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Effect of Giant Ginger Extract (Zingiber officinale. var. Roscoe) As Toothpaste Ingredients on Saliva pH

Muhammad Asman Setiawan Jumain*)[1]
Poltekkes Kemenkes Semarang
Dental Therapist and Hygienist
Tirto Agung Rd, Semarang Central Java, 50628, Indonesia

Ari Suwondo [2]
Poltekkes Kemenkes Semarang
Dental Therapist and Hygienist
Tirto Agung Rd, Semarang Central Java, 50628, Indonesia

Lanny Sunarjo [3]
Poltekkes Kemenkes Semarang
Dental Therapist and Hygienist
Tirto Agung Rd, Semarang Central Java, 50628, Indonesia

Melyana N. Widyawati [4]
Poltekkes Kemenkes Semarang
Dental Therapist and Hygienist
Tirto Agung Rd, Semarang Central Java, 50628, Indonesia

Diyah Fatmasari [5]
Poltekkes Kemenkes Semarang
Dental Therapist and Hygienist
Tirto Agung Rd, Semarang Central Java, 50628, Indonesia

Jumain [6]
Poltekkes Kemenkes Makassar
Pharmacy
Baji gau Rd, Makassar South Celebes, Indonesia

Abstract:- **Background: According to the results of basic health research (Riskesdas) in 2018, 45.3 % of Indonesian Indonesian has oral healt problem, especially cavities, but only 4.1 % of teeth were filled because of cavities. The government, through the Ministry of Health, set a 2030 target for the Indonesian population to be caries-free, Degree of acidity (pH) of saliva is a factor in development of dental caries, periodontal disease, and other diseases of the oral cavity. The normal pH of saliva in the mouth is 7. The degree of acidity (pH) of saliva is the most important factor to enhance tooth integrity because it can stimulate remineralization, whereas a decrease in salivary pH can cause tooth demineralization. While the remineralization process will reduce the possibility of caries, giant ginger contains ingredients that can help to remineralize the tooth surface. Purpose: To determine the effectiveness of giant ginger extract (zingiber officinale var. Roscoe) toothpaste in preventing the growth of bacteria that causes dental cavities. Method: Laboratory experimental research, using the True Experiment method where this study had a control group with a pretest–posttest with control group design. Saliva samples collected before and after brushing teeth with concentrations of 5%, 10%, 20%, 40%, K(+) and K(-). The pH of the saliva specimen then evaluated, the physical quality test and hedonic test were then conducted, followed by sampling using the Lameshow formula. Based on the inclusion criteria, the sample was divided into two groups: treatment and control, each with 66 based on the inclusion criteria. Result: Since the degree of acidity (pH) of saliva before and after brushing teeth with giant ginger extract toothpaste (Zingiber officinale. var. Roscoe) had a *P*-value of 0.034 < 0.05 before and after brushing teeth with giant ginger extract toothpaste (Zingiber officinale. var. Roscoe), it was concluded that there was an effect of the degree of acidity (pH) of saliva before and after brushing teeth with giant ginger extract toothpaste. Conclution: The degree of acidity (pH) of saliva before and after brushing teeth are affected by the preparation of giant ginger extract toothpaste (Zingiber officinale var. Roscoe).**

Keywords:- *Caries, pH Saliva, Giant Ginger Extract Toothpaste.*

I. INTRODUCTION

In 2016, the World Health Organization (WHO) stated that the rate of dental caries in children worldwide were still high, at 60-90 %.(1) according to the 2015 Global Burden of Disease Study, caries afflicted 560 million children.(2) The results of the 2018 Basic Health Research (Riskesdas) reported that the largest proportion of dental problems in Indonesia was dental caries reaching 88.8%,(3) the national prevalence of tooth decay or diseased cavities in Indonesia is 45.3% but only 4.1% of teeth have been filled or filled because of cavities,(4) the government through the ministry of health is targeting caries-free for Indonesian population by 2030.(5)

Dental caries is a disease that can be said to be endemic in Indonesia, and caries does not directly cause death, but the presence of dental caries can interfere with comfort so that it affects eating and sleeping patterns,(2) based on data from morbidity reports from various provinces on Indonesia's dental and oral health profile.(6)

