was the plaque index. This research was conducted in May 2024 in Manado City. A total of 42 adolescent girls aged 18-20 years are the subjects of this study. The subject criteria were adolescent girls aged 18-20 years, willing to be the subject of the study and following all the instructions given by the researcher. The selection of research subjects used the purposive sampling method. Sampling was carried out in several women's dormitories in the city of Manado. This research instrument uses a set diagnostic tool, a plaque index examination format, and uses materials, namely lime juice. The data obtained, tabulated and then analyzed using the paired sample t-test. This research has passed the ethical feasibility based on the Certificate of Ethical Worthiness No. KEPK. 01/07/144/2024.

## RESULT AND DISCUSSION

### Categories of plaque index before and after treatment

The distribution of the category of plaque index of the research subjects before being given treatment can be seen in Table 1.

Table 1. Distribution of plaque index categories before treatment

Category	n	%
Excellent	0	0,0
Good	14	28,6
Keep	22	57,1
Bad	6	14,3
Total	42	100,0

Table 1 shows that the plaque index category of the research subjects before being given the most treatment is in the medium category as many as 22 people (57.1%) and the bad category as many as 6 people (14.3%). The distribution of the category of the plaque index of the research subjects after being given treatment can be seen in Table 2.

Table 2. Distribution of plaque index categories after treatment

Category	n	%
Excellent	8	19
Good	34	81
Keep	0	0
Bad	0	0
Total	42	100

Table 2 shows that after being given treatment, there is a change in plaque index where the dominant ones are in the good category as many as 34 people (81%) and 8 people (19%) are very good.

### Effect of treatment on plaque index

The results of the analysis of the effect of the treatment given on the plaque index can be seen in Table 3.

Table 3. Paired *Sample t-test* results

Treatment	Average plaque index before	Average plaque index after	Interval	Sig.
Gargle lime juice	2,1809	0,3357	1,8452	0,000

Table 3 shows that the average plaque index of the research subjects before gargling with lime juice is 2.1809 and after gargling is 0.3357. This value shows that there is a difference in the decrease in plaque index before and after gargling lime juice by 1.8452. The results of the *Paired Sample t-test* showed a value of  $p = 0.000$  ( $0.000 < 0.05$ ). This means that gargling with lime juice has an effect on decreasing the plaque index.

Research from Ramadhan et al. (2020) shows that gargling with a solution of lime juice (*Citrus aurantifolia*) at a concentration of 25%, is effective in reducing dental plaque, because lime can inhibit the formation of dental plaque by increasing the speed of saliva flow which is able to carry out antibacterial and antibody activities. The results of data analysis obtained the average score of plaque index before gargling with lime juice solution 4.2 after gargling with lime juice solution to 1.6 so that it can be concluded that gargling with lime juice solution can reduce the plaque index.

Research from Kamila et al. (2021) which aims to analyze the effectiveness of gargling with lime fruit extract on the score of dental plaque index. The results of the study on the effectiveness of lime extract solution as a mouthwash on plaque index in junior high school adolescents in Semarang and in kindergarten children with early childhood caries in Makassar there was a significant difference in plaque index before and before gargling lime extract. Higher concentrations of lime extract may lower larger dental plaque index scores.

Research from Ahdiatus (2020) who conducted a pseudo-experimental study with a *pre-post-test control group* design. The research was conducted on students of the Bachelor of Dentistry Program, Faculty of Dentistry, Unissula. The sample obtained was 30 people. The data was analyzed using the Wilcoxon Rank and Mann Whitney tests with a degree of significance of 95%. The results showed that there was an average difference in plaque index before and after gargling lime of 0.53. The Wilcoxon Rank test obtained a lime significance value of  $p=0.002$ , meaning that gargling with a 60% concentric lime extract solution both decreased the plaque index.

Research from Wulandari et al. (2021) which aims to analyze the effectiveness of lime active antiseptic substances at concentration levels of 15% and 30% on the reduction of dental plaque formation. This study uses a pre-test and post-test design of experimental randomized controlled trials. A total sample of 42 students aged 15 to 17 was randomly divided into three groups: the first and second treatment groups were given 15% and 30% lime extract as mouthwash while the third group was given distilled water instead. The data were analyzed using the Turesky-Gilmore-Glickman Modified plaque index of Quigley-hein. The results of the paired t-test showed a significant change with a  $p=0.00$  value while the independent t-test showed a different rate of reduction in dental plaque formation with the treatment group using a 30% lime extract solution.

Research from Asmawati et al. (2021) showed that gargling with lime solution (*Citrus aurantifolia*) was effective in reducing gingival inflammation in the community in Tongalere Village, North Wawonii District, Konawe Islands Regency.

The research of Nurcahyo et al. (2024) used primary data on plaque index before and after gargling lime juice with salt, then a *paired sample t test* was carried out to determine the difference in plaque index before and after gargling lime juice with salt. It is known that the average plaque index before gargling lime juice with salt is 2.3577 and the average plaque index after gargling lime juice with salt is 1.4683. The results of the *paired sample t test* were 16.902 with a significance p value of  $< 0.001$ . The conclusion of this study is that gargling lime juice with salt can affect the plaque index.

The difference in the average plaque index formed is due to the fact that lime has a composition, namely citric acid, essential oils, saponins, alkaloids, phenols, tannins, vitamins A, B1, and C. Essential oils contained in lime have flavonoid compounds that play a role in inhibiting bacterial growth (Hakim et al., 2018).

## CONCLUSION

The conclusion of this study is that the habit of gargling with lime juice (*Citrus Aurantifolia*) has an effect on plaque index in adolescent girls aged 18-20 years. Therefore, young women aged 18-20 years can improve the maintenance of dental and oral health by gargling lime juice, because lime juice is used as an ingredient to be able to lower the plaque index.

## AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Data curation; Investigation

Author 2: Methodology; Writing - original draft.

Author 3: Data curation; Investigation.

Author 4: Data curation; Investigation.

Author 4: Writing - review and editing; Validation

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