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The Effectiveness Test of Pulp Maceration (*Mimusops elengi L*) on Bacterial Growth Normal Microfloras of Mouth

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ABSTRACT

Tanjung or *Mimusops elengi L.* is a member of the *Sapotaceae* which is known as a evergreen tree. So far, the headland has only been used as a shade planted in parks and on the side of the road, even though the headland has a number of health benefits. Flora in the oral cavity basically has a harmonious relationship with the host and consists of a variety of organisms, including bacteria, fungi, mycoplasma, protozoa, and viruses that can be encountered from time to time. The research objective was to determine whether the ethanolic extract of Tanjung (*Mimusops elengi L*) fruit had anti-bacterial inhibition against oral microflora. This research was a true-experiment which aims to determine the possible cause and relationship effect of one or more groups being studied. The research was carried out in several locations of Tanjung tree plants in Medan city, and secondary metabolite testing (Phytochemical Screening) was carried out at the Pharmacy Laboratory of Universitas Sumatera Utara (USU) as well as at the Microbiology Laboratory of Poltekkes Kemenkes Medan. The research time started after receiving the title of the proposal until the final report. Improvement of the proposal until completion was estimated from November 2019 to July 2020. The population was cape plants in the city of Medan, and samples are taken from fruiting and ripe cape plants (red fruit) in the Medan Estate area. In the test phase for the extract's antibacterial activity, the inhibitory diameter data will be obtained for each of the tested bacteria at a certain concentration. Data were analyzed using the One Way ANOVA statistical test. Before the test was carried out, the normality test was carried out first to ensure that the data were normally distributed. In the 25% extract treatment, 50% of Tanjung fruit pulp against *Staphylococcus aureus* and *Streptococcus mutans* showed p value <0.05 and 100% Tanjung fruit pulp extract against *Streptococcus mutans* bacteria showed p value <0.05. Where these results indicated the data was not normally distributed so that the Kruskal Wallis test was continued. The results of post-hoc Mann Whitney analysis showed that there were differences in the growth inhibition zone of *Staphylococcus aureus* bacteria, *Lactobacillus acidophilus*, *Streptococcus mutans* between levels of concentration and also had significant differences between treatments in all treatments at various levels of concentration (p <0.05) Tanjung fruit flesh. The zone of inhibition of growth of *Staphylococcus aureus*, *Lactobacillus acidophilus*, *Streptococcus mutans* bacteria between concentration levels also had a significant difference (p <0.05). So that the effect of different concentrations on the diameter of inhibition produced by the etanolic extract of Tanjung fruit pulp (*Mimusops elengi* L) against normal micro bacteria in mouth. Tanjung fruit pulp extract can inhibit the growth of *Lactobacillus acidophilus*, *Staphylococcus aureus* and *Streptococcus mutans* bacteria at test concentrations of 25%, 50%, 75% and 100%. The most effective concentration which has a diameter of the inhibition zone was a concentration of 100% with an average diameter of the inhibition zone formed in each of *Lactobacillus acidophilus* bacteria of 27.925 mm, *Staphylococcus aureus* of 9.425 mm and *Streptococcus mutans* of 14.825 mm. The extract of Tanjung fruit pulp was more effective for inhibiting the growth of *Lactobacillus acidophilus* bacteria.
Keywords: inhibition; Tanjung Fruit (*Mimusops elengi* L), Normal microflora in mouth

INTRODUCTION

The oral cavity and teeth are parts of the body that have important functions in relation to body health. By maintaining the health of our mouth and teeth, we have indirectly reduced the risk of getting diseases that involve the health of the body, especially the health of the oral cavity and teeth. Some diseases that are commonly caused by a lack of hygiene in the oral cavity and teeth include caries, gingivitis and some infections caused by bacteria that cannot be cleaned when we brush our teeth. Normal flora bacteria are microorganisms that inhabit the human body without causing disease under normal conditions and are usually a group of aerob bacteria, but some are anaerobs [(1)]. The normal bacterial flora itself is a population of normal bacteria that usually inhabit certain parts of the body, such as the skin, mouth, eyes, genital organs, ears, and nose. In the oral cavity, there are groups of normal flora bacteria such as *Streptococcus mutans*, *Staphylococcus aureus*,

Neisseria sp, Corynebacterium, and many more. Apart from normal bacterial flora, there are also pathogenic bacteria in the oral cavity. Pathogenic bacteria are bacteria that have the potential to cause disease [(2)].

