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The Effectiveness of Using Jengkol Peel Extract (*Pithecellobium lobatum* Benth.) in Inhibits Bacterial Growth *Staphylococcus aureus* In Vitro

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A B S T R A C T

Staphylococcus aureus is aerobic bacteria that are gram-positive and are one of the normal human flora on the skin and mucous membranes. Most infections in the oral cavity are caused by *Staphylococcus aureus*, which is a normal flora in the oral cavity that can turn into a pathogen if trauma or abrasion occurs on the mucosal surface. Jengkol peel is thought to contain tannin compounds, which have the potential as an anti-inflammatory, anti-diarrheal, antioxidant, treatment of infections of the skin and mouth, and treatment of burns. This study aimed to explore the potential of jengkol peel extract (*Pithecellobium lobatum* Benth.) as an antibacterial *Staphylococcus aureus* regularly in vitro. This study is an experimental research in vitro, where as many as 7 treatment groups were used in this study. Positive and negative controls and extract concentrations of 5%-80% were used as the treatment group. Analysis of the average diameter of the inhibition of bacterial growth was carried out using SPSS version 25 software. The potential inhibition of jengkol peel extract was in line with the increase in the concentration of jengkol peel extract. The higher the concentration of jengkol peel extract, the greater the inhibition of bacterial growth. Extract concentration of 20% has a comparable inhibition of bacterial growth control positive. Jengkol peel extract effectively inhibits the growth of *Staphylococcus aureus* bacteria. Jengkol peel extract concentration of 20% has effectiveness in inhibiting bacterial growth equivalent to 0.2% chlorhexidine in vitro.

1. Introduction

Odontogenic infection is the most common type of infection in the oral cavity, with a prevalence of 34.21%. Odontogenic infection can be the initiation or continuation of periodontal disease, pericoronal, trauma, or postoperative infection. Bacteria that are generally found are bacteria *Streptococcus viridans*, *Streptococcus anginosus, Staphylococcus aureus, Prevotella,* and *Fussobacterium*. These bacteria can cause caries, gingivitis, and periodontitis and can cause odontogenic infections if they enter through necrotic pulps and deep periodontal pockets. *Staphylococcus aureus* is aerobic bacteria that are gram-positive and are one of the normal human flora on the skin and mucous membranes. Most infections in the oral cavity are caused by *Staphylococcus aureus,* which is a normal flora in the oral cavity that can turn into a pathogen if trauma or abrasion occurs on the mucosal surface.[1-5]

The most widely used drug for the treatment of infections caused by the bacteria *Staphylococcus aureus* is an antibiotic. In the world of dentistry, the treatment of infections that occur in the teeth is carried out by giving antibiotics as part of the dentist's therapy which is generally carried out with various indications. It is estimated that approximately 10% of all prescriptions are related to dental infections. Antibiotic resistance occurs when microorganisms change, causing drugs given with the aim of curing infections by microorganisms to become ineffective. This is a serious concern because it can cause death and unwanted side effects such as respiratory

problems, tendonitis, headaches, seizures, arrhythmias, leukopenia, and thrombocytopenia. Then it can also cause financial outlay that is too large and repeated relapses due to the use of drugs that are beyond the limits.[6-9]

Exploration of new therapeutic modalities for handling Bacterial infection is a very important thing to do. Indonesia is a country with abundant natural wealth potential, including rich in biodiversity. One of the ingredients that have antibacterial properties is jengkol peel (*Pithecellobium lobatum* Benth.). So far, jengkol peel is classified as an abundant organic waste in traditional markets. The chemical content in jengkol can be efficacious as a medicine for wounds, boils, scabies, and eczema. Usually, people use dry jengkol peel, which is mashed. After it is smooth, then soaked using hot water, then filtered. After being filtered, the dregs from the jengkol peel are directly used by placing them on the wound. Jengkol peel is suspected of containing tannin compounds. This allegation is based on the fact that if the jengkol peel is peeled with a knife, a blue-black color will form on the peeled jengkol peel. This indicates the presence of tannin compounds which can be used as anti-inflammatory drugs, anti-diarrheal, antioxidants, treatment of infections of the skin and mouth, and treatment of burns. Therefore, tannin as an antibacterial can be used in the field of medicine.[10-14] This study aimed to explore the potential of jengkol peel extract (*Pithecellobium lobatum* Benth.) as an antibacterial *Staphylococcus aureus* in vitro.

