Healthsains
Printed ISSN: 2722-7782
Electronic ISSN:2722-5356
jurnal.healthsains.co.id

POTENCY OF TURMERIC EXTRACT SOLUTION (*CURCUMA LONGA*) AS AN ALTERNATIVE HERBAL MOUTHWASH IN GINGIVITIS MARGINALIS

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Keywords:
Gingivitis Marginalis; Turmeric Herbal Mouthwash.

ABSTRACT
Marginal gingivitis is an inflammation of the gingiva at the margin. It is the earliest stage characterized by a reddish inflammation that is not persistent but prominent in areas where bacterial plaque is concentrated. Preventive efforts to rinse mouthwash contain antibacterial but long-term use has side effects, so we need herbal ingredients with antibacterial properties, including turmeric. This researcher aims to prove the potential of turmeric extract solution (Curcuma longa) as an alternative herbal mouthwash against gingivitis marginalized. This type of research uses a Quasy experiment with a pre and post-tesposttestt design with a control group design. Consisting of the intervention group using turmeric extract mouthwash with a concentration of 2.5% and 5% and the control group without active ingredients, the sample consisted of 27 people gargling for 1 minute for five consecutive days—index gingival examination before and after rinsing. The results of the independent t-test for reducing marginal gingivitis at concentrations of 2.5% and 5% on days 1 and 2 showed a sig value of 0.002, Mondays three the sig value was 0.004 on days 4 and 5, the sig value was 0.000, meaning that there was a significant difference in reduction of marginal gingivitis. This study concludes that herbal mouthwash is effective as an alternative to herbal mouthwash in reducing marginal gingivitis compared to formulas without active ingredients.

Info Artikel | Artikel masuk 01-04-23, Direvisi 14-04-23, Diterima 24-04-23

INTRODUCTION

Gingivitis marginalized is an early stage of periodontal disease in the form of inflammation of the gingiva Analysis of Cross-Sectional and Retrograde Data on the Prevalence of Marginal Gingivitis (Robo et al., 2020). In general, the main factor causing gingivitis is plaque (Nataris & Santik, 2017). Plaque is a layer of biofilm on the tooth surface consisting of microorganisms. Plaque bacteria that are not cleaned and stick to the surface of the teeth or between the teeth, if left unchecked, will become a toxin that

How to cite: Febi Magfirah, Ari Suwondo, Supriyana, Diyah Fatmasari, Masrifan Djamil (2023) Potency of Turmeric Extract Solution (Curcuma Longa) as on Alternative Herbal Mouthwash in Gingivitis Marginalis, *Journal Health Sains*, *4*(4).
https://doi.org/10.46799/jhs.v4i4.879
E-ISSN: 2722-5356
Published by: Ridwan Institute

will irritate the gingiva. Gums cause infection and bleeding easily (Wijayakusuma, 2002). Tartar and plaque are the leading causes of bleeding gums. A large amount of tartar, plaque and food debris attached to the neck of the teeth indicates poor oral hygiene. This is due to the position of the teeth which makes it difficult to clean. Such as crowded teeth, so that food is easily tucked in, or a large amount of leftover food that causes the teeth to be inaccessible with a toothbrush, for example, the back teeth require a small brush head tip. Brushing teeth that are not right will make the teeth less clean and even injure the gums. Prevention can be done by maintaining optimal oral hygiene, including effective tooth brushing and proper gargling. Good dental care will remove tartar. It was then assisted with the consumption of vitamins and nutrients such as fruit and vegetables to restore gum health (Rosmalia, 2021). Gingivitis is a disease that occurs in more than 90% of the population, regardless of age and gender.

According to the World Health Organization (WHO), chronic noncommunicable diseases, including cardiovascular disease, cancer, chronic respiratory disease, and diabetes, remain the leading cause of death globally, at about 70%. In addition, periodontal disease is one of the essential oral diseases contributing to the global burden of chronic disease and is a significant public health problem (Cardoso et al., 2018). The results of Basic Health Research (RISKESDAS) stated that the prevalence of caries disease was 88.8% followed by the periodontal disease which was 74.1%. Today, the most prevalent dental and oral diseases are caries and periodontal disease caused by dental plaque.