Pathogenic bacteria can be bacteria that originate from outside the body or can also be normal flora bacteria which due to certain conditions turn into pathogenic bacteria. Bacteria in the human oral cavity are actually not dangerous if they are still within normal limits. Oral conditions greatly affect the types of bacteria that live in the oral cavity. Healthy oral conditions can reduce the presence of pathogenic bacteria that cause disease in the oral cavity. Flora in the oral cavity basically has a harmonious relationship with the host and consists of a variety of organisms, including bacteria, fungi, mycoplasma, protozoa, and viruses that can be encountered from time to time. Bacteria are the main group of microorganisms in the oral cavity and can be divided into aerobic or facultative anaerobic bacteria, based on the oxygen demand of these bacteria. The ability of bacteria to stick in the oral cavity is a prerequisite for colonization. Bacteria do not colonize clean enamel surfaces, but interact with a layer containing material on the tooth surface called the pellicle. Pellicle formation occurs in seconds on clean enamel and reaches a maximum thickness in 90-120 minutes.

The formation of pellicles will continue to form biofilms, an example of a biofilm is dental plaque which is the cause of caries. Caries is damage that occurs locally in tooth tissue due to fermentation of carbohydrates by bacteria. The main factors causing caries are: host factors (teeth and saliva), food (carbohydrates), time, and bacteria in plaque. The bacteria contained in plaque can be reduced in number mechanically or chemically, namely by using antibacterial agents, the use of fluoride, and natural medicinal plants. One of the natural medicinal plants is tanjung leaf which has the ability to act as an antiseptic, antioxidant and fungicide, also has the property of preventing bleeding, helping wound healing, digestive tract medicine, and can strengthen teeth. In a study conducted by Hardianti EP, the ethanolic extract of tanjung leaf was known to have anti-bacterial activity and had an inhibitory power against Escerecia coli and bacillus aureus. The Tanjung plant (*Mimusops elengi L*.) Was traditionally used to treat cancer, diabetes, liver and cardiovascular disease by the people of Bangladesh. Judging from the structure, all of these compounds contain hydroxyl groups which can act as antioxidants, but only compounds from the flavonoid group in Tanjung fruit have phenolic groups. This plant thrives throughout tropical Asia to East Africa and spreads almost all parts of Indonesia. Besides being used as an ornamental plant, this plant is included in the Piperceae family with the appearance of green and shiny leaves when exposed to light. Tanjung leaf is one of the potential medicinal plants which is known empirically to have the property to cure various types of diseases.

Based on the background described above, the researchers felt attracted to study the Inhibition of *Mimusops elengi* L. Leaf Maserate on the development of normal oral microflora.

METHODS

Design

This research was a true-experiment which aims to determine the possible cause and effect relationship of one or more groups being studied. The treatment was designed with the one-shot case study (treatment of a certain group, then measurements were taken) in this case the pure method, where at the initial stage, the maserat of tanjung fruit (*Mimusops elengi*, L) was made, then the effectiveness of the meat fiber was tested fruit (*Mimusops elengi*, L) against normal oral micro flora bacteria.

The research was carried out in several locations of Tanjung tree plants in Medan city, and secondary metabolite testing (Phytochemical Screening) was carried out at the USU Pharmacy Laboratory and at the Integrated Laboratory of Microbiology, Poltekkes Kemenkes Medan. When the research starts after receiving the title of the proposal until the final report, from November 2019 to July 2020. The population was all Tanjung plants in the city of Medan, and samples are taken from Tanjung plants that are bearing fruit and are ripe (red fruit).

