

Effectiveness of Mouthwash Containing Cloves (*Syzygium Aromaticum*) in Treating Gingivitis in Adolescents

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Abstract:- Marginal gingivitis is inflammation of the gingiva at the margin characterized by a reddish and raised color that is not persistent in areas where bacterial plaque is concentrated. Cloves are an herbal ingredient that can be used as an alternative for treating gingivitis, especially in adolescents. Cloves contain active ingredients, namely essential oils that can inhibit plaque formation and act as anti-inflammatories. This research aims to prove the potential of clove extract solution (*Syzygium Aromaticum*) as an alternative herbal mouthwash for gingivitis in adolescents. The method used is quasi-experimental, with a pre-and post-test and a control group design. The population of this study was gingivitis patients at the Kolonodale Regional Hospital dental clinic. Sampling was carried out using random sampling. The sample consisted of 27. The dependent variable was the gingivitis score, the independent variables were clove extract, clove decoction, and no active ingredients and the confounding variables were the respondent's lifestyle and discipline. The patient intervention was carried out for 6 days with a pre-post-test examination of the gingivitis score. The samples were divided into 3 treatments, namely clove extract, clove decoction, and no active ingredients. Test results for the effectiveness of administering mouthwash with clove extract, clove decoction, and without active ingredients using the Non-Parametric Kruskal Wallis with a big value. 0.000 which means H1 is accepted, namely the treatment has a significant influence. The Mann-Whitney test showed that clove extract was more effective in curing gingivitis with a difference value of 1.89 for clove extract, 1.22 for clove decoction, and 0.33 for no active ingredient.

Keywords:- *Gingivitis, Adolescents, Clove Herbal Mouthwash.*

I. INTRODUCTION

Dental and oral health is a very important factor in supporting body health. However, this is often overlooked due to people's busy schedules in the current era of globalization, causing many people to suffer from various types of dental and oral diseases. Problems with oral and gingival hygiene often occur in children aged 10-15 years. The World Health Organization (WHO) recommends epidemiological studies of dental and oral health in the 10 to 15-year age group. Where this age range is a critical age for measuring indicators of childhood periodontal disease as the age for examination because the permanent teeth which are the research index have

fully grown. Poor oral and dental hygiene can cause gingival inflammation. Several epidemiological studies show that oral hygiene and gingival status of various levels of severity are generally found in children and adolescents.[1]

Dental and oral diseases that are often suffered by the general public are dental disease (gingivitis), dental caries (cavities), and halitosis (bad breath). The national prevalence data for gingivitis based on 2018 Riskesdas data is 13.9%, while the prevalence of gingivitis in Central Sulawesi Province is 35.6%.[2]

Gingivitis is a periodontal disease that is generally caused by plaque microorganisms which cause inflammation and infection thereby destroying the supporting tissues of the teeth including the gums, periodontal ligament, and alveolar bone. *Porphyromonas gingivalis* bacteria are often found in dental plaque, where they cause pathological changes in periodontal tissue by activating the host's immune and inflammatory responses, which directly affect periodontium cells. *Porphyromonas gingivalis* produces various pathogenic virulence factors, such as lipopolysaccharide and hydrogen sulfide, which can induce the host to release IL-1 and TNF- α . *Porphyromonas gingivalis* grows in culture media to form colonies 1-2 mm in diameter, convex, smooth, and shiny, the center of which shows a darker appearance due to the production of protoheme, which is a substance responsible for the characteristic color of these colonies. Identification of local isolates of *Porphyromonas gingivalis* will provide a great opportunity for the development of an oral intervention method used to fight this bacterial species, and will subsequently be useful for the prevention and treatment of periodontal disease.[3] Gingivitis is a disease that can be cured by removing plaque and carrying out effective plaque control. To overcome gingivitis and prevent the onset of periodontitis, plaque control is carried out by providing education to always maintain oral hygiene, scaling, polishing teeth, and using a toothbrush, dental floss, or mouthwash.[4]

Mouthwash is used as a cosmetic and therapeutic agent in the mouth. Mouthwash in liquid form is a traditional method to stabilize and deliver various pharmaceutical agents to the surface of teeth and tissues to provide a treatment effect. The benefits of mouthwash mainly function as a breath freshener and to maintain oral hygiene. One antimicrobial agent that can provide effective results is cloves. Cloves are a type of herbal plant that is easily found in various regions in Indonesia. Cloves

contain quite large amounts of essential oils, both in flowers (10 – 20%), stalks (5 – 10%) and leaves (1 – 4%). The content of cloves can inhibit plaque formation and act as an anti-inflammatory. Therefore, cloves are widely used as a raw material for making mouthwash.[4],[5]

