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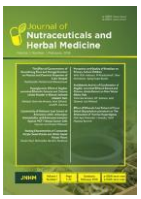

Development of Herbal Toothpaste Formulation with Combination of Binahong and Stevia (Stevia Rebaudina) Leaves Extract and Lemon Juice

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Abstract

Toothpaste is the most important thing for oral health. A common problem that is susceptible to society is dental caries caused by Streptococcus mutants. Stevia leaves are widely used as a natural sweetener for food and beverage products that have low calories and are beneficial for health. Binahong leaves have traditional medicinal properties such as antibacterial. The content of vitamin C on the skin of a lemon has the potential to whiten teeth and prevent thrush. These three natural ingredients are used to make toothpaste. This research aims to make an effective and safe herbal toothpaste using a combination of stevia leaf extract, binahong leaf, and lemon peel flavoring. Binahong leaf extract is taken by a maceration method with a storage period of 7 days, stevia leaf 5 days, and lemon peel 3 days. The volumes of stevia leaf extract, binahong leaf and lemon peel used for each formulation were 0 ml, 0.5 ml, 1 ml, and 1.25 ml. To obtain toothpaste that has efficacy and safety, a series of tests are carried out starting from the organoleptic test, homogeneity test, spreadability test, and pH test. The pH of the toothpaste produced during the three weeks of testing fulfilled the SNI standard (12-3524-1995), which was 8.08-8.69 while the spread of toothpaste was quite good when applied to a toothbrush.

***Keywords**:* stevia leaf, binahong leaf, lemon peel, extraction, toothpaste.

INTRODUCTION

Oral and dental health is no less important to the health of other parts of the body because the mouth and teeth are an important part of conducting a daily social activity that can affect self-confidence, besides, the mouth is the main door of entering all sorts of foreign bodies into the body (Nurdiati, et al., 2016).

Toothpaste is a semi-solid material that is used together with a toothbrush to clean the whole teeth (Khairi, et al., 2016). Toothpaste used at the time of brushing teeth serves to reduce the formation of plaque, strengthening the teeth against caries. Dental caries problems continue to increase in developing and backward countries (Teltrandhe, et al., 2017). The addition of herbs to toothpaste is expected to inhibit plaque growth. It is related to the ability of several types of herbs that can inhibit

microbial growth. In addition, because herbs are derived from plants, it is hoped that the material is safe and natural. It is expected that herbal toothpaste derived from plants can be used as an antiplaque to maintain dental hygiene (Bhat, et al., 2015, Warnida et al., 2016).

Stevia belongs to the family Asteraceae which contains stevioside glycosides and Rebausida that have a sweetness range of 300-400 times that of sucrose. This plant is native to Paraguay and in 2018 in Indonesia, it has been used as sweetener and flavorings of food and beverages instead of several synthetic sweeteners (Bhutia and Sharangi., 2016).

Other additives that can be used in the manufacturing of toothpaste are Binahong leaves. Binahong leaves contain ascorbic acid (vitamin C), where acids can increase the body's resistance to infections (Wijayanti and Esti., 2017). It also has the efficacy of traditional medicine with its antibacterial properties (Paju et al., 2013). Binahong leaves are herbs containing antibacterial compounds such as flavonoids, alkaloids, terpenoids, and saponins. The active compounds of flavonoids can act directly as antibiotics against microorganisms such as bacteria and viruses. Binahong also contains active antimicrobial so that it can be used in preventing the growth of bacteria (Warokka et al., 2016). In Virginia et al (2019) Binahong can also be useful as a cytotoxic or drug that kills cancer cells.

The content of vitamin C on lemon peel can also potentially whiten teeth and anti (Nurdianti, et al., 2016). Research has proven the benefits of lemon peel as an antifungal and antibacterial that can be used in the field of dentistry. The compounds of flavonoids, hesperidin, and pectin are more widely found in lemon peel extracts (Parmadianti, et al., 2017).

From the background above, this research is beneficial in contributing to the sciences, especially pharmaceutical and medical, and at a later stage will be very beneficial for the community for health and hygiene of oral and dental, given you have developed a combination of Herbal toothpaste formulation Binahong and Stevia leaf extract (Stevia Rebaudina) with lemon juice taste.

METHODS

Research was conducted using experimental Research laboratory type in chemical engineering laboratories of Universitas Muhammadiyah Surakarta. Using 3-factor variables, namely the concentration of Binahong extracts (0%, 0.5%, 1% and 1.5%), stevia extract concentrations (0%, 0.5%, 1% and 1.5%) and the concentration of lemon peel fruit extract (0%, 0.5%, 1% and 1.5%). Each dosage was subjected to four remedies with each having three repetitions.