Extraction

Extraction was carried out by maceration using 96% ethanol solvent by taking a sample of 1 kg of dry powder of simplicia (one part) put into a vessel and added with 96% ethanol as much as 75 parts of 96% ethanol solvent (7.5 liters), closed. Left for 5 days protected from sunlight, stirring frequently. After 5 days of maceration, squeezed and then rinsed with 25 parts of 96% ethanol solvent (2.5 liters) to obtain 100 parts, then left for 2 days protected from sunlight and poured or filtered to obtain macerate. Maserate is evaporated by means of a rotary evaporator at a temperature of not more than 45ºC until the extract is almost thick. Then evaporated over a water bath until a thick extract was obtained [(3, 4)].

This macerate was made into concentrations with the dilutions required for the test (eg 100%, 75%, 50%, 25%) and control (control for diluting media).

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Table 1. Preparation of mimusops elengi mass concentrations

No	Maserat	Aquadest	Concentration
1	10 ml	-	100%
2	7.5 ml	2,5 ml	75%
3	5 ml	5 ml	50%
4	2.5 ml	7,5 ml	25%

Then drop the macerate on the MHA media as much as 1 ml on the surface of the media and leave it for 60 minutes so that the macerate absorbs into the media. After absorption, wipe the swabs from the mouth onto the surface of the MHA medium and incubate them in the incubator for 24 hours at 37 0C.

Mc Farland Standard Making

Enter 9.9 ml of 1% sulfuric acid (H_2SO_4) solution into the tube and add 0.1 ml (9:1) of Barium chloride ($BaCl_2$) 1% solution. Then cover the tube with sterile cotton and homogenize it. The $BaSO_4$ suspension contained in the tube was compared to the turbidity. This material is used when necessary to measure the density of growth of normal oral micro flora.

Making Bacterial Suspensions

In a sterile tube that has been filled with sterile 0.9% Nacl as much as 10 ml, then 1 swab that has normal oral micro flora, and is inserted into the tube then homogenized. Adjust the turbidity of the bacterial suspension to the Mc Farland standard which contains 1x108 bacteria / ml. If the color is not suitable, add the bacterial suspension again until you get the same color.

Testing the Effectiveness of the Maserat *Mimusops elengi L*

In testing the effectiveness of the *Mimusops elengi* L maserat against the normal oral micro flora bacteria, the following is done:

1) In the MHA media, 1 ml of macerate was dropped and flattened so that it covered the entire surface of the media.
2) Media that has been spread with maserate of various concentrations, and left for ± 60 minutes.
3) Then, apply a cotton swab containing the normal oral micro flora (first do a mouth swab) on the surface of Muller Hinton Agar media, then incubate for 1 x 24 hours at 37 ° C.
4) After 24 hours of incubation, see whether there is growth of normal oral microflora on the media, whether or not there is bacterial growth, it is the effectiveness of the pulp mass on the growth of normal oral microflora bacteria and the results of this measurement are the test results.

Preparation of Control Solutions

The controls used to test the antibacterial activity of fruit pulp (*Mimusops elengi L*) against oral flora bacteria were control solution CMC-Na 0.5% and control 0.0025% tetracycline antibiotic solution

Antibacterial Activity Test

The test is by doing the following steps:

1) Oral flora bacteria were taken 1 eye loop from pure culture in agar, put in sterile NB media then shaken for 18-24 hours.
2) Prepare the MHA test media, sterilized at 121 ° C then cooled to 10-15 ° C.
3) The absorbance of the test bacteria that has been suspended is measured according to the respective wavelengths to obtain an absorbance of 0.5.
4) The suspension of tested bacteria was then transferred to MHA at a temperature of 50-55 ° C as much as 1/100 of the amount of media, then homogenized.
5) Pouring MHA media that has been added with the tested bacterial suspension into a 20 ml petri dish and allowed to solidify
6) Make a well hole using a foam punch on the solid media.
7) Entering 20µL of each series of fruit pulp macerate concentration into the well, then labeled and incubated at 25-27 ° C for 24 hours.
8) Measure the diameter of the zone of inhibition at each well using a caliper.
9) Performed the replication test 3 times The inhibition zone diameter values of the three replications were averaged.