Gingivitis marginalized is characterized by reddish inflammation that is not persistent but prominent in areas where bacterial plaque is concentrated (Robo et al., 2020). The primary treatment of marginal gingivitis is maintaining a diet and oral hygiene by removing etiological factors, such as plaque and skin control, to reduce or eliminate inflammation and give gingival tissue a chance to heal. Plaque adheres tightly to the surface of the teeth 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 using mouthwash (Riyanti, 2008).

Mouthwash plays an essential role in a person's oral hygiene. It helps relieve the symptoms of gingivitis. Moreover, reliably used to destroy pathogenic germs. Most patients use mouthwash to treat dry mouth (xerostomia), laryngitis and sensitive teeth (Banu & Gayathri, 2016). A non-herbal mouthwash, has side effects if used for a long time, such as staining of the teeth and the sensation of malaise (Dwipriastuti et al., 2017). As well as more significant damage to the sense of taste caused (Khairunnisa, 2019).

So that other alternatives are needed as raw materials for making a mouthwash with minimal side effects, economical and efficacious (Dwipriastuti et al., 2017). One effective and efficient effort is to utilize herbal plants such as turmeric (Curcuma longa). Turmeric is a medicinal plant material that has anti-inflammatory. Studies have shown that turmeric has antioxidant, anti-inflammatory, and anti-cancer properties (Augustina et al., 2019). In line with some studies, states that turmeric has been said to have many

pharmacological effects, including antioxidant, antimicrobial, and anti-inflammatory. Turmeric exhibits potent antioxidant and anti-inflammatory activity (Rasyadi, 2018).

Turmeric does not cause toxic effects even if given at high doses. Tests of plant safety limits with oral LD50 safety data on rats and mice showed no acute toxic effects in both species, with the highest dose tested is 2000 mg/kg. Rats and mice also did not show any pathological abnormalities during the necropsy. In addition, oral administration of SLC up to 720 mg/kg (the highest dose tested) of body weight per day for 90 days did not cause subchronic toxicity in male and female rats (Nasser, 2020).

Turmeric is a plant widely cultivated in India, South China, Taiwan, the Philippines, and Indonesia, especially the island of Java. The rhizome of this plant is usually widely used as a raw material for kitchen spices, dyes and traditional medicine. For traditional medicine, turmeric can be used as an external or inner medicine, also said to be a ginger-like plant that is sticky and bitter but not toxic (Mutiah, 2015). The active compounds found in turmeric are essential oils, phenols, flavonoids, tannins, and saponins. These five compounds are antibacterial, antioxidant and anti-inflammatory (Kumara et al., 2019).

METHODS

The type of research used in this study is experimental Quasy with pretest and posttesposttestt with control group design, with a sampling technique that is purposive sampling, which consists of 2 (two) groups, namely the intervention group and one control group. The design in this study was chosen because it was done before and after treatment. The intervention carried out in this study was turmeric extract mouthwash with concentrations of 2.5% and 5%. In comparison, the control group was given a formula without active ingredients. The respondents to be used in this study were female dormitory students aged 18 years and over, and as many as 27 people who experienced gingivitis were marginalized. This research was conducted at the Female Dormitory of Campus 1 Poltekkes Semarang.

RESULTS AND CONCLUSIONS

Results

Based on the research conducted, namely the provision of turmeric extract and formula without active ingredients. The decrease in gingivitis marginalized can be seen in table 1.