Indonesia has long been known as a spice-producing country with a diverse variety of spices and medicines. In Indonesia, there are many different cultures and ethnicities, including one in Java that practices traditional medicine with plants from the Zingiberaceae family. The giant ginger plant (Zingiber officinale var. Roscoe) belongs to the Zingiberaceae family.(7) and it is one of the most frequently used spice plants due to its many efficacies.(8)

Primary active substances contained in giant ginger include gingerols, with other gingerol analogues such as shogoals, paradol and zingerone. In addition to these

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substances, giant ginger also contains essential oil components.(8) One way to prevent caries is to brush teeth with toothpaste.

Based on the description, a research will be conducted to make preparations toothpaste with giant ginger extract and then test the salivary pH before and after brushing teeth with giant ginger extract toothpaste, along with physical quality and hedonic tests.

II. METHOD

Laboratory experimental research using the True Experiment method, with a control group and a pretest-posttest with control group design. Saliva samples were collected before and after brushing teeth at concentrations of 5%, 10%, 20%, 40%, K(+) and K(-) then measured the pH of the saliva specimen, Then a physical quality test and a hedonic/favorite test were performed, followed by sampling using the Lameshow formula. The sample was divided into two, namely the treatment and control groups consisting of 66 based on the inclusion criteria.(9)(10)(11)

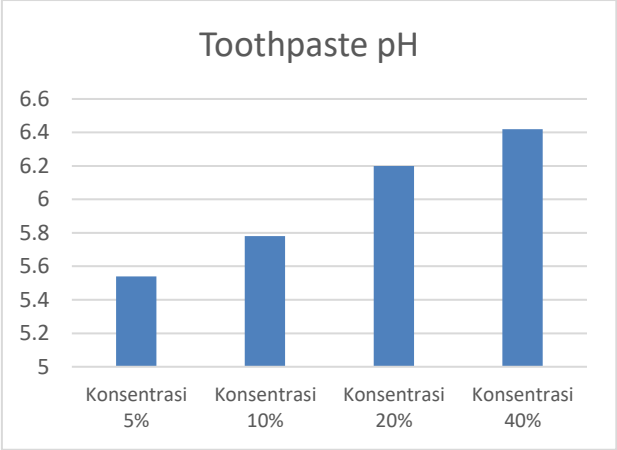
III. RESULTS AND DISCUSSION

A. PHYSICAL QUALITY TEST

Table 1. pH Test Results for Giant Ginger Extract Toothpaste

No	Toothpaste formula	Replication	pH	Average
1	5%	1 2 3	5,68 5,56 5,37	5,54
2	10%	1 2 3	5,86 5,67 5,82	5,78
3	20%	1 2 3	6,40 6,22 5,97	6,20
4	40%	1 2 3	6,48 6,50 6,27	6,42

Table 1. showed that the 5% formula after 3 times replication got an average pH of 5.54, at 10% after 3 replications the average pH was 5.78, for 20% the average pH was 6.20, 40% the average pH obtained is 6.42, the pH requirements for toothpaste are 4.5 - 10.5.



Picture 1 pH Test Results for Giant Ginger Extract Toothpaste

Picture 1. showed that the highest pH value of giant ginger extract toothpaste was at 40%, while the lowest pH value was at 5%. The pH value of the giant ginger extract toothpaste is within the pH range set by the Indonesian National Standard, which is between 4.5 – 10.5. The higher the concentration of giant ginger extract, the closer to the normal pH of the toothpaste. This because giant ginger extract is acidic. The pH value is related to the effectiveness and stability, as well as the convenience of the preparation when applied to the oral area. A pH value that is too acidic or alkaline can cause irritation.