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Identification of Chemical Compounds in Tanjung Fruit Pulp

1) Alkaloid: Test Maserate added 2% HCL. The solution was divided into 2 tubes. Tube 1 was added with Dragendrof reagent, tube 2 was added with Mayer reagent. The formation of orange deposits in tube 1 and white deposits in tube 2 indicates the presence of alkaloids.
2) Saponym: test. The extract was dissolved with aquadest and then heated with water. Once cool, the laurtan in the test tube is shaken vigorously for 30 seconds. Positive results are indicated by the formation of a consistent foam for several minutes and with the addition of some dilute HCL still forming foam.
3) Flavonoid: Test. Maserate was added with mg powder and 2N HCL then heated over a water bath. after that, add amyl alcohol, shake until well blended. A positive result is an attraction of the yellow-red color to the alcohol layer.
4) Tannins: A small amount of sample in a test tube was heated over a water bath, then filtered. Then the filtrate was added with a 1% gelatin solution. The presence of tannin compounds is indicated by the occurrence of white deposits.

Testing the Antibacterial activity of Tanjung Fruit Extract

The pulp of the fruit was tested for its antibacterial activity to determine its potential as antibacterial. Maserate was made in certain concentration with 0.5% CMC _Na solvent. Testing for antibacterial activity was carried out by the diffusion method against E. coli and B. cereus bacteria with the following work stages:

1) Preparation of Tools and Materials
   The tools and materials used in the antibacterial activity test are sterilized beforehand. Glassware and ingredients in autoclave (wet heating) at 121 ° C for 15 minutes. For tetracycline antibiotics, because they are not resistant to heating, they do not need to be sterilized, but they are made by dissolving them in sterile aquadest.
2) Media creation
   a) NA (Nutrient Agar): Media A total of 0.7 g of NA media were dissolved in 30 ml of aquadest, then heated until dissolved and put in 5 ml test tubes each. then the media is sterilized before use. Media. Sterilized using an autoclave for 15 minutes at a pressure of 1 atm, 121 °C. The test tube is then tilted so that the NA media inside freezes in an oblique shape.
   b) Media NB (Nutrient Broth): The media was made by dissolving 0.6 grams of NB media in 75 ml of aquadest, while heating it until dissolved in Erlenmeyer, then sterilization was carried out.
   c) Making MHA (Mueller Hinton Agar): Media 21 g of MHA media was dissolved in 550 ml of distilled water, then the solution was heated until dissolved, then put in Erlenmeyer and sterilized. MHA media that has been sterile, allowed to stand until the temperature range of 50-60 °C, then aseptically mixed with the test bacteria culture with a ratio of 1: 100 (bacteria: media).
   d) Preparation of 0.5% CMC-Na Solution A total of 0.5 grams of CMC-Na powder were dissolved in 100 ml of sterile aquadest.
   e) Preparation of 0.025% tetracycline antibiotic solution A total of 25 mg of tetracycline antibiotic powder were dissolved in 100 ml of sterile aquadest.
3) Production of Bacteria Stock
   The normal oral flora bacteria were each taken as much as one eye loop from the bacterial culture, then inoculated in NB medium, then incubated at 37 °C for 18-24 hours. The growing bacterial colonies were then inoculated on a slanted NA medium and then incubated at 37 °C for 24 hours.
4) Preparation of bacterial suspensions Normal oral flora bacteria were taken 1 eye loop from pure culture in agar, put in sterile NB media, then discharged for 24 hours.

