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CURCUMA DOMESTICA AND MORINGA OLEIFERA EXTRACT GEL AS AN ALTERNATIVE FOR GINGIVAL BRIGHTENING: A PILOT STUDY

Devy Anugraeni Pratiwi[1], Nadya Rismawati[1], Tsuraya Bilqis[1], Rahma Dwi Fitriyani[1], Elya Mardhania Tiara Dewi[1], Ayuda Nur Sukmawati[2]

1. Undergraduate Students, Faculty of Dentistry, Universitas Muhammadiyah Semarang
2. Department of Periodontics, Faculty of Dentistry, Universitas Muhammadiyah Semarang

Correspondence: devyanugraeni@gmail.com

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ABSTRACT

Background: Gingival hyperpigmentation can occur in active smokers with high frequency. The current treatment is surgical. Therefore, researchers found a new breakthrough by creating a minimally extensive treatment, namely gel preparations. Combination of turmeric *(Curcuma domestica)* and moringa leaf *(Moringa oleifera)* extract that has the potential as a tyrosinase enzyme inhibitor. The extract will be made in a gel preparation. This study aims to determine the most optimal concentration of the gel.
Methods: This study used an experimental method. The gel preparation was made with various concentrations of turmeric extract and moringa leaf extract, namely F1 0.1%: 2%, F2 0.5%: 4% and F3 0.9%: 6%. Followed by testing the physical and chemical properties. Chemical properties in the form of pH, physical properties in the form of organoleptic, homogeneity, adhesiveness and spread ability by measuring the diameter of TB (No Load), B50 (Load 50 g), B100 (Load 100 g) and B150 (Load 150 g).
Results: The results showed that F1, F2 and F3 were homogeneous with dark brown colour, distinctive smell of moringa leaves and increasingly dilute form with each additional concentration with pH (F1) 7.99, (F2) 7.71 and (F3) 7.58. The spread ability of gel preparation F1 (TB) 2.7, (B50) 2.8, (B100) 2.9, (B150) 3.1; F2 (TB) 2.8, (B50) 3.1, (B100) 3.3, (B150) 3.5 and F3 (TB) 4.2, (B50) 4.6, (B100) 4.7, (B150) 5.1 based on these observations it is known that F3 meets the criteria for spread ability at a load of 150 gr.
Conclusion: Based on this study, it can be concluded that F3 gel, a combination of turmeric extract and moringa leaf extract, has the most optimal formula because it almost meets all the requirements for gel preparations.

INTRODUCTION

Smoker's melanosis is a type of gingival hyperpigmentation that clinically appears as spots that spread, are uneven and are blackish brown in the oral cavity tissue. Smoker melanosis can occur due to the heat effect caused by cigarette smoke that is inhaled continuously on the oral tissue or the direct

effect of nicotine that stimulates melanocytes that are usually located along the basal cells of the epithelium. Melanocytes in the basal cells of the epithelium produce melanomes, resulting in increased melanin deposition and pigmentation in the oral cavity tissue.[1] Smoker's melanosis a harmless and reversible abnormality, but if left untreated it can interfere with appearance. Melanin pigmentation in gingiva creates unaesthetic smile which requires depigmentation procedure to enhance the aesthetics.[2]

Gingival depigmentation is one of the periodontal surgical procedures to treat gingival hyperpigmentation. Gingival depigmentation procedures consist of gingivectomy, abrasion with diamond burs and the use of 90% phenol chemicals.[3] Gingival depigmentation has several risks such as bleeding, pain in the oral cavity tissue, keratinocyte inflammation and burning sensation in the use of 90% phenol. From these risks, a gingival depigmentation medication is needed that is easy to use, painless and non-invasive.