Table 2. Results of Viscosity Test Preparation of Giant Ginger Extract Toothpaste Using Brookfield Viscosity at RPM 50 Spindle No.64

No	Formula	Replication	Viscosity	Average
1	5%	1 2 3	78.750 79.120 78.320	78.730
2	10%	1 2 3	82.550 83.570 82.440	82.853
3	20%	1 2 3	89.680 87.320 86.770	87.923
4	40%	1 2 3	93.750 90.220 89.550	91.173

Table 2. showed that the 5% formula after doing 3 times replication got an average viscosity of 78,730, at 10% after 3 times replication it got an average viscosity of 82,853, for 20% it got an average viscosity of 87,923, and for 40% the average viscosity was 91,173.

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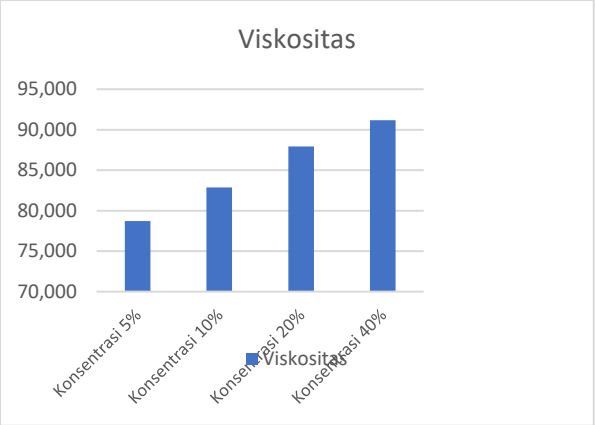


Picture 2 Results of Viscosity Test Preparation of Giant Ginger Extract Toothpaste Using Brookfield Viscosity at RPM 50 Spindle No.64

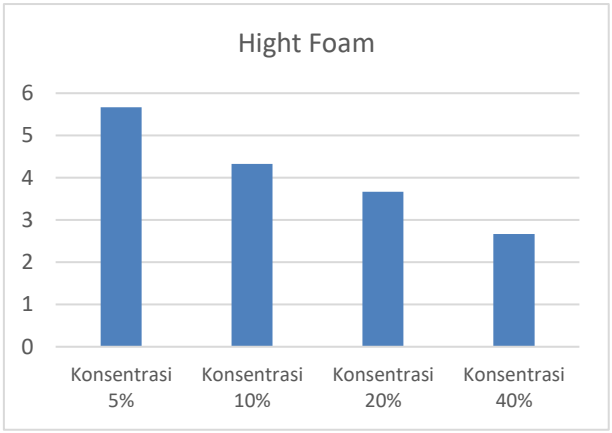
Picture 2. showed that 40% toothpaste was easily removed from the tube and formed a consistent paste because the higher the viscosity value of the preparation, the stronger it looked when it was attached to the toothbrush. Conversely, the lower the viscosity value, the toothpaste immediately melts under the surface of the toothbrush.

From picture 2. it can be seen that the 40% preparation has the highest viscosity value of 91,173 Cps while 5% has the lowest viscosity value of 78,730 Cps. At the end of the preparation obtained an increase in the value of viscosity.

Table 3. Test Results of High Foam Preparation of Giant Ginger Extract Toothpaste

No	Formula	Replication	Foam Height (mm)	Average
1	5%	1 2 3	6 6 5	5,67
2	10%	1 2 3	4 5 4	4,33
3	20%	1 2 3	4 3 4	3,67
4	40%	1 2 3	4 2 2	2,67

Table 3. showed that the 5% formula after doing 3 times replication got an average foam height of 5.67mm, at 10% after 3 times replication it got an average foam height of 4.33mm, for 20% it got an average foam height of 3.67mm and 40% the average foam height obtained is 2.67mm.

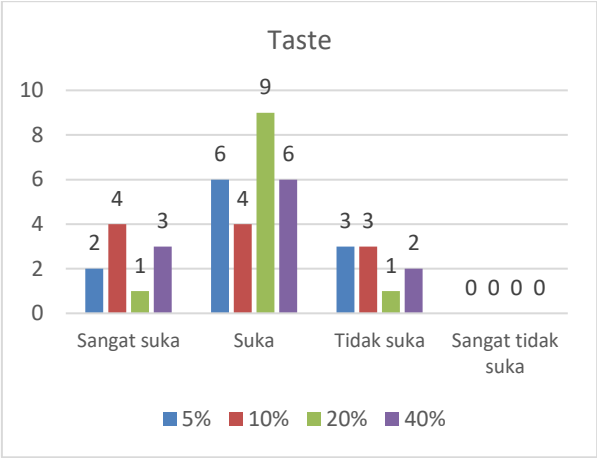


Picture 3 Test Results of High Foam Preparation of Giant Ginger Extract Toothpaste

Picture 3. shows that Observation of foam height was carried out to see the height of foam formed. The higher the concentration of giant ginger extract used, the smaller the height of the foam formed. From Table 4.5 it can be seen that 5% has the highest foam height.

