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Antibacterial Effectiveness of Rambutan Peel Extract (*Nephelium lappaceum* L.) in Inhibiting the Growth of Enterococcus Faecalis Bacteria

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ABSTRACT

Backgrounds. This research is a study that seeks to explore the potential of rambutan extract in inhibiting the growth of Enterococcus faecalis bacteria, where this bacterium is one of the bacteria that is often found in the oral cavity and often causes infections and dental and oral problems. **Methods:** This research is an experimental study in vitro. This study aims to determine the diameter of the inhibition zone of rambutan peel extract on Enterococcus faecalis. Rambutan peel extracts were tested at levels of 5%, 7.5% and 10% with NaOCl (Sodium Hypochlorite) 2.5% control, where each test group was tested on 6 culture plates of Enterococcus faecalis bacteria. **Results:** The 10% rambutan peel extract group had the highest inhibition zone diameter of 12.4 ± 1.21 mm. Rambutan peel extract 5% - 10% showed a higher inhibition zone diameter than the control NaOCl 2.5%. The results of the effectiveness test of the diameter of the inhibition zone between the test groups. Rambutan peel extracts 5%, 7.5% and 10% showed different levels of inhibition zone diameter compared to 2.5% NaOCl. Rambutan peel extract 5%, 7.5%, and 10% had a higher diameter of the inhibition zone than the 2.5% NaOCl control. **Conclusion:** Rambutan peel extract 5%, 7.5% and 10% were more effective in inhibiting the growth of Enterococcus faecalis than control NaOCl.

1. Introduction

Pulp disease in root canals can be treated with appropriate treatment options, one of which is root canal treatment.¹ Tooth can still function if treated through root canal treatment. It refers to the act of removing infected pulp tissue and reshaping and repopulating the root canal to prevent bacteria from entering the root canal. There are three important stages in the principle of root canal treatment as a hallmark of endodontic success known as the endodontic triad, namely biomechanics, disinfection, and root canal obturation.² Sodium hypochlorite

(NaOCl) with a concentration of 2.5% is the most commonly used root canal irrigant because of its low cytotoxicity, so it has the most suitable criteria for treating root canals. and bactericidal action when compared to concentrations. Sodium hypochlorite has drawbacks such as high concentrations of toxic to tissue, has a high surface tension which causes the dentin wall to be difficult to wet, has a bad odor, is corrosive to metals, and can cause tissue swelling and inflammation of the gingiva to overcome the weakness of the material. chemical irrigation, the researchers

looked for natural irrigation materials, one of which was rambutan peel.³

The peel of the rambutan (*Nephelium lappaceum L.*) is often thrown away by the public even though the peel of the rambutan fruit has health benefits.⁴ Antibacterial compounds contained in plants can be an option to prevent chemical plaque formation and rambutan peel contains flavonoid, phenolic, terpenoid, and steroid compounds. On the other hand, there are various experiments showing that there are antibacterial functions possessed by steroid and terpenoid compounds found in the peel of the rambutan fruit.^{5,6} Studies on the antibacterial effect of *Staphylococcus epidermidis* in vitro from *Nephelium lappaceum L.* or rambutan leaves in concentrations of 10%, 50%, and 100% resulted in the average inhibition of 28.23 mm, 31.47 mm, and 35.17 mm.^{7,8}

This research is a study that seeks to explore the potential of rambutan extract in inhibiting the growth of *Enterococcus faecalis* bacteria, where this bacterium is one of the bacteria that is often found in the oral cavity and often causes infections and dental and oral problems.

2. Methods

This research is an in vitro experimental study. This study aims to determine the diameter of the inhibition zone of rambutan peel extract on *Enterococcus faecalis*. Rambutan peel extracts were tested at levels of 5%, 7.5% and 10% with NaOCl (Sodium Hypochlorite) 2.5% control, where each test group was tested on 6 culture plates of *Enterococcus faecalis* bacteria. The process of making rambutan peel extract, starting with the rambutan peel is washed then cleaned and dried in an oven at a temperature of 60°C. Next, the dried rambutan peel is then mashed so that the

rambutan peel *Simplicia* is obtained. 200 grams of rambutan peel *Simplicia* was dissolved in 2 liters of 70% ethanol for 3x24 hours. The macerate was then evaporated using a rotary evaporator to obtain a thick extract.

Use a sterile ose to take a colony of pure bacterial culture, grow it on an inclined agar medium, then use an incubator to incubate for 1 x 24 hours at 37°C. Then prepare petridish and MHA (Mueller Hinton Agar) media. Until the density occurs, the petri dish will be poured 20 mL of MHA media. A sterile cotton swab soaked in bacterial suspension was then scratched evenly onto the solid surface of the MHA media. Incubate for 20 hours at 37°C using an incubator that has been prepared. After 20 hours, the authors will observe and check the diameter of the inhibition zone visible around the disc. The clear area of horizontal, vertical, and diagonal diameters can be measured using a caliper so that the authors can determine the diameter of the inhibition zone. The result is the average of the three expressed in millimeters.