Data Analysis

In the test phase for the extract's antibacterial activity, the inhibitory diameter data will be obtained for each of the tested bacteria at a certain concentration. The data were analyzed using the One Way ANOVA statistical test so that the effect of different concentrations on the diameter of inhibition produced by the etanolic extract of tanjung fruit flesh (*Mimusops elengi* L) against the normal oral micro flora.

RESULTS

After the bacterial test was carried out on the Tanjung fruit pulp extract at a concentration of 25%, 50%, 75% and 100%, the growth of the tested bacterial colonies was obtained with a different number of colonies according to the concentration of Tanjung fruit pulp extract as shown in the graph below. Figure 1 is a graph of the average number of bacterial colonies of *Lactobacillus acidophilus, Staphylococcus aureus, Streptococcus mutans* which are able to grow at concentrations of 100%, 75%, 50% and 25% of the tanjung fruit extract. From the data above, it can be seen that the

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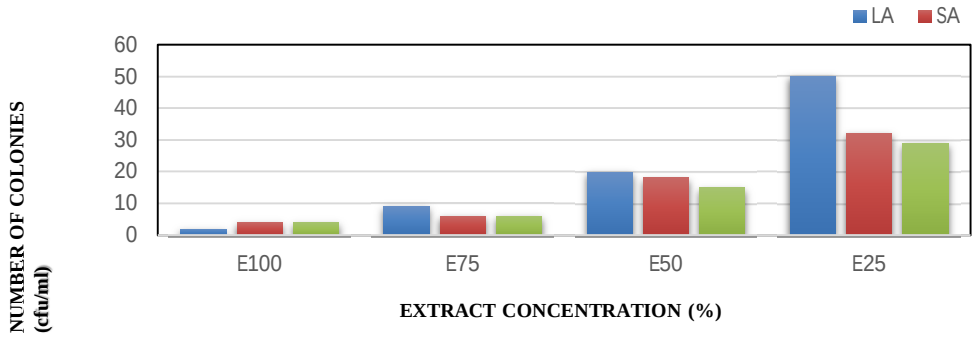
100% extract concentration has the smallest number of colonies that each bacteria can grow, namely *Lactobacillus acidophilus* 2x106 cfu/ml, *Staphylococcus aureus* and *Streptococcus mutans* 4x106 cfu / ml.



Notes: La = Lactobacillus acidophilus, SA = Staphylococcus aureus, SM = Streptococcus mutans

Figure 1. Average number of bacterial colonies

At a concentration of 75% of Tanjung fruit pulp extract, the number of colonies that were able to grow included 9x106 cfu / ml *Lactobacillus acidophilus, Staphylococcus aureus* and 6x106 cfu / ml *Streptococcus mutans*. The number of colonies formed in the 50% extract included 20x106 cfu / ml *Lactobacillus acidophilus*, 18x106 cfu / ml *Staphylococcus aureus* and 15x106 cfu / ml *Streptococcus mutans*. Meanwhile, the number of colonies formed in the 25% extract included 50x106 cfu / ml *Lactobacillus acidophilus*, 50x106 cfu / ml *Staphylococcus aureus* and 29x106 cfu / ml *Streptococcus mutans* 29x106 cfu/ml.