C. Hedonic/Preference Test Results for Preparation of Giant Ginger Toothpaste

The results of the preference or hedonic test carried out by 44 respondents on the preparation of giant ginger extract toothpaste on taste, color, aroma, and texture:



Picture 4 Results of the Preference Test on the Taste of the Giant Ginger Extract Toothpaste

Picture 4. shows that the highest percentage of respondents' preference for the taste of the giant ginger extract toothpaste preparation is that there is no formula that is strongly disliked, disliked at 5% and 10%, favored at 20%, and very favored at 10%.

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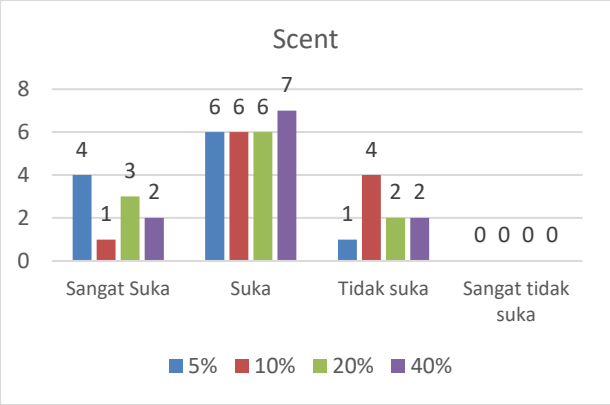
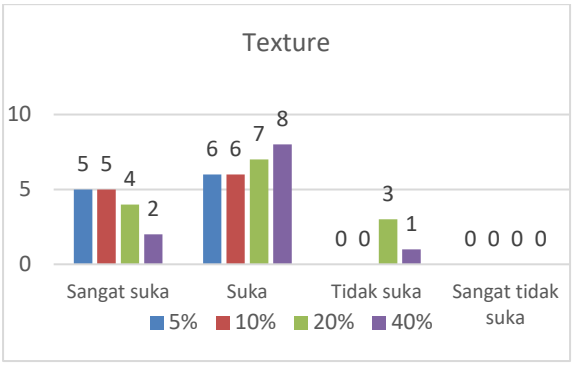


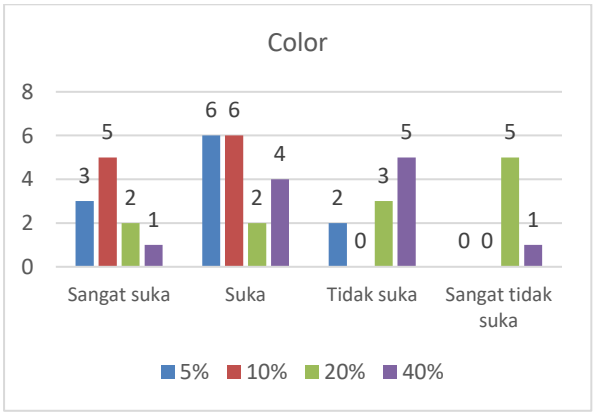
Picture 5 Results of the Preference Test for the Scent of Toothpaste Preparation of Ginger Giant Extract

Picture 5. shows that the highest percentage of respondents' preferences for the scent of the giant ginger extract toothpaste preparation is that there is no formula that is strongly disliked, disliked at 10%, preferred at 40%, and very favored at 5%.



Picture 6 the results of the preference test on the texture of the giant ginger extract toothpaste preparation

Picture 6. shows that the highest percentage of respondents' preferences for the texture of the giant ginger extract toothpaste preparation is that there is no formula that is strongly disliked, disliked at 40%, preferred at 10%, and highly favored at 5%.