Table 1. Mean Test

No	Variable	Mean					
		Gingival index before treatment	Day to 1	Day to 2	Day 3	toDay to 4	Day to 5
1	Concentration 2,5%	0,97	0,97	0,97	0,97	0,77	0,57
2	Concentration 5%	1,34	1,34	1,34	0,73	0,38	0,16
3	FTBA	0,84	0,84	0,84	0,84	0,84	0,84

Table 1. Shows that the mean test for the treatment of giving 2.5%, 5% turmeric extract mouthwash and a formula without an active ingredient was at a concentration of 2.5% before treatment and after treatment on day 1 to day 3 of administration of concentration turmeric mouthwash 2.5% had the same mean value of 0.97 which means that there had not been a decrease in the gingival index. On the fourth day, the mean value was 0.77, which meant a decrease in marginal gingivitis. On the fifth day, the mean value was 0.57. At a concentration of 5% before and after treatment on day 1 to day 2 of administration, 5% concentration of turmeric mouthwash had the same mean value of 1.35, meaning there had not been a decrease in the gingival index. On day three, the mean value was 0.73, meaning there had been a decrease in marginal gingivitis. On day 4, the mean value was 0.38. On day 5, the mean value was 0.16. The formula without active ingredients before and after treatment on day 1 to day 5 had the same mean value of 0.84, which meant no decrease in the gingival index. It can also be seen from graphs 1,2, and 3.

Graph 1. The mean value of the Gingival Index changes at a concentration of 2,5%

Graph 2. The mean value of the Gingival Index changes at a concentration of 5%

Graph 3. The mean value of the Gingival Index change in a formula without an active ingredient

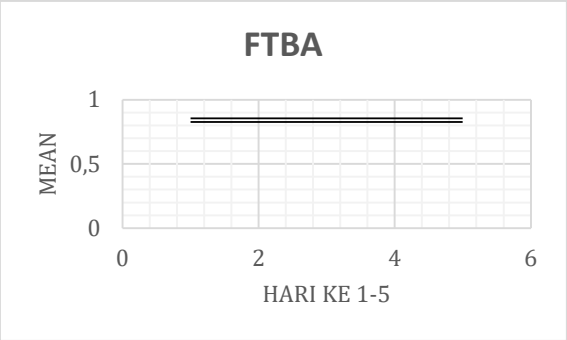

Table 2. Independent t-test difference in gingivitis marginal values between turmeric gargling concentration of 2.5% and concentration of 5%

Changes in the gingival index after treatment for five days	Concentration 2,5%		Concentration 5%		Sig
	Mean±SD	Difference (Δ)	Mean±SD	Difference (Δ)	
Day to 1	0,97±0,16	0,00	1,34±0,24	0,00	0,002
Day to 2	0,97±0,16	0,00	1,34±0,24	0,00	0,002
Day to 3	0,97±0,16	0,00	0,73±0,16	5,50	0,004
Day to 4	0,77±0,15	1,80	0,38±0,16	8,60	0,000
Day to 5	0,57±0,15	3,70	0,16±0,86	10,60	0,000

Table 2 shows that on days 1 and 2, with a concentration of 2.5% compared to a concentration of 5% sig value (0.002), there was a significant difference in marginal gingivitis ($p<0.05$). On day three, there was a decrease in marginal gingivitis, and there was a significant difference between concentration/15% and 5% with sig (0.044) due ($p<0.05$). P there are days 4 and 5 sig values (0.000) ($p <0.05$) which means turmeric mouthwash with a concentration of 2.5% and 5% effective in reducing gingivitis marginalis evidenced by graph two concentration of 5% effective in reducing gingivitis marginal compared to concentration 2.5% in graph 2.

Table 3. Independent test t-test difference in gingivitis marginalized between gargling turmeric concentration 2.5% and formula without active ingredients

Changes in the gingival index after treatment for five days	Concentration 2,5%		FTBA		Sig
	Mean±SD	Difference (Δ)	Mean±SD	Difference (Δ)	
Day to 1	0,97±0,16	0,00	0,84±0,21	0,00	0,901
Day to 2	0,97±0,16	0,00	0,84±0,21	0,00	0,901
Day to 3	0,97±0,16	0,00	0,84±0,21	0,00	0,901
Day to 4	0,77±0,15	1,80	0,84±0,21	0,00	0,044
Day to 5	0,57±0,15	3,70	0,84±0,21	0,00	0,000