1. SAMPLE AND EXTRACT PREPARATION

The maceration of the leaf Binahong was based on the research of Paju DKK (2013), which is 350 grams of powdered binahong soaked by using a 96% ethanol solvent of 2575 ml for 5 days in a chemical glass with occasional stirring. After 5 days, using filter paper, debris I, and filtrate I was separated. Then, the debris was immersed again using 925 ml ethanol (96%) for two days with occasional stirring. Then debris II and filtrate II were separated using filter paper. Filtrate I and Filtrate II were merged and filtered back to ensure that there is no debris involved and to

obtain the total macerated binahong leaves. Later, the leaves were evaporated using the evaporator vacuum.

The clean stevia leaves were sifted with the 40-mesh sieve. A total of 150 grams of simplicia powder of stevia leaf was macerated with a 70% ethanol solvent in 1500 ml for 5 days. Later, the extract was evaporated by the evaporator in the rotary deviation until the concentrated extract was obtained.

50 grams of lemon peel was macerated for 3 days with a 500 ml ethanol solution (96%). After that, the lemon peel extract is evaporated in the rotary vacuum, at 80 °c until the extract is reduced.

2. Making toothpaste preparations

Na-CMC was sown in hot water and then allowed to stand for 15 minutes to form a homogeneous mixture, to facilitate the making of pasta (mass 1). Stevia leaf extract, binahong, and lemon peel were dissolved using distilled water plus nipagin and stirred until homogeneous (mass 2). Calcium carbonate (CaCO3) was added little by little to 25 ml of glycerin and stirred at a constant speed until homogeneous (mass 3). Mass 1 was added to mass 2, added to mass 3, and stirred until homogeneous until a paste mass was formed (F0 without stevia leaf extract, binahong leaf, and lemon peel). Sodium lauryl sulfate was then added to F0, F1, F2, and F3 stirring at a low speed to avoid foam formation, resulting in the formation of a homogeneous mass of paste. The resulting toothpaste preparation was finally put into a container. Table 1 shows the toothpaste formulations made.

Tabel 1. Toothpaste formulations

Material (g)	**F0**	**F1**	**F2**	**F3**
Na-CMC	1,5	1,5	1,5	1,5
Stevia extract*	0	0,5	1	1,5
Binahong extract*	0	0,5	1	1,5
Lemon peel extract*	0	0,5	1	1,5
$CaCO_3$	40	40	40	40
Nipagin	0,5	0,5	0,5	0,5
Glycerin*	25	25	25	25
Na-Lauryl sulfate	1	1	1	1
Aquadest add*	100	100	100	100

Note: (*) in mL unit

3. Evaluasi Fisik dan Kimia Sediaan Pasta Gigi

Four tests that include the organoleptic test, homogeneity, coverage, and pH test were performed on the prepared toothpaste. Testing was conducted every 7 days (one week) for up to three weeks.

a. Organoleptic Test

The organoleptic test was carried out by asking panelists as many as 10 people about visual observations of colors, smells, and textures on samples F0, F1, F2, and F3. Panelists in this test were students of Muhammadiyah University of Surakarta (UMS).

b. Homogeneity test

The homogeneity test was done by applying toothpaste preparations (F0, F1, F2, and F3) on a piece of transparent glass and then visually observed in an upside-down position.

c. Scatter strength test
The scatter power test is a useful test to find out how much the paste spreads if applied on a toothbrush. It was done by weighing 0.5 grams of paste placed in the middle of the glass, the other glass was placed over the mass of the paste and left for 1 minute, then given a weight of 150 g, then measuring its diameter.

d. pH test
The pH test was carried out using an Ohaus-brand pH meter by dissolving a prepared toothpaste of 1 g with 10 ml of distilled water.

RESULT AND DISCUSSION

1. Ekstraksi Binahong dan Stevia

Binahong leaf extract produced an extract weight of 43 grams with a yield of 12.28%. While the value of yield produced in research conducted by Paju et al (2013) is 12.15% using 96% ethanol solvent, the yield value produced is higher than the results of research conducted by Nidinilla (2014) which resulted in a yield value of 4.45% using 70% ethanol solvent. The difference in yield value is caused by differences in the type of solvent and the concentration of the solvent used (Ukhty, 2011).

Stevia leaf extract produced an extract weight of 49.5 grams with a yield of 33%. Compared to Yulianti et al (2014) that value was deemed suitable because the yield of stevia leaf extracts ranges between 18.41-37.27%.