Indonesia has a variety of medicinal plants that play a role in melanogenesis activity. Turmeric (Curcuma domestica) is a traditional plant that is efficacious with its main component curcumin. Curcumin contains phenolic compounds that act as antioxidants and melanogenesis inhibitors.[4] This research is also supported by the creation of gingival patches of turmeric extract in patients with gingival hyperpigmentation and has been proven to be able to reduce the amount of melanin in the gingiva.[5]

One of the plants that has the potential as a medicinal plant is Moringa. The Moringa plant (Moringa oleifera Lam) has been known for centuries as a multipurpose plant that is dense in nutrients and has medicinal properties. Moringa oleifera lam leaf extract contains quercetin with strong affinity for the target protein tyrosinase.[6] Besides that, Dried Moringa leaves contain 7 times more Vitamin C than oranges. Vitamin C acts as a depigmentation agent through the mechanism of reducing melanin pigmentation by reducing tyrosine activity, so that it can reduce the precursor of melanin synthesis (dopaquinone).Vitamin C has also been used as a non-surgical gingival depigmentation agent and has been shown to be effective in the treatment of mild gingival hyperpigmentation.[7]

Based on the research, both plants have the potential as gingival depigmentation materials. In this study, the manufacture of "Black to Pink Gel" will be carried out, namely a combination gel of turmeric *(Curcuma domestica)* and moringa leaf *(Moringa oleifera)* extract using various concentrations. The gel preparation was chosen because it is easy to apply and feels cool when used. After making the gel, an evaluation of the gel preparation was carried out by observing the physical properties consisting of organoleptic tests, homogeneity tests, adhesion tests and spread ability tests, while the pH test was carried out to determine the chemical properties of the gel. Evaluation of the preparation was carried out to determine the stability of the gel preparation formula. The goal of this research is to create a gingival depigmentation agent in gel preparation as a home-care treatment for

smokers' melanosis sufferers. It is expected that this study will obtain one formula with the best physical and chemical properties of the gel preparation.

RESEARCH METHOD

Tools and materials

The tools used in this study were Rotary evaporator, water bath, mesh no.60, gram scale, bunsen, dropper, sterile tweezers, beaker glass, glass plate, laboratory funnel, mortar and pH meter. The materials used in this study were turmeric rhizome simplicia, moringa leaf simplicia, Carbopol, propylene glycol, triethanolamine, methyl paraben, EDTA, propyl paraben, 96% ethanol and 70% ethanol. Sampling of turmeric rhizome simplicia was carried out at the Tawangmangu Herbal Medicine Center, Karanganyar, Central Java and moringa leaf simplicia from Gubuk Herbal Indonesia Surakarta.

Research Procedures

Making Turmeric Rhizome Extract *(Curcuma domestica)* and Making Moringa Leaf Extract *(Moringa oleifera)*

Up to 2 kg of turmeric rhizome simplisia was ground and sieved into powder with mesh no. 60. The powder weighed as much as 40 grams which was then subjected to the Soxhlet extraction process with 96% ethanol solvent as much as 400 mL. The results of the extraction process obtained 350 mL of liquid extract which was then evaporated at a temperature of 600 C in 3 days. The extract obtained was made into a concentration of 45%. Gel making used extract concentrations of 0.1%, 0.5%, and 0.9% from the 45% extract taken by micropipette. [8,9]

Next, the making of moringa leaf extract. Extraction is done by weighing 2 kg of moringa leaf powder then macerated with 70% ethanol (1:5), protected from light for 3 days. The macerate is separated from the pulp by filtration and the residue is re-macerated. The filtrate is evaporated using a rotary evaporator at a temperature of 70ºC for 6 hours per day for 5 days. Then, it is evaporated using a rotary evaporator at a temperature of 700C̊ and a speed of 60 rpm. The semi- thick extract is put into a porcelain cup and evaporated over a water bath.[8,10]

Making gel from turmeric extract *(Curcuma domestica)* and moringa leaf extract *(Moringa Oleifera)*

Table 1. Gel Formulation[9, 10,11]