Table 3 shows that on days 1 to 3, with a concentration of 2.5% compared to formulas without active ingredients sig values (0.901), there was no significant difference in marginal gingivitis (p>0.05). On day four, there was a decrease in marginal gingivitis, and there was a significant difference with the control group of formulas without active ingredients with sig (0.044) due (p<0.05). On day 5 there was a decrease in marginal gingivitis and there was a significant difference with the control group formula without active ingredients with sig values (0.000) due (p<0.05). It was evidenced by graph one at a concentration of 2.5% effective in reducing gingivitis marginal compared to formulas without active ingredients in reducing gingivitis marginalized in graph 3.

Table 4. Independent t-test difference in gingivitis marginal values between turmeric gargle concentration of 5% and formula without active ingredients

Changes in the gingival index after treatment for five days	Concentration 5%		FTBA		Sig Mean±SD
	Mean±SD	Difference (Δ)	Mean±SD	Difference (Δ)	
Day to 1	1,34±0,24	0,00	0,84±0,21	Day to 1	1,34±0,24
Day to 2	1,34±0,24	0,00	0,84±0,21	Day to 2	1,34±0,24
Day to 3	0,73±0,16	5,50	0,84±0,21	Day to 3	0,73±0,16
Day to 4	0,38±0,16	8,60	0,84±0,21	Day to 4	0,38±0,16
Day to 5	0,16±0,86	10,60	0,84±0,21	Day to 5	0,16±0,86

Table 4 shows that on days 1 to 2 with a concentration of 5% compared to formulas without active ingredients sig values (0.003), there was a significant difference in marginal gingivitis (p>0.05). On day three, there was a decrease in marginal gingivitis, and there was a significant difference with the control group of formulas without active ingredients with sig (0.011) due (p<0.05). On days 4 and 5, there was a decrease in marginal gingivitis, and there was a significant difference with the control group formula without active ingredients with sig values (0.000) due (p<0.05). It was evidenced by graph two at a concentration of 5% effective in reducing gingivitis marginal compared to the formula without active ingredients in graph 3.

Table 5. Test One Way Anova

Changes in the gingival index after treatment for five days	Sig
Day to 1	0,001
Day to 2	0,001
Day to 3	0,006
Day to 4	0,000
Day to 5	0,000

Table 5 shows that on days 1 and 2 between the treatment group turmeric extract mouthwash and the control group, the formula without the active ingredient had a sig 0.001, meaning that there was a significant difference between the treatment group and the control group in reducing marginal gingivitis. On day three, between the treatment

group turmeric extract mouthwash and the control group, the formula without the active ingredient had a sig 0.006, meaning that there was a significant difference between the treatment group and the control group in reducing marginal gingivitis. On days 4 and 5, between the treatment group turmeric extract mouthwash and the control group, the formula without the active ingredient had a sig 0.000, meaning that there was a significant difference between the treatment group and the control group in reducing marginal gingivitis.

Table 6. Post Hoc Test

Changes in the gingival index after 5-day treatment	I (Group)	J (Group)	Sig
Day to 1	2,5%	5%	0,003
		Formula without active ingredients	1,000
	5%	2,5%	0,003
		Formula without active ingredients	0,002
	Formula without active ingredients	2,5%	1,000
		5%	0,002
Day to 2	2,5%	5%	0,003
		Formula without active ingredients	1,000
	5%	2,5%	0,003
		Formula without active ingredients	0,002
	Formula without active ingredients	2,5%	1,000
		5%	0,002
Day to 3	2,5%	5%	0,014
		Formula without active ingredients	1,000
	5%	2,5%	0,014
		Formula without active ingredients	0,019
	Formula without active ingredients	2,5%	1,000
		5%	0,019
Day to 4	2,5%	5%	0,000
		Formula without active ingredients	0,000
	5%	2,5%	0,087