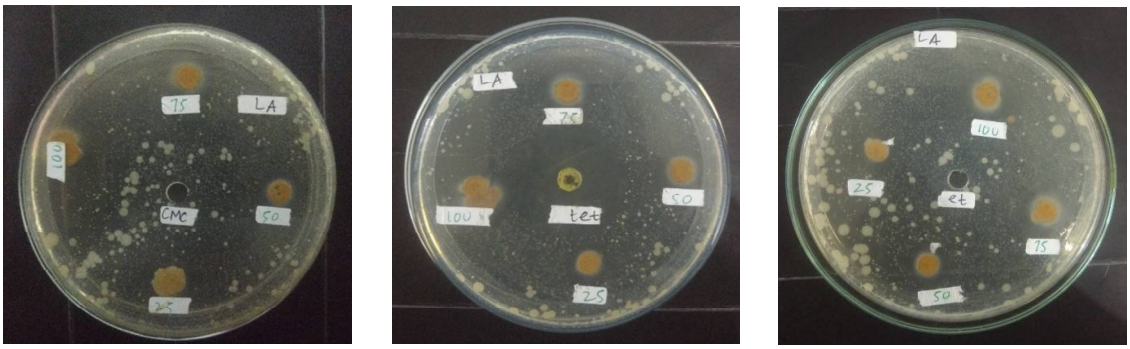


Figure 2. Diameter of the inhibition zone of *Lactobacillus acidophilus* bacteria controlled by cmc-Na, tetracycline, and ethanol

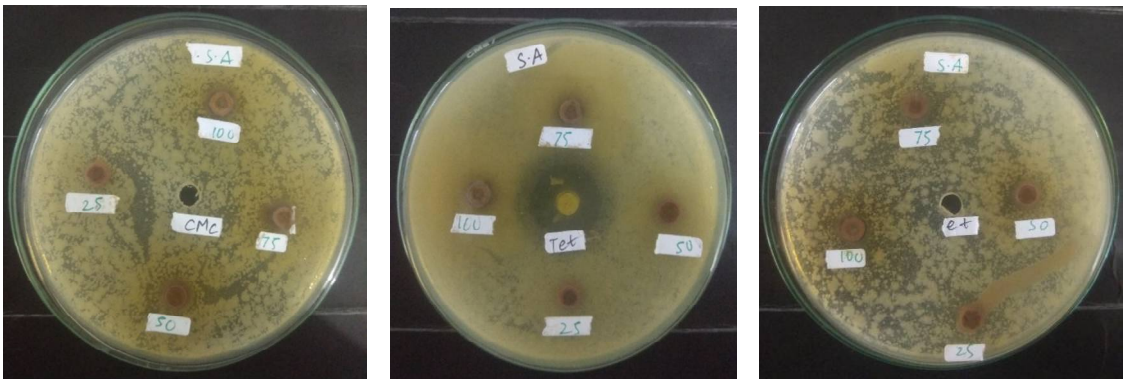


Figure 3. Diameter of the inhibition zone of *Staphylococcus aureus* bacteria controlled by cmc-Na, tetracycline, and ethanol

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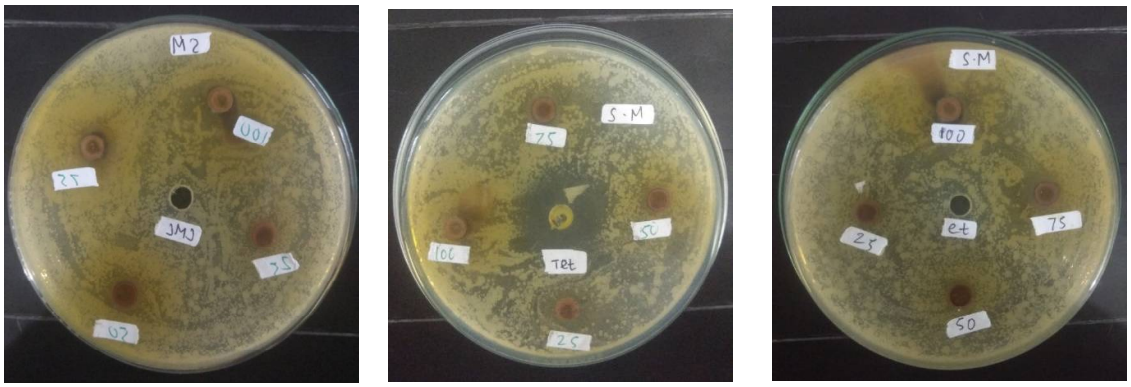

Figure 4. Diameter of the inhibition zone of *Streptococcus mutans* bacteria with control of cmc-Na, tetracycline, and ethanol

After testing the inhibition of 3 types of normal oral flora bacteria with a concentration of 25%, 50%, 75% and 100%, a different inhibition zone was obtained for each bacterial species. The greater the extract concentration, the greater the inhibitory power formed in the test. The greatest inhibitory power is found in the bacteria *Lactobacillus acidophilus*. The test results can be seen in the table 1.