Material	Concentration			
	K (-)	**F1**	**F2**	**F3**
Turmeric Extract	-	0.1%	0.5%	0.9%
Moringa Extract	-	2%	4%	6%
Carbopol	1%	1%	1%	1%
Propylene Glycol	15%	15%	15%	15%
TEA	3%	3%	3%	3%
Nipagin	0.1%	0.1%	0.1%	0.1%
Propyl Paraben	0.02%	0.02%	0.02%	0.02%
EDTA	0.03%	0.03%	0.03%	0.03%
Ethanol	0.1%	0.1%	0.1%	0.1%
Aquadest	100 ml	100 ml	100 ml	100 ml

All components of the formula were weighed. Carbopol 940 was soaked in water overnight to swell. The gel base (mass 1) was prepared by gradually neutralizing the formula using triethanolamine while stirring using a homogenizer. Methyl paraben was dissolved in propylene glycol (mass 2). Masses 1 and 2 were mixed until homogeneous using a homogenizer (mass 3). Turmeric rhizome and moringa leaf extracts were added to mass 3, followed by the remaining distilled water. The mixture was homogenized using a homogenizer at optimal speed and duration. This process was repeated three times with the best extract concentration. Furthermore, a series of tests were carried out on the resulting gel. Gel tests include:

Organoleptic Test

Organoleptic testing is an observation made on the shape, color and aroma of the preparation made.[12]

Homogeneity Test

The homogeneity test of gel preparation is done using two glass objects, where the preparation is placed and placed on one of the glass objects. The criteria for quality preparation are marked by uniformity of composition (homogeneity) and the absence of lumps or insoluble particles.[13]

Adhesion Test

The adhesion test is carried out to assess the adhesion strength of the gel preparation being tested. The adhesion test is carried out by placing 0.5 grams of the preparation in the center of the object glass and the preparation is covered with another object glass. A load of 1 kg is placed on the object glass for 5 minutes, the object glass is attached to the test tool with a load of 80 grams. The adhesion time is the time required to separate the 2 object glasses until they are separate. Good adhesion to the gel preparation if the duration of adhesion is >1 second.[14]

Spread Power Test

Spread ability tests are conducted to assess how far the preparation can spread when applied. This is an important indicator of the quality of topical preparations. A 0.5-gram preparation is placed between two clear glass objects and given a load of 150 grams. The diameter of the spread ability formed is measured after the preparation stops spreading or is left for 1 minute. A good spread ability of the preparation is 5-7 cm.[14]

pH Test

pH measurement is carried out to determine the acidity level of the preparation and ensure the safety of use on the skin to avoid irritation. The pH test is carried out using a pH meter by weighing 0.5 grams of the combination gel preparation of turmeric and moringa leaf extracts and dissolving it in 5 mL of distilled water and then stirring until evenly mixed. Then, the pH meter is dipped into the solution and the results are recorded. The pH value of gel, emulsion and emulgel preparations that are good for the skin and meet the requirements according to SNI 16-3499-1996 is 4.6-8.[12]

RESEARCH FINDINGS

Gel Evaluation

Table 2. Evaluation Results of Combination of Curcuma domestica and Moringa Oleifera Extract Gel

Gel Evaluation	Results		
	F1	F2	F3
Organoleptic			
Form	Gel (Thick)	Gel (A bit thick)	Gel (A bit runny)
Color	Dark brown	Dark brown	Dark brown
Smell	The distinctive smell of Moringa	The distinctive smell of Moringa	The distinctive smell of Moringa
Homogeneity	Homogeneous	Homogeneous	Homogeneous
Adhesion	1.33 s	1.05 s	0.98 s
Spread Power			
TB (0 grams)	2.7 cm	2.8 cm	4.2 cm
B1 (50 grams)	2.8 cm	3.1 cm	4.6 cm
B2 (100 grams)	2.9 cm	3.3 cm	4.7 cm
B3 (150 grams)	3.1 cm	3.5 cm	5.1 cm
pH	7.99	7.71	7.58

Organoleptic Test

In table 2 and figure 1, the organoleptic test of the combination gel preparation of turmeric extract and moringa leaf extract can be seen. Based on the results of organoleptic observations, the gel preparation produces the same shape, color, and odor in the three gel preparation formulations. The gel is semi-solid, dark brown in color and has a distinctive moringa odor. The resulting dark brown

color can be caused by the combination of curcumin in turmeric and chlorophyll in moringa leaves. The distinctive odor of moringa leaves is caused by the concentration of moringa leaf extract being higher than the concentration of turmeric extract.