	5%	Formula without active ingredients	0,000
		2,5%	0,000
Formula without active ingredients		5%	0,000
		5%	0,000
	2,5%	Formula without active ingredients	0,903
		2,5%	0,000
Day to 5	5%	Formula without active ingredients	0,001
		2,5%	0,903
Formula without active ingredients		5%	0,001

**Independent T-Test **One Way Anova ***PostHoc LSD*

Table 6 above shows that the significant value on day one and day two between the 2.5% and 5% turmeric mouthwash groups was 0.003, meaning that there was a significant difference (p <0.05) between the two concentration turmeric mouthwash groups .5% and the formula without active ingredients had a sig value of 1.000 meaning that there was no significant difference (p>0.05), 05). The significance value on day three between the 2.5% and 5% turmeric mouthwash group was 0.014, meaning a significant difference (p <0.05) between the 2.5% turmeric mouthwash group and the formula without active ingredients. Sig 1.000 means no significant difference (p>0.05) between the 5% concentration of turmeric mouthwash and formula without active ingredients. The sig value of 0.019 means a significant difference (p<0.05). Significance value on day four between the turmeric mouthwash group, the turmeric mouthwash group with a concentration of 5% and 2.5%, a sig value of 0.087, meaning that there was no significant difference (p>0.05), in the turmeric mouthwash group with 5% concentration and formula without the active ingredient the sig value of 0.000 means that there is a significant difference (p<0.05), the significance value on day five between the 2.5% and 5% turmeric mouthwash group is 0.000 meaning there is a significant difference (p<0, 05), between the 2.5% concentration of turmeric mouthwash group and the formula without active ingredients, the sig value was 0.903, meaning that there was no significant difference (p>0.05), between the 5% concentration of turmeric mouthwash group and the formula without active ingredients, the sig value 0.001 means that there is a significant difference (p <0.05).

Discussion

The results of data collection are obtained in table 1. Namely, the average value of treatment every day of giving turmeric mouthwash with a formula without active ingredients had the same mean value before and after the treatment of turmeric mouthwash, a concentration of 2.5%, namely on days 1-3 and a concentration of 5% on

days 1 and 2, while formulas without active ingredients on days 1-5 mean that there has not been a decrease in gingivitis marginalized. After the treatment of turmeric mouthwash concentration of 2.5%, there was a decrease in gingivitis on days 4 and 5, at a concentration of 5%, there was a decrease in gingivitis on days 3-5.

The effectiveness of giving turmeric extract herbal mouthwash (Curcuma longa) with a concentration of 2.5%, 5% and a formula without active ingredients reduces gingivitis marginalized. In the results of data collection, ANOVA tests showed that the ability of turmeric mouthwash concentrations of 2.5%, 5% and formulas without active ingredients had significant differences, namely on days 1 and 2, the sig value was 0.001, on day three, the sig value was 0.006, on days 4 and 5 the sig value was 0.000. This concentration is classified as reducing gingivitis marginalized. Following Augustina's research, 2019 states that a turmeric concentration of 1% shows promising results for reducing inflammation in the gingiva (Augustina et al., 2019).

At concentrations of 2.5% and 5%, the formula without active ingredients was better compared to the control group. The effect of concentration indicates the concentration and amount of solutes contained in the mouthwash. The higher the concentration, the greater the number of active ingredients contained in it, so the more significant the strength of the preparation that can have an effect, especially against plaque bacteria. The decrease in the gingival index at these two concentrations shows that the content in turmeric extract is excellent in reducing inflammation in the gums. This is due to the mechanism of action of turmeric content, namely essential oils, phenols, flavonoids, tannins, and saponins. The mechanism of action of the active compound is as follows:

Essential oil

Essential oils contain monoterpene and sesquiterpene compounds, and yellow dyes called curcuminoids, phosphorus, protein, iron, potassium, and Vitamin C (Wibowo, 2015). SIt can denature and destroy the cytoplasmic membrane of the cell. Unstable cell walls and bacterial cytoplasmic membranes will interfere with the permeability, active transport function, and protein control of bacterial cells. The impaired cytoplasmic integrity will cause bacterial cells to undergo lysis.