Plaque efficacy between alcoholic mouthwash containing essential oils and non-alcoholic mouthwash with the active ingredient chlorhexidine showed comparable effectiveness for 4 days. Based on this and seeing the increasing market opportunities for herbal or natural mouthwash products, inventions regarding natural or herbal mouthwash products need to be commercialized.[6] Stevia leaf extract is taken using the infusion method, namely by soaking dried stevia leaves in distilled water at a temperature of 90oC for 15 minutes then filtering with filter paper. Meanwhile, extracting robusta coffee is done by dissolving whole, ground robusta coffee in hot water. The effect of coffee on eliminating unpleasant odors or the characteristic smell of stevia mouthwash is not that strong. For this reason, you can experiment again with the right coffee

composition so that the aroma of coffee can overpower the strong smell of stevia.[7]

II. RESEARCH METHODS AND SAMPLE

The research design used was quasi-experimental, namely research carried out without randomization, but involving group placement of participants. The design of this research uses a pretest & posttest with a control group design. Sampling was carried out using random sampling. The sample in this study was 27 people who were divided into 3 groups, namely the intervention group using clove decoction of as many as 9 samples (group 1), using clove extract of as many as 9 samples (group 2), and the control formula without active ingredients as many as 9 samples (group 3) the research will be carried out. This study describes the effectiveness of mouthwash containing cloves (*Syzygium Aromaticum*) in treating gingivitis in adolescents. The respondents used were patients aged 10-15 years who visited the dental clinic at Kolonodale Regional Hospital and experienced gingivitis.

III. RESEARCH RESULT

A. Gingivitis Score

Table 1 Average Gingivitis Score Before and After Gargling with Clove Extract, Clove Decoction, and Without Active Ingredients

No	Variable	Mean		
		Gingivitis score before treatment	Gingivitis score after treatment	Difference Before and after treatment
1	Clove Extract	2.22	0.33	1.89
2	Clove Decoction	2.11	0.89	1.22
3	No Active Ingredients	2.11	1.78	0.33

Based on the table above, explains that the mean scores in the intervention group and the control group have different values. It is known that the mean gingivitis score before and after the clove extract mouthwash is 2.22. After being given treatment in the form of clove extract mouthwash for 6 days, the mean gingival index value became 0.33. The difference in reducing gingivitis scores in the group without active ingredients was the smallest when compared with clove extract mouthwash and clove decoction mouthwash.

B. Normality Test

The normality test in research aims to determine whether the data obtained is normally distributed or not (Arikunto, 2006). The data normality test using Shapiro-Wilk produced significant values in the intervention group and control group for marginal gingivitis.

Table 2 Normality test

Variable	P-value
Clove Extract Mouthwash	0.012
Clove Leaf Decoction Mouthwash	0,000
Without Active Ingredients	0,000

**Shapiro-Wilk*

In clove extract mouthwash, the sig. value is 0.012, in clove leaf boiled mouthwash, the sig. value is 0.000, and in the group without administration of active ingredients, the sig. value is 0.000. These values are <0.05 and <0.005. So the conclusion is that the research data is not normally distributed because the value is (p<0.05).

C. Homogeneity Test

Table 3 Homogeneity Test

Variable	Sig.
Gingival Index	0.788

The homogeneity test is used as a reference material to determine the next statistical test decision. This shows that the significance value of the gingival index is 0.788 ($p > 0.05$), meaning that the average gingival index is homogeneous.

D. Kruskal-Wallis test

Table 4 Analysis of Differences in Gingivitis Marginalis Scores between Gargling Clove Extract, Clove Decoction, and Without Giving Active Ingredients

Variable	Kruskal-Wallis	df	Sig.
Gingivitis Score	16,743	2	0,000

Based on the table above, it is known that the Kruskal-Wallis test results have a Sig value. 0.000, which is a value smaller than the critical threshold value (< 0.005), which means that H1 is accepted or there is a difference in marginal gingivitis scores between the groups gargling with clove extract, clove decoction, and without active ingredients.

E. Mann-Whitney Post Hoc Test

Table 5 Comparison between the group given clove extract mouthwash and the group without the active ingredient.