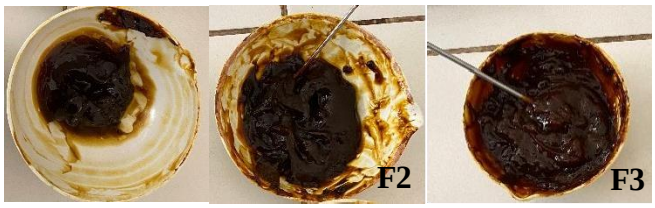

Figure 1. Organoleptic Testing of the gel

Homogeneity Test

In Table 2 and Figure 2, the results of the homogeneity test of the combination gel preparation of turmeric extract and moringa leaf extract can be seen. Based on homogeneity observations, the three gel preparation formulas of the combination of turmeric extract and moringa leaf extract have good homogeneity properties and there are no coarse particles that clump. These results are in accordance with the homogeneity standards of gel preparations.

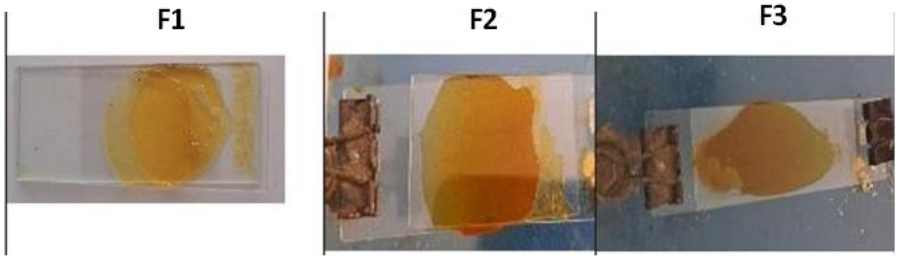

Figure 2. Homogeneity Test of the gel

Information:

F1 : Homogen

F2 : Homogen

F3 : Homogen

Adhesion Test

In table 2 and Figure 3, the adhesion test of the combination gel preparation of turmeric extract and moringa leaf extract can be seen. According to Irianto (2020), the best gel adhesion is> 1 second. Based on the results of the adhesion test, formulations 1 and 2 have better adhesion compared to formulation 3.

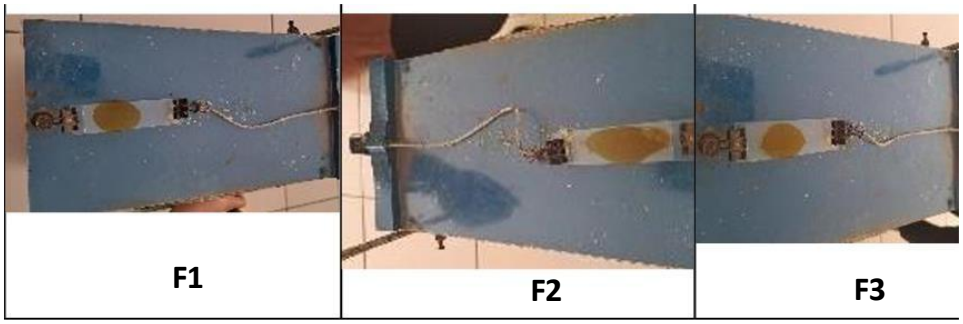

Figure 3. Adhesion Test of the gel

Spread Power Test

In table 2 and Figure 4, the spread ability test of the combination gel preparation of turmeric extract and moringa leaf extract can be seen. Based on the results of observations, the spread ability of the gel on D4 has a value of F1 (3.1 cm), F1 (3.5 cm) and F3 (5.1 cm).

