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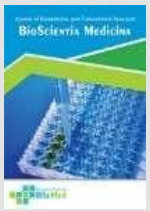

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Comparison of Antibacterial Effectiveness of Rambutan Leaf Extract (*Nephelium lappaceum L.)* and Tin Leaf Extract (*Ficus carica L.*) to *Streptococcus mutans*

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A B S T R A C T

Background: Caries is an infectious disease accompanied by damage to the surface tissue of enamel, dentin and extends toward the pulp. Microorganisms that have a role in the formation of caries, namely *Streptococcus mutans*. Rambutan leaves and tin leaves are plants that have an antibacterial effect. This study aimed to compare the antibacterial effects of rambutan and tin leaves on the bacteria *Streptococcus mutans*. **Methods:** In vitro experimental studies. A total of 30 petri dishes that have been added 1-2 ose of bacterial culture *Streptococcus mutans* and MHA (mueller hinton agar) were used in this study, with 10 test groups, namely 2 control groups, 4 rambutan leaves extract test groups, and 4 tin leaves extract test groups. Data analysis was carried out with the help of SPSS using univariate and bivariate. **Results:** Extracts of rambutan leaves and tin leaves show the ability to inhibit the bacterial growth of *Streptococcus mutans*, along with increasing the dose of the extract. However, the inhibition ability of tin leaf extract was not as great as that of rambutan leaf extract at the same concentration. **Conclusion:** Rambutan leaf extract (*Nephelium lappaceum L.*) has effectiveness as an antibacterial *Streptococcus mutans* more optimal than tin leaf extract (*Ficus carica L.*).

1. Introduction

Caries is an infectious disease accompanied by damage to the surface tissue of enamel, dentin and extends toward the pulp. Host, microorganisms, substrate, and time are factors that interact with each other in the formation of caries. Microorganisms that have a role in the formation of caries, namely *Streptococcus mutans*. *Streptococcus mutans* are acidogenic (produces acid) and aciduric (acid resistant). *Streptococcus mutans* able to produce extracellular polysaccharides and undergo cell-to-cell aggregation. This can cause disruption of the balance between the remineralization and demineralization processes.[1-5]

Indonesia is a tropical country with a variety of biological natural resources, especially plants, and plants that are useful in traditional medicine. Rambutan belongs to the family *Sapindaceae* and genus *Nephelium L.* In general, rambutan is found in Southeast Asia, namely Indonesia and Malaysia, and has a wide distribution throughout Indonesia, namely Sumatra, Java, and Kalimantan. Rambutan leaves contain saponins, tannins, and flavonoids. Rambutan leaves can also be used as a traditional medicine because these phenolic compounds can be used as antibacterials. Tin (*Ficus carica L.*) is a Middle Eastern plant with a spread to the plains of Europe, America, and Asia, including Indonesia. Tin is included in the family *Moraceae* and comes from the genus *Ficus*. Secondary metabolite compounds in the form of flavonoids, alkaloids, and tannins are found in the tin. These compounds support the efficacy of tin as a

traditional medicine. Tin has antibacterial, antioxidant, anti-inflammatory, antidiarrhea, and anticancer activities.[6-11] This study aimed to compare the antibacterial effects of rambutan and tin leaves on the bacteria *Streptococcus mutans*.

2. Methods

This study was an in vitro experimental study and used bacterial culture *Streptococcus mutans* on petri dishes obtained from the laboratory of microbiology, Faculty of Pharmacy, Universitas Sumatera Utara, Medan, Indonesia. Rambutan leaves (*Nephelium lappaceum L.*) and tin leaves (*Ficus carica L.*) as the test material, and the extraction process was carried out using 96% ethanol solvent by maceration for 1x24 hours. The macerate resulting from maceration is thickened into an extract using a rotary evaporator. This study was approved by the medical and health research ethics committee of the Faculty of Medicine, Dentistry and Health Sciences, Universitas Prima Indonesia, Medan, Indonesia.