Treatment	N	Mean Rank	Sig.
Clove Extract Mouthwash	9	13.67	0.001
No Active Ingredients	9	5.33	

Based on the test results above, a significance value of 0.001 was obtained, where this value is < 0.05 , so it is known that there is a significant difference between the two groups, by looking at the mean rank of the two groups, it is known that giving clove extract mouthwash is more effective in reducing the gingivitis index. Compared with the group without active ingredient administration.

Table 6 Comparison between the Group Given Clove-Boiled Mouthwash and the Group without the Active Ingredient.

Treatment	N	Mean Rank	Sig.
Clove Extract Mouthwash	9	12.83	0.003
No Active Ingredients	9	6.17	

Based on the test results above, a significance value of 0.003 was obtained, where this value is < 0.05 , so it is known that there is a significant difference between the two groups, by looking at the mean rank of the two groups, it is known that administering clove boiled mouthwash is more effective in reducing the gingivitis index. Compared with the group without active ingredient administration.

Table 7 Comparison between the Group Given Clove Extract Mouthwash and the Group Given Clove Decoction Mouthwash

Treatment	N	Mean Rank	Sig.
Clove Extract Mouthwash	9	12.11	0.020
No Active Ingredients	9	6.89	

Based on the test results above, a significance value of 0.020 was obtained, where this value is < 0.05 , so it is known that there is a significant difference between the two groups, by looking at the mean rank of the two control groups, it is known that giving clove extract mouthwash is more effective in reducing the index. Gingivitis compared with the group given clove decoction mouthwash.

F. Relationship Between Lifestyle and Gingivitis Score

Table 8 Relationship between Lifestyle and Gingival Score

	df	Asymp. Sig.
Pearson Chi-Square	3	0.132

After carrying out the Pearson Chi-Square test using SPSS, the significance value of the chi-square test was 0.132, where the value was > 0.05 , this shows that there is no relationship between confounding lifestyle variables and the gingival index in this study.

G. Relationship Between Discipline and Gingival Score

Table 9 Relationship between Discipline and Gingival Score

	df	Asymp. Sig.
Pearson Chi-Square	3	0.481

After carrying out the Pearson Chi-Square test using SPSS, the significance value of the Chi-Square test was 0.481, where the value was > 0.05 , this shows that there is no relationship between the disciplinary confounding variable and the gingivitis score in this study.

IV. DISCUSSION

Gingivitis is generally caused by plaque, which is a sticky layer containing bacteria that sticks to the teeth. The bacteria in plaque produce toxic substances that seep into the gums through the small gaps between the teeth and gums. This constant irritation triggers inflammation and makes the gums bleed easily.

The type of gingivitis based on its location is marginal gingivitis. Marginal gingivitis is inflammation of the gingiva at the margin or edge of the gum which is the earliest stage characterized by reddish inflammation that is not persistent but stands out in areas where bacterial plaque is concentrated. Marginal gingivitis, if left unchecked, can worsen the gums and cause periodontitis. Signs and symptoms of marginal gingivitis are gingival inflammation in the margin area, characterized by changes in color, consistency size, and shape of the gingival surface. The most common causes of inflammation are caused by the accumulation of plaque bacteria and the presence of calculus. Discoloration and swelling of the gingiva are clinical features of marginal gingivitis.[12]

The main treatment for gingivitis is to maintain a diet and maintain oral hygiene by removing etiological factors, such as by controlling plaque and scaling, to reduce or eliminate inflammation to give the gingival tissue a chance to heal. Plaque adheres tightly to the tooth surface and can only be removed through mechanical and chemical cleaning. Mechanical plaque control can be done using cleaning tools such as toothbrushes, interdental cleaners, and gargling, while chemical plaque control can be done using mouthwash. To support the organic farming movement in Indonesia, effective organic herbicides are needed on a commercial scale. One thing that can be used as a natural herbicide is clove leaves. Clove leaves have not been utilized optimally and are still considered less useful waste. Clove leaves contain 1 - 4% essential oil, which can be utilized so that the waste has high economic value. Although no one has researched this, this research will examine extracts from clove leaves as a natural herbicide, clove leaves that are just left to become trash, can be used to help make it easier for farmers to get herbicides that are cheap, easy to reach and environmentally friendly.[5]

The important compounds found in cloves are useful for the prevention, care, and treatment of various types of diseases because curcuminoid compounds have anti-oxidant, anti-tumor, anti-cancer, anti-microbial, antiseptic and anti-inflammatory properties.⁵In line with research from Nanan Nurdjannah, 2007, cloves contain a fairly large amount of essential oil yield, both in flowers (10 - 20%), stalks (5 - 10%) and leaves (1 - 4%). The content of cloves can inhibit plaque formation and act as an anti-inflammatory. Therefore, cloves are widely used as a raw material for making mouthwash.[5]