Lemon peel extract yields an extract weight of 6.4 grams with a yield of 12.8%. Research conducted by Nurdiati et al (2016) shows the yield value of lemon peel extract is around 12.8%.

2. Organoleptic test

Organoleptic tests conducted on the toothpaste included the texture, color, and smell (Table 2).

Table 2. Organoleptic test data

Formulation	Texture	Color	Smell
F0	Viscous	Milky white	-
F1	Viscous	Greenish-yellow	Binahong
F2	Viscous	Very greenish-yellow	Binahong
F3	More viscous	Light green	Binahong

In F0 the texture was viscous, this is because F0 is a control, so it did not use binahong leaf extract, stevia, and lemon peel. While in F3, the texture property was more viscous because the extracts of binahong, stevia and lemon peel used were more than F1 and F2.

3. Homogeneity test

Homogeneity testing aims to analyze changes in the homogeneity of the toothpaste preparations that may occur due to several factors. For example, the storage time is too long, the mixing is less homogeneous, or the sifting process is too

coarse. In research by Elfiyani et al (2015), the toothpaste was said to be homogeneous if there were no coarse grains on the object glass. The requirements for it to be homogeneous are if there is a visible uneven color and no particles or rough materials that can be touched (Setyaningrum., 2013).

Table 3. Homogeneity test data

Formulation	Week		
	1	2	3
F0	Homogeneous	Homogeneous	Homogeneous
F1	Homogeneous	Homogeneous	Homogeneous
F2	Homogeneous	Less homogeneous	Less homogeneous
F3	Homogeneous	Less homogeneous	Less homogeneous

From Table 3, the most homogeneous batch of toothpaste obtained was the toothpaste formula with two weeks of storage, namely F0 and F1 toothpaste. The longer the storage, the homogeneity value of toothpaste will decrease. Another factor influencing the lack of homogeneity of toothpaste is the effect of stirring and too much material added to the formula, seen in F2 and F3 toothpaste in the second and third weeks.

4. Scattering Test

The scattering power of toothpaste aims to determine the softness of the preparation to provide comfort during use. The greater the spread diameter value, the greater the surface area that can be reached by a toothpaste preparation. The spread area is directly proportional to the increase in added load, the greater the burden added by the wider the distribution power produced (Andriana et al., 2011).

Table 4. Scattering Test Data

Week	Scattering Power (cm)			
	F0	F1	F2	F3
1	5,5	5,4	5,3	5,3
2	6,2	5,5	5,7	5,8
3	6,7	6,5	6,8	6,6

From Table 4, the results of the measurement of spreadability were obtained, with the lowest value being 5.3, which is toothpaste F2 and F3 at week 1. While the widest power spread was at week 3 of toothpaste F2 and week 3 of paste F3. In Mahdalin et al (2017), the value of the resulting dispersal power is worth 7.8 - 8.6. The difference in the spread of the resulting toothpaste is caused by several factors in this study, the factors that influence are the weight and mass of the paste being tested. In this study, the load and paste mass used was 150 g and 0.5 g, respectively, whereas, in the study of Mahdalin et al (2017), the load used was 200 g, and paste mass used was 1 g. From this study, it was found that the longer the storage time the wider the spreading power. This is because the more often the preparation of toothpaste interacts with air, the spreading power is related to the water content, and thus the more the water content, the greater the spreading power (Mahdalin et al., 2017).

5. pH test

The pH test was carried out to check and ensure the pH of the toothpaste preparation is by SNI standards. Measurements were made using a pH meter before

the preparation was dipped (Habiburrahim et al., 2016). In the formulas, F0, F1, F2, and F3 always decrease every week.

Table 5. pH measurement results

Week	pH			
	F0	F1	F2	F3
1	8,69	8,50	8,50	8,40
2	8,67	8,49	8,46	8,39
3	8,15	8,12	8,08	8,11

From Table 5 the pH test results obtained pH test results for toothpaste during three weeks of storage changes every week and is in the pH range of 8.08-8.69 which is still following SNI (12-3524-1995) which is 4.5-10, 5 In a study conducted by Khairi et al (2016) the pH range of binahong leaf extract toothpaste was 7.8-9.12. In Nurdiati et al (2016) the pH range of a combination of betel leaf extract and the lemon peel has a range of 6.5-7.5. The decrease in pH that occurs can be caused by environmental factors such as poor temperature and storage, causing an unstable pH (Younget and Anne., 2002).

CONCLUSION

The longer the storage, the homogeneity value of toothpaste decreases. Four toothpaste formulations have met the requirements of the Indonesian National Standard 12-3524-1995. The pH value of the toothpaste produced ranged from 8.08-8.69.

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