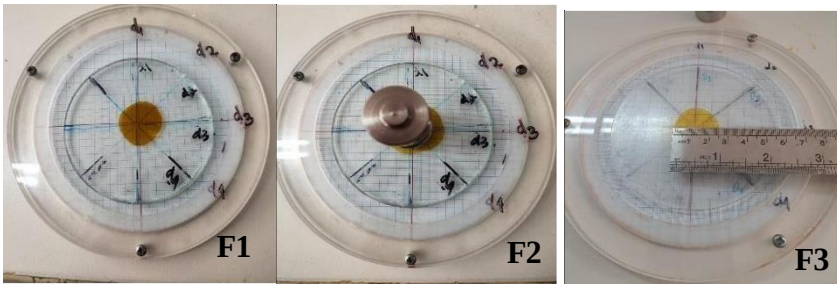

Figure 4. Spread ability Test of the gel

pH Test

Based on the results of the pH gel test, the pH ranged from 7.5 to 7.9. The pH value of the gel preparation combining turmeric extract and moringa leaf extract tended to decrease as the concentration of moringa leaves decreased.

DISCUSSION

Curcuma Domestica and Moringa Oleifera Gel as A For Gingival Brightening

Color changes in the gingiva cannot be separated from the melanin content in the cells. Tyrosinase is an enzyme that catalyzes chemical reactions in the process of melanin formation and plays a role in the hyperpigmentation process.[15] In the case of active smokers, gingival pigmentation is caused by the nicotine and benzopyrene content in cigarette smoke which stimulates excessive melanin production from melanocytes.[16] Therefore, a tyrosinase inhibitor is needed to inhibit the melanogenesis process. Some compounds that have tyrosinase inhibitor activity in plants are simple phenolic derivatives, flavonoids, anthocyanidins and curcuminoids.[17]

The use of herbal ingredients is necessary for the development of medicinal products because they have minimal side effects. Curcuma domestica and Moringa oleifera have active ingredients that

have the potential to act as tyrosinase inhibitors. Curcuma domestica contains several compounds such as terpenoids, flavonoids, saponnins, essential oils, alkaloids, terpenoids and curcuminoids.[11] Curcuminoid compounds consist of curcumin, dimethoxy curcumin, desmetoxy curcumin, triethyl curcumin, and bisdemethoxy. More curcumin compounds are produced in the extraction process using the soxhletation method compared to maceration.[18] Curcuminoids bind to free enzymes and enzyme-substrate complexes and act as competitive-noncompetitive mixed type II inhibitors. This potent analog serves as a novel tyrosinase inhibitor with potential for the prevention and treatment of pigmentation disorders.[19]

Moringa oleifera contains ß-carotene, tocopherolic acid, phenolics, hydroxynamic acid, carotenoids, derivatives, flavonoids and vitamin C. The content of these antioxidant compounds means that Moringa leaves can be developed as an herbal ingredient for whitening. Quercetin is a flavonoid compound that is most found in Moringa oleifera. Quercetin has been proven to have anti-tyrosinase activity through in-silico and in-vitro assays.[6] Apart from that, vitamin C has also been used as a non-surgical gingival depigmentation agent via injection. This vitamin is an essential nutrient for the biosynthesis of collagen, L-carnitine, and the conversion of dopamine to norepinephrine. Vitamin C interacts with copper ions in the active site of tyrosinase and inhibits the action of the tyrosinase enzyme (the rate-limiting enzyme required for melanin biosynthesis), thereby reducing melanin formation.[7]

Physical Properties Combination of Curcuma Domestica and Moringa Oleifera Gel

Organoleptic

Organoleptic testing involves the five senses to observe the shape, color, and odor of the gel preparation. This test needs to be done because it is related to comfort when using gel. Based on the results of organoleptic observations of the gel shows that the higher the concentration of the extract, the thinner the resulting preparation. This is not in accordance with the research conducted (Handayani 2019) that the higher the concentration of the extract, the thicker the resulting preparation because the added extract is a thick extract.[20] The cause of this difference is that the added moringa leaf extract is a semi-thick extract, mixing and stirring the ingredients when making the gel can also affect the texture of the gel preparation.[20,21] The color produced from the gel preparation is dark brown, while the smell of the gel preparation has a distinctive smell of moringa leaves.