Picture 7. The results of the preference test on the color of the giant ginger extract toothpaste preparation

Picture 7. showed that the highest percentage of respondents' preference for the color of the giant ginger extract toothpaste was very disliked at 40%, disliked at 40%, favored at 20%, and very much liked at 10%.

D. Saliva pH Test Before And After Brushing Teeth Giant Ginger Extract

Table 4. Saliva pH Test Results Before and After Brushing Teeth

NO	**Average Saliva pH**				
Formula		**Before brushing teeth using giant ginger extract toothpaste**	**After brushing teeth using giant ginger extract toothpaste**	**Delta (Δ)**	***P* Value**
1	5%	7,1	6,7	0,4	0,034
2	10%	7,0	6,9	0,1	
3	20%	7,0	6,9	0,1	
4	40%	7,0	6,8	0,2	
5	K(+)	6,9	6,8	0,1	
6	K(-)	7,0	6,8	0,2	
Average		7,0	6,8	0,2	

Table 4. showed that there was a change in the average pH value at each concentration, on the average before brushing teeth using toothpaste with giant ginger extract, the highest delta value was seen at a concentration of 5%, namely 0.4 before and after brushing teeth using toothpaste of giant ginger extract, because the p value is 0.034 <0.05. As a result, it can be stated that using giant ginger extract toothpaste has an effect on salivary pH.

IV. DISCUSSION

A. Giant ginger extract toothpaste (Zingiber officinale. var. Roscoe)

Toothpaste from the giant ginger rhizome herbal plant is a product that is used as a preventive. Toothpaste is an ingredient used in the process of cleaning the surface of the teeth, brushing teeth as an effort to reduce or remove debris, plaque and the number of microorganisms in the mouth.(12)

The development of toothpaste products from herbal plant materials goes through the testing stages, physical quality tests, hedonic tests or preferences. Giant ginger extract toothpaste can be used as a preventive measure.

The most important phase in ensuring the stability of chemicals in simplicia is drying. The aim of drying plant material is to prevent fungus growth, reduce water content, prevent enzymatic reactions, and make it easier to crush simplicia into powder. The simplicia of giant ginger leaves was dried by wind drying at room temperature of 20-25°C until the leaves were easily crushed. Drying is carried out in a place protected from sunlight to avoid damage to the content of compounds that exist in a simplicia that has antioxidant activity, it is reported that the drying process affects the total

phenolic and flavonoid content in a simplicia that has antioxidant activity. This is because antioxidant compounds and flavonoids are sensitive to light and heat.

B. Physical Quality Test

1. Ph Test Preparation of Giant Ginger Extract Toothpaste

The pH test carried out on each preparation of giant ginger extract toothpaste obtained different pH values for each preparation. The difference is caused by the acidic compounds contained in the ginger extract including phenol derivative compounds, such as Gingerol and Shogaol and other alcohol-derived compounds which are weak acids which are added to toothpaste preparations.(14)

2. Viscosity Test of Giant Ginger Extract Toothpaste

Viscosity is a measure of the viscosity of a fluid which states the size of the friction in the fluid. The greater the viscosity of the fluid, the harder it is for an object to move in the fluid. The importance of viscosity in toothpaste is so that the toothpaste can adhere well to the toothbrush. The viscosity level of the fluid is expressed by the viscosity coefficient. The more viscous the fluid, the greater the required tensile force.(15)

3. Foam High Test of Toothpaste Giant Ginger Extract

The occurrence of a decrease in the foam height parameter because the foam height parameter is very dependent on the surfactant used, water hardness, room temperature at the time of measurement and the settling time based on Depkes RI,1985. The size of the foam height that can be associated with the aesthetic value that consumers prefer. The parameter for measuring foam height is very dependent on the concentration of foaming agent which in this formula uses Sodium Lauryl Sulfate. The concentration of the extract can also affect the foam height of the preparation. Foam is made by surfactants in toothpaste preparations. Foam is formed in the presence of surfactants in the liquid and changes the dispersion system between air bubbles separated by the liquid layer so that the surfactant can reduce the tension in the air/liquid.(16)

C. Hedonic Test/Preference of Giant Ginger Toothpaste Preparation

- *Color*

Based on Picture 7, the addition of the amount of extract has a significant effect on the level of preference for the color of the giant ginger extract toothpaste produced, with the result that it is liked by the panelists. The difference in color that is formed is a sign that the higher the concentration of the extract, the darker the color, for a concentration of 10% the respondents prefer it and it can be seen that at a concentration of 40% it has a dark brown color.