Bacterial culture *Streptococcus mutans* Standardization of bacterial concentrations was carried out using McFarland 0.5 solution. The similarity of turbidity levels showed the same concentration of bacteria between test groups. A total of 30 petri dishes that have been added 1-2 ose of bacterial culture *Streptococcus mutans* and MHA (mueller hinton agar) were used in this study. There are 10 test groups, chloramphenicol 1% as a positive control (K1), negative control, DMSO (K2), rambutan leaf extract treatment group 25%, 50%, 75%, and 100% respectively as K3-K6, tin leaf extract treatment group 25%, 50%, 75% and 100% as K7-K10 respectively. A total of 3 test petri dishes were used in each group. Furthermore, the inhibition of bacteria was measured by measuring the diameter of the inhibition zone of each treatment group. Data analysis was performed with the help of SPSS software version 25. Univariate analysis was performed to present the data distribution for each test variable. Bivariate analysis was carried out to see statistical differences in each test variable, where $p < 0.05$.

3. Results

Table 1 shows a comparison of the effectiveness of rambutan leaf extract and tin leaf extract as an antibacterial against *Streptococcus mutans*. Rambutan leaf extract shows the ability to inhibit bacterial growth of *Streptococcus mutans*, along with increasing the concentration of the extract. The inhibition of bacterial growth was 15.27 mm at a concentration of 25% and an inhibition of 17.40 mm at a concentration of 100%. Tin leaf extract shows the ability to inhibit bacterial growth *Streptococcus mutans* along with increasing the dose of the extract. However, the inhibition ability of tin leaf extract was not as great as that of rambutan leaf extract at the same concentration.

Table 1. Comparison of antibacterial effectiveness of rambutan leaf extract (*Nephelium lappaceum L.*) and tin leaf extract (*Ficus carica L.*) to *Streptococcus mutans.*

Group	**Concentration**	**Inhibition diameter**
		Mean±SD
Rambutan leaf extract	25%	15,27±0,64
	50%	15,43±0,67
	75%	16,17±0,21
	100%	17,40±0,10
Tin leaf extract	25%	14,30±0,92
	50%	15,23±0,51
	75%	16,00±0,30
	100%	16,30±0,39
Positive control		20,20±0,53
Negative control		0

4. Discussion

This study shows that rambutan leaf extract (*Nephelium lappaceum L.*) and tin leaf extract (*Ficus carica L.*) have antibacterial against *Streptococcus mutans*. This shows that at each concentration tested, and an inhibition zone was formed around the paper disc. The existence of the inhibition zone was caused by secondary metabolites of rambutan leaf extract and tin leaf extract, which acted as antibacterials. Tannins, flavonoids, and saponins are compounds that can be found in rambutan leaves (*Nephelium lappaceum L.*) and on tin leaves (*Ficus carica L.*) in the form of flavonoids, tannins, and alkaloids. Flavonoids can inhibit the synthesis of nucleic acids and the function of cell membranes and interact with bacterial DNA and cause damage to the bacterial cell wall, lysosomes, and microsomes. Bacterial growth is inhibited due to tannin polyphenolic compounds that react with cell membranes. Tannins are also able to inactivate bacterial cell adhesion and enzymes and protein transport will be disrupted. Saponins can cause leakage of proteins and enzymes and damage the permeability of the membrane in bacterial cells resulting in cell death. Saponins can also cause the release of bacterial cell components in the form of proteins, nucleotides, and nucleic acids, causing bacterial lysis. Alkaloids work to interfere with the arrangement of peptidoglycan in bacterial cells, causing it not to form completely in the cell wall.[12-16]

This research is strengthened by other studies that have tested extracts of rambutan leaves and tin leaves but tested with other bacteria. A study reports that rambutan leaves can inhibit growth *in S. aureus* concentrations of 3.125%, 6.25%, 12.5% , 25%, 50%, and 100%. Another study also reported that tin leaf extract has the antibacterial ability to inhibit the growth of *E. Coli* and *Staphylococcus aureus*. Another study states that tin leaf extract concentrations of 12.5%, 25%, 50%, 75%, and 100% have antibacterial properties against *Porphyromonas gingivalis* which is a bacterium that causes periodontitis.[17-20]

5. Conclusion

Rambutan leaf extract (*Nephelium lappaceum L.*) has effectiveness as an antibacterial *Streptococcus mutans* more optimal than tin leaf extract (*Ficus carica L.*).

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