Homogeneity

To ensure that the ingredients used in the gel preparation have been mixed well, a homogeneity test is performed. This level of homogeneity affects the spread ability of the gel preparation on the

gums[22] The gel preparation must have a compatible mass. A compatible gel preparation is characterized by the absence of coarse granules in the preparation, an even color and spread evenly when applied.[23] Based on Table 2, it is shown that the three formulas are homogeneous. Thus, it is known that the three formulas with different concentrations of turmeric extract and moringa extract show no difference in homogeneity. This shows that the procedure for making the gel preparations of the three formulas carried out is appropriate.

Adhesion

Adhesion testing is done to determine the adhesion ability of the Combination of Curcuma domestica and Moringa Oleifera Extract gel in the application area. If the preparation bond lasts longer on the skin, then the preparation has better adhesion.[20]Judging from Table 2, the preparation shows a decrease in adhesive power from F1>F2>F3. The adhesive power standard is >1 second. F1 and F2 meet the requirements. The test results show that the higher the adhesive power, the lower the spread ability value of the gel preparation and vice versa, the lower the adhesive power value, the higher the spread ability value of the gel preparation.

Spread Power

Spread ability test is used to measure the ability of gel preparation to spread throughout the skin surface. The ability of gel to spread can affect the level of absorption and release of active ingredients.[24] The standard criteria for consistency and spread ability of gel preparations are expected to be owned by each gel preparation. Gel with a smooth viscosity makes the gel easy to absorb, easy to apply and feels soft when used. The thickness of the gel is related to its spread ability and viscosity.[25]

Based on the results of the F1, F2 and F3 spread ability tests, they have varying spread ability criteria. The best spread ability standard is 5-7 cm. The best spread ability is found in F3, which is 5.1. This figure shows a better value compared to the spread ability of both F1 and F2. The higher the spread ability, the higher the ability to spread the active substance and the wider the gel that is in contact.

Chemical Properties of pH testing

pH measurement is done to determine the acidity level in the gel preparation. The purpose of this test is to determine the pH of the gel that is safe to be applied to the oral mucosa. The acidity level of the oral cavity in normal conditions is between pH 6.8 - 7, while the pH of saliva crisis is 5.5.[26] The pH value of the gel should not be too basic or too acidic. Gels that are too alkaline can cause dry oral mucosa, while gels that are too acidic can cause irritation to the oral cavity.

In Table 2, the Combination of Curcuma domestica and Moringa Oleifera Extract gel shows that the pH value decreases if the concentration of turmeric extract and moringa leaf extract is smaller. This

is because the turmeric extract has a pH of 6.56 while moringa leaf extract has a pH of 6. The measurement results of F1, F2 and F3 have a pH close to neutral and have met the requirements even though there are changes with increasing concentration. This illustrates that the gel has a safe pH in the oral mucosa.

CONCLUSION

Based on the results that have been carried out on the Combination of Curcuma domestica and Moringa Oleifera Extract gel, it can be concluded that the most optimal formulation and close to the physical and chemical properties requirements is (F3) with a concentration of 0.9%: 6% although the adhesive power is still below standard. While for (F1) with a concentration of 0.1%: 2% and (F2) with a concentration of 0.5%: 4% do not meet the standards of spread ability and pH value. Suggestions for further research are to test the gel preparation with variations in gelling agent materials, to test the acceptability of the gel preparation to see the comfort of the gel when used and to conduct further tests to determine the tyrosinase inhibitor activity of the gel preparation as a gingival pigmentation material.

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