Data analysis was carried out with the help of SPSS 25 software. Univariate data analysis was carried out to determine the mean inhibition zone diameter and standard deviation. Furthermore, an analysis was carried out to test the difference in the diameter of the inhibition zone between the test groups with one-way ANOVA followed by post hoc LSD, with a significance value of $p < 0.05$.

3. Results

Table 1 shows the diameter of the inhibition zone for each test group. The 10% rambutan peel extract group had the highest inhibition zone diameter of 12.4 ± 1.21 mm. Rambutan peel extract 5% - 10% showed a higher inhibition zone diameter than the control NaOCl 2.5%.

Table 1. Inhibitory zone diameter values for each test groups

Group	Inhibitory zone diameter (mm) Mean \pm SD
EKR 5%	10.2 \pm 0.54
EKR 7.5%	11.5 \pm 0.83
EKR 10%	12.4 \pm 1,21
NaOCl 2.5%	6.7 \pm 0.19

*EKR: Rambutan peel extract

Table 2 is the result of the effectiveness test of the diameter of the inhibition zone between the test groups. Rambutan peel extracts 5%, 7.5% and 10% showed different levels of inhibition zone diameter compared to

2.5% NaOCl. Rambutan peel extract 5%, 7.5%, and 10% had a higher diameter of the inhibition zone than the 2.5% NaOCl control.

Table 2. Effectiveness test of inhibition zone diameter between test groups

	EKR 5%	EKR 7.5%	EKR 10%	NaOCl 2.5%
EKR 5%		0.009*	0.000*	0.000*
EKR 7.5%	0.009*		0.057	0.000*
EKR 10 %	0.000*	0.057		0.000*
NaOCl 2.5%	0.000*	0.000*	0.000*	

*ECR: Rambutan Peel Extract; one way ANOVA – post hoc LSD; p<0.05

4. Discussion

The results of this study are in line with studies that explain that rambutan leaf extract at a concentration of 7.5% has a higher level of effectiveness to limit the development of *Streptococcus* mutants when compared to a concentration of 5%. This can happen because the content of antibacterial active compounds, tannins, and flavonoids, plays an important role in limiting the development of gram-positive bacteria because there are cell walls owned by these bacteria. The cell wall can be damaged because the cell's permeability is disrupted due to the cell wall being wrinkled by tannins. On the other hand, extracellular proteins play a role in the formation of complex compounds together with flavonoids so that bacterial cell membranes can be damaged because of this and cause intracellular compounds to come out. Thus, the growth of *Enterococcus faecalis* bacteria could be inhibited more effectively with a 7.5% concentration of rambutan peel extract compared to a 5% concentration.⁹⁻¹⁰

Some findings show that there is a significant difference between the 5% rambutan peel extract and 10% rambutan peel extract with a p-value <0.05, namely p = 0.000 so that the 10% concentration is more effective than the 5% concentration. This means that the more active compounds there are in the group, the higher the concentration level will make it easier for the active compounds to penetrate cells. Antibacterial active compounds found in rambutan peel are terpenoids and alkaloids, flavonoids, saponins, triterpenoids, steroids, and tannins.¹¹ Bacterial cell walls can be penetrated easily because of the ability to

dissolve easily in lipids possessed by terpenoid compounds. On the other hand, there is a potential for leakage of enzymes and proteins from inside the cells as a mechanism of action of saponins as antibacterial. This causes permeability to be damaged and the cell wall surface tension to decrease due to the role of saponins. In addition, in bacterial cells, the peptidoglycan constituent components can be disrupted thanks to the mechanism of action of alkaloids as antibacterial. Thus, these cells can experience death and the cell wall layer cannot be formed completely. In addition, there is a reaction that has transmembrane (porins) on the outer membrane of the cell wall as a triterpenoid mechanism in antibacterial.⁵⁻⁶

The results of the study showed that the 7.5% rambutan peel extract showed no significant difference in antibacterial effectiveness with the 10% rambutan peel extract. This finding was caused by the length of immersion of the disc paper which was not uniform and not controlled in this study. The length of soaking the disc paper affects the absorption of the active ingredients contained in the extract into the disc paper because the longer the soaking time, the more active ingredients that can be absorbed with an immersion time of ± 15 minutes.

The results showed that the diameter of the inhibition zone of the NaOCl group was 2.5% lower when compared to the treatment group, which is in line with the study which showed that the diameter of the inhibition zone of the NaOCl group was 2.5% lower than the treatment group (*Cyombopogon citratus*

extract). in inhibiting *Enterococcus faecalis* bacteria. This could be due to a large number of antibacterial active compounds such as tannins, flavonoids, etc. in the rambutan peel so that the experimental group had a better level of effectiveness in limiting the growth of *Enterococcus faecalis* bacteria compared to 2.5% NaOCl. From the results of this study, it was proven that the inhibition of rambutan peel extract at 10% concentration was the most effective (2 times compared to the positive control group) to limit the growth of *Enterococcus faecalis* bacteria. Therefore, rambutan peel extract can be used as an alternative source of root canal irrigation which is more effective than 2.5% NaOCl.⁹

5. Conclusion

Rambutan peel extract 5%, 7.5%, and 10% were more effective in inhibiting the growth of *Enterococcus faecalis* than control NaOCl.

6. References

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