Table 1. Average of bacterial growth inhibition zones at each tanjung fruit extract

No	Treatment	Bacteria		
		Lactobacillus acidophilus (mm)	*Staphylococcus aureus* (mm)	*Streptococcus mutans* (mm)
1.	100% extract	27,925	9,425	14,825
2.	75% extract	23,625	6,025	7,825
3.	50% extract	20,775	3,3	5,8
4.	25% extract	9,6675	1,125	0,4
5.	Ethanol Control 70%	0	0	0
6.	CMC-Na control 0.05%	0	0	0
7.	Tetracycline Control 0.0025%	91,3	46,75	65,75

From the table 1, it can be seen that, each concentration of Tanjung fruit pulp extract can form an inhibition zone on Mueller Hinton Agar media that has been grown by the bacteria *Lactobacillus acidophilus, Staphylococcus aureus*, and *Streptococcus mutans*. Of the four concentrations, it can be seen that, the concentration of 100% has the largest inhibition zone in each bacterium. The 100% concentration of tanjung fruit extract had the largest inhibition zone in inhibiting the growth of *Lactobacillus acidophilus* bacteria by 27.925 mm; *Staphylococcus aureus* was 9.425 mm, and *Streptococcus mutans* was 14.825 mm. The negative control in the form of 70% ethanol and 0.05% CMC-NA was unable to inhibit the growth of the three bacteria. While the positive control, namely tetracycline 0.0025%, can inhibit the growth of *Lactobacillus acidophilus* bacteria by 91.3 mm, *Staphylococcus aureus* by 46.75 mm, and *Streptococcus mutans* 65.75 mm.

The research data was carried out by using the One-way Anova statistical test. Before the test is carried out, the normality test is carried out first to ensure that the data is normally distributed. One way ANOVA test results for the treatment group of Tanjung fruit pulp extract with the bacteria *Lactobacillus acidophilus, Staphylococcus aureus*, and *Streptococcus mutans* had a value of $p = 0.000$. Because the p-value <0.05, the average value between the treatment groups of Tanjung fruit pulp extract showed a significant difference, therefore the post hoc test was carried out.

At post hoc which shows that the p value <0.05, which means that the data is significantly different from other concentrations. This test shows that the inhibition zone diameter of *Lactobacillus acidophilus* bacteria for a concentration of 25%, 50%, 75% and 100% respectively has a value of $p = 0.000$. This shows that each concentration has a significantly different effect on the inhibition zone of *Lactobacillus acidophilus* bacteria. Each concentration of tanjung fruit extract was able to inhibit the growth of *Staphylococcus aureus* bacteria. The results of the post hoc test showed that the inhibition zone diameter of the *Staphylococcus aureus* bacteria for concentrations of 25%, 50%, 75% and 100% had a p value <0.05. This means that each tanjung fruit extract concentration has a significantly different effect.

The concentration of Tanjung fruit pulp extract can inhibit the growth of *Staphylococcus aureus* bacteria. The post hoc test showed that the inhibition zone diameter for concentrations of 25%, 50%, 75% and 100% each had a value of p = 0.000. This means that each tanjung fruit extract concentration has a significantly different effect. The results of data analysis on the diameter of the inhibition zone formed by One way Anova show a significant value of 0.000, which means p <0.05. This means that there is a significant difference between the extract concentration groups. After doing the post hoc test, it was found that the 25% extract was significantly different from the 50%, 75%, and 100% extracts. With a value of p = 0.000. Then the 50% extract was significantly different from the extract concentration of 25%, 75% and 100% with a value of p = 0.000. The 75% extract had a significant effect on the concentration of 25%, 50% and 100% with a value of p = 0.000. The 100% extract concentration with a value of p = 0.000 showed a significant difference between the respective concentrations of *Lactobacillus acidophilus* and *Streptococcus mutans*.