Fenol

Fenol dapat mendenaturasi protein pada bakteri sehingga sel bakteri akan mengalami kerusakan. Kerusakan sel bakteri ini terjadi akibat penurunan permeabilitas dinding sel bakteri yang menyebabkan pertumbuhan sel terhambat dan akhirnya akan menyebabkan sel mati. Kumara

Flavonoids

Flavonoids can cause damage to bacterial cell walls. The damaged bacterial cell wall will cause an increase in cell membrane permeability so that fluid from outside the cell enters the cell and results in the rupture of the bacterial cell.

Tannin

Tannins can form hydrogen bonds with bacterial cell proteins. If tannin levels succeed in forming hydrogen bonds with bacterial cell proteins, it will cause changes in bacterial cell protein molecules. Changes in these protein molecules can disrupt bacterial cell metabolism.

Saponin

Saponins can increase cell membrane permeability so it becomes unstable, and cell hemolysis occurs. Saponin levels also can disrupt the surface tension of bacterial cell walls. When the surface tension of the bacterial cell wall is disturbed, other antibacterial compounds can quickly enter the bacterial cell and disrupt cell metabolism resulting in bacterial death (Mutiah, 2015).

In line with research from Munasyifan 2017 states that a concentration of 2.5% can reduce the number of polymorphonuclear leukocyte cells in the healing process of gingivitis Rattus norvegicus (MUNASYIFA, 2017). Research from Tang, 2021 states that turmeric significantly reduces gingival inflammation and modulates collagen fibres and alveolar bone loss in vivo (Tang et al., 2021). According to research from Personal, 2016 states that a concentration of 5% can decrease gingivitis (Pribadi et al., 2016). Scientific studies reveal that turmeric is a potent agent in managing and preventing pain and inflammation, associated with antioxidant, anti-inflammatory, analgesic, antimicrobial, and neuroprotective effects (Razavi et al., 2021) A review of therapeutic potentials of turmeric (Curcuma longa) and its active constituent, curcumin, on inflammatory disorders, pain, and their related patents. Research from Majeed, 2020 states that turmeric (Curcuma longa) is also proven to have potential benefits in relieving pain and healing patients with aphthous ulcers and gingivitis. The research that is not in line with the research from the kumara study 2019 states that turmeric extract concentrations of 5%, 10%, 20%, and 40% cannot inhibit the growth of Streptococcus mutans bacteria (Rasyadi, 2018). This is because drying with direct sunlight causes a reduction in the content of active compounds contained in the extract, while the research I did was drying by not being directly exposed to sunlight so that the turmeric extract content is maintained.

The results of reducing the gingival index after rinsing with 2.5% and 5% turmeric extract did not cause the gingiva to heal from inflammation because as long as the tooth surface still has accumulated plaque, the effect of the activity of the turmeric extract content can only reduce the severity. In contrast, the formula without the active ingredients cannot reduce gingivitis because the ingredients contained in this formula do not have active compounds as antibacterial. The main action in dealing with marginal gingivitis due to plaque is by mechanical means such as tooth brushing. Turmeric extract mouthwash can be used as a complement after brushing teeth. Cleaning the mouth with the use of turmeric mouthwash can clean food debris found between the teeth so that inflammation of the gingiva can decrease. The way turmeric works as an antibacterial and anti-inflammatory can reduce inflammation of the gingiva. Based on the discussion

above, turmeric extract mouthwash is recommended as one of the natural ingredients that can be used to reduce gingivitis marginalized. Besides that, getting turmeric plants is relatively easy because they can thrive in tropical countries. Turmeric extract (Curcuma longa) also has no side effects.

CONCLUSION

This study concludes that turmeric extracts and herbal mouthwash effectively reduce marginal gingivitis. At a concentration of 2.5%, gingivitis marginalis decreased on days 4 and 5. At a concentration of 5%, gingivitis marginalis decreased on days 3, 4, and 5, while the most effective mouthwash preparation in reducing gingivitis marginalized was at a concentration of 5%.

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