- *Scent*

Based on Picture 5, the concentration treatment shows that concentration has a significant effect on the scent of the giant ginger extract toothpaste produced. The higher the concentration given, the panelists' preference for the scent produced is higher, it can be seen that the 5% concentration is the most preferred.

- *Flavour*

Flavour has the highest criterion weight, because it is the main factor for consumers to choose.(17) Based on Picture 4 shows that, concentration has a significant effect on the resulting taste. Giant ginger extract toothpaste with good quality has characteristics of light brown color and a homogeneous texture. The taste of giant ginger extract toothpaste is slightly spicy, because it is affecteded by ginger oleoresin compounds which contain many components that form a spicy taste that does not evaporate, which consists of on gingerols, zingiberen and shagaol,(18) for the most preferably 5% concentration.

- *Texture*

Texture is one of the sensory factors or often referred to as the level of hardness, namely the properties observed with the mouth and touch, (16) texture is also a measure of product quality that needs to be considered, for the most preferred concentration at 10%.

D. Saliva Ph Test Before and After Brushing Teeth

A degree of acidity, or (pH), is a measurement that is used to determine the acidity level of a liquid. The higher the acidity of a liquid, the lower the pH value, and is said to be neutral if the pH value is 7. Saliva is a fluid with a constantly changing arrangement, as indicated by the degree of acidity (pH), electrolyte, and protein content in its composition among other elements. According to Amerogen (1991), the pH and buffering capacity of saliva are determined by the qualitative and quantitative composition of electrolytes in saliva.

The buffer effect is the nature of saliva which tends to always keep the oral composition neutral, in a way that saliva tends to reduce plaque acidity caused by sugar. The findings showed that brushing teeth before eating and brushing after eating can cause alkaline, neutral, and acidic alterations in saliva pH. This is due to the various mechanical movements performed, with the exception of brushing teeth, chewing, and gargling movements, and its one of the secretion stimuli that could impact saliva viscosity.(19)

The average salivary pH of 66 samples of respondents before gargling was 7.0 then alkaline conditions sustain a change in salivary pH after using giant ginger extract toothpaste to 6.8. This indicates a change in pH after using giant ginger extract toothpaste. Thus, in this case the researchers reviewed from previous studies that giant ginger extract toothpaste can increase salivary pH and giant ginger extract toothpaste can reduce saliva pH from too alkaline conditions to normal pH conditions. As a result, the researchers concluded that it is very suitable to be used as an alternative toothpaste that can maintain the balance of the degree of acidity (pH) of the oral cavity. So in this case, giant ginger extract toothpaste is able to maintain a normal acid-b Under certain conditions, the condition of a person's oral cavity can have a pH that is more acidic or alkaline. A person is said to have a normal level of salivary acidity if it is at a pH of 6.8-7.5ase balance in the oral cavity. Under certain

conditions, the condition of a person's oral cavity can have a pH that is more acidic or alkaline. A person is said to have a normal level of salivary acidity if it is at a pH of 6.8-7.5(20)

V. CONCLUSION AND SUGGESTION

A. *Conclusion*

1. Based on the hedonic test or the preference of the 10% concentration the respondent likes the most
2. There is an effect of the degree of acidity (pH) of saliva before and after brushing teeth with giant ginger extract toothpaste.

B. *Suggestion*

The dark brown color of the 40% concentration of giant ginger extract toothpaste reduces the attractiveness of the product to respondents; therefore, it is recommended to further research be done on the color and taste aspects of the 40% concentration of giant ginger extract toothpaste.

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