Essential oils can denature and destroy cell cytoplasmic membranes. Unstable bacterial cell walls and cytoplasmic membranes will disrupt permeability, active transport function, and control of bacterial cell proteins. Disturbed cytoplasmic integrity will cause bacterial cells to lyse. Flavonoids can cause damage to bacterial cell walls. Damaged bacterial cell walls will cause an increase in cell membrane permeability so that fluid from outside the cell enters the cell and results in bacterial cell rupture. Tannins can form hydrogen bonds with bacterial cell proteins. If tannins succeed in forming hydrogen bonds with bacterial cell proteins, it will cause changes in the bacterial cell protein molecules. Changes in these protein molecules can disrupt bacterial cell metabolism. Saponins also can increase cell membrane permeability so that it becomes unstable and cell hemolysis occurs. Saponins also have the ability to disrupt the surface tension of bacterial cell walls. When the surface tension of the bacterial cell wall is disturbed, other antibacterial compounds can easily enter the bacterial cell and disrupt cell metabolism, resulting in bacterial death.[5]

Gingival examination is carried out using the Gingival Index (GI) from Loe and Sillness, using a dental probe as an examination tool. The gingiva examined is the gingiva surrounding the teeth (mesial, distal, labial/buccal, lingual/palatal), while the teeth examined are the right upper first molar (16), right upper second incisor (12), left upper first premolar (24), left lower first molar (36), left lower second incisor (32), and right lower first premolar (44). Each tooth is assessed for the level of inflammation, and given a score of 0-3. The gingival index assessment criteria are as follows:

- Normal gingiva, no inflammation, no discoloration, and no bleeding
- Mild inflammation, slight discoloration, and slight edema. There was no bleeding on probing.
- Moderate inflammation, redness, edema, and shine, there is BOP.
- Severe inflammation, redness, edema, ulceration, and spontaneous bleeding.

Assessment is carried out based on gingival criteria. The total of all dental values is divided by the number of teeth examined and a person's GI (Gingival Index) score will be obtained to determine the condition of the gingiva. The research results found that the results of testing 3 groups of samples with 3 different treatments had a significant influence on the gingivitis score with a significance value for the Kruskal Wallis test of 0.00. The results of follow-up testing (post-doc) showed that there was a significant difference between the sample group given clove extract mouthwash and the sample group without the active ingredient. The results obtained were that the group given clove extract was more effective in reducing gingivitis scores when compared to the group without the active ingredient. As research conducted by Novalia & Yohana (2019), found that the use of clove extract mouthwash was effective in reducing plaque index scores. Where other research conducted by Marawati (2017) shows that plaque accumulation that is not immediately treated can cause gingivitis and if it continues it can cause periodontitis.[5]

Apart from that, in Table 6, it was found that the sample group given clove leaf decoction was more effective in reducing gingivitis scores compared to the sample group without the active ingredient, in line with research conducted by Maramis, et al (2023) that gargling with clove leaf decoction was effective in reducing accumulation Plaque. This will reduce the gingivitis score.[17]

Furthermore, the research results in Table 7 show that giving clove leaf extract mouthwash is more effective than clove leaf boiled mouthwash. In line with research conducted by Rosyada (2020) which found that the results of the flavonoid test showed that there were differences in flavonoid content between ingredients. The flavonoids contained in bay leaf extract are higher than the flavonoids contained in decoction of bay leaves, this is because the extraction removes unwanted compounds so that the desired compounds or nutrients are obtained, whereas in the decoction the substances taken are the juice from boiling bay leaves so they are still It allows undesirable compounds or other substances to dissolve in the water. Although previous research was conducted on bay leaf herbs.[18]

Apart from that, this study found that there was no relationship between variable confounding lifestyle and gingivitis score. This is because the lifestyle of the research sample was 74% good, 26% moderate, and 0% had a bad lifestyle. This result is of course influenced by respondent data which is not spread out and tends to be the same. Apart from that, this study also found that there was no relationship between the disciplinary confounding variable and the gingivitis score. This is also influenced by the fact that almost all respondents have good discipline in using the mouthwash given, namely 96% of the research sample has good discipline, so the data in this study cannot compare various types of samples.

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