The post hoc test on the inhibition of *Staphylococcus aureus* bacteria showed that the 25% extract was significantly different from the 50% extract with a value of pP = 0.001 while for 75% and 100% with a value of p = 0.000. Then the 50% extract was significantly different from the extract concentration of 25% and 75% with each value with a value of p = 0.001 and 100% with a value of p = 0.000. The 75% extract had a significant effect on the concentration of 25% and 100% with a value of p = 0.000; extract 50% with p value = 0.001. The 100% extract concentration with a value of p = 0.000 showed a significant difference between each concentration. This overall proves that the extract of Tanjung fruit pulp can inhibit the growth of *Lactobacillus acidophilus*, *Staphylococcus aureus* and *Streptococcus mutans* bacteria.

DISCUSSION

Tanjung fruit pulp contains tannins, saponins, alkaloids, flavonoids and steroids which are antibacterial compounds. Kalanduyung leaves contain tannins, saponins, alkaloids, flavonoids and steroids which are antibacterial compounds. Tannins, saponins, alkaloids, flavonoids and steroids which are antibacterial compounds are found in the mangosteen rind. Flavonoids are one of the natural phenolic compounds that are widespread in plants. The mechanism of action of phenolic compounds by interfering with active transport and proton strength in the microbial cytoplasmic membrane [(5)]. The bioactive components of phenol can cause selysis, denaturation of proteins, inhibit the formation of cytoplasmic proteins and nucleic acids and inhibit ATP-ase bonds [(6)]. The tannin compound group is able to form complexes with bacterial cell wall polysaccharides so as to inhibit the growth of these bacteria. Tannins have antibacterial activity related to their ability to activate adesin and enzymes in microorganism cells and interfere with protein transport in the inner layer of cells. Saponins are able to inhibit microbial growth by interacting with sterol membranes. The main effect of saponins on bacteria is the release of proteins and enzymes from the cells and affects the stability of the cytoplasmic cell membrane so that microbial cells become lysis [(6)]. The mechanism of action of alkaloids as antibacterials is by disrupting the components of peptidoglycan which causes the bacterial cell wall layer to not form completely which leads to cell death [(7)]. According to Karou and Savadogo [(8)] alkaloid components act as DNA intercalators and inhibit the work of the topoisomerase enzyme in bacterial cells. Steroid mechanism as antibacterial causes leakage of liposomes [(9)]. Steroids can cause decreased membrane integrity due to the ability of steroids to interact with cell membrane pospolipids which are permeable to lipophilic compounds [(10)]. Amrie et al. [(11)] stated that high concentrations of antimicrobial agents will cause high inhibition as well. This is also supported by the research of Aldelgrit et al. [(12)] that the higher the ethanol extract of Kalanduyung leaves, the higher the antibacterial activity test will be.

This overall proves that the extract of Tanjung fruit pulp can inhibit the growth of *Lactobacillus acidophilus*, *Staphylococcus aureus* and *Streptococcus mutans* bacteria.

CONCLUSION

Tanjung fruit pulp extract can inhibit the growth of the bacteria Lactobacillus acidophilus, Staphylococcus aureus and Streptococcus mutans and the most effective concentration is 100%, with an average diameter of the inhibition zone which is Lactobacillus acidophilus bacteria of 27,925 mm, Staphylococcus aureus of 9,425 mm and Streptococcus mutans of 14,825 mm. The extract of Tanjung fruit pulp is more effective at inhibiting the growth of Lactobacillus acidophilus bacteria.[(9)]

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