2. Methods

This study is experimental research in vitro. This study uses a sample of bacteria *Staphylococcus aureus* isolated from patients at the Universitas Sumatera Utara Hospital and cultured on agar media at the microbiology laboratory of the Faculty of Pharmacy, Universitas Sumatera Utara, Medan, Indonesia. jengkol peel (*Pithecellobium lobatum* Benth.) as the test material, the extraction process was carried out using solvent ethanol 96% 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, Universitas Sumatera Utara, Medan, Indonesia.

Bacterial culture *Staphylococcus aureus* 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 28 petri dishes that had been added 1-2 ose of bacterial culture *Staphylococcus aureus* and MHA (Mueller Hinton Agar) were used in this study. There were 7 test groups, namely 0.2% chlorhexidine as a positive control (K1), negative control, DMSO (K2), 5%, 10%, and 20% gambas fruit extract treatment group. 40% and 80%, respectively, as K3-K7. A total of 4 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 carried out using SPSS version 25 software. Univariate analysis was performed to present the distribution of each data variable test. Bivariate analysis was carried out to see statistical differences in each test variable, where $p < 0.05$.

3. Results and Discussion

Table 1 presents power resistor bacterial growth between treatment groups. The potential inhibition of jengkol peel extract is in line with the increasing concentration of jengkol peel extract. The higher the concentration of jengkol peel extract, the greater the inhibition of bacterial growth. An extract concentration of 20% has a comparable inhibition of bacterial growth control positive. The effectiveness of the 20% concentration extract with positive control was shown by the results of the LSD post hoc test, where $p > 0.05$ (Table 2). Jengkol peel extract concentration of 20% has a comparable inhibition of bacterial growth control positive.

Table 1. Comparison of inhibition between groups.

Treatment group	Mean±SD
5%	11,20±0,41
10%	13,15±0,85
20%	14,82±0,49
40%	15,70±0,65
80%	16,85±0,67
Positive control (Chlorhexidine gluconate 0.2%)	14,32±0,47
Negative control (DMSO)	0

Table 2. Comparison of the average inhibition between groups.

Treatment group		Mean difference	Sig.*
Jengkol peel 5%	Jengkol peel 10%	-1.950	0.000
	Jengkol peel 20%	-3.625	0.000
	Jengkol peel 40%	-4.500	0.000
	Jengkol peel 80%	-5.650	0.000
	Positive control	-3.125	0.000
	Negative control	11.200	0.000
Jengkol peel 10%	Jengkol peel 20%	-1.675	0.000
	Jengkol peel 40%	-2.550	0.000
	Jengkol peel 80%	-3.700	0.000
	Positive control	-1.175	0.006
	Negative control	13.150	0.000
Jengkol peel 20%	Jengkol peel 40%	-0.875	0.035
	Jengkol peel 80%	-2.025	0.000
	Positive control	0.500	0.212
	Negative control	14.825	0.000
Jengkol peel 40%	Jengkol peel 80%	-1.150	0.007
	Positive control	1.375	0.002
	Negative control	15.700	0.000
Jengkol peel 80%	Positive control	2.525	0.000
	Negative control	16.850	0.000
Positive control	Negative control	14.325	0.000

*Post hoc LSD.

The inhibitory activity caused by jengkol peel extract as an antibacterial agent is caused by the ability of jengkol peel to inhibit bacteria *Staphylococcus aureus*. Bacteria *Staphylococcus aureus* is a normal flora that can turn into a pathogen when there is trauma or abrasion on the mucosal surface. Bacteria *Staphylococcus aureus* can cause or exacerbate various infections that occur in the oral cavity through the mechanism of toxin removal. Necrosis, inflammation, and abscess formation are characteristic features of the disease caused by these bacteria.[15-17]

Jengkol peel contains active compounds, namely flavonoids, tannins, saponins, alkaloids, and polyphenols. Flavonoid compounds are antibacterial and inhibit bacterial growth by damaging bacterial cells so that cells cannot carry out living activities. As a result, their growth will be inhibited. Tannin compounds in jengkol peel have antibacterial action related to their ability to deactivate bacterial adhesin, inhibit enzyme action, and inhibit protein transport in the cell envelope so that the bacteria become lysed. Saponins can cause cell hemolysis by increasing the permeability of the cell membrane so that the membrane becomes unstable. Alkaloids inhibit the formation of synthesis proteins that interfere with bacterial metabolism. Meanwhile, polyphenols can cause damage to bacterial cells and cause cell leakage.[18-20]

4. Conclusion

Jengkol peel extract effectively inhibits the growth of *Staphylococcus aureus* bacteria. Jengkol peel extract concentration of 20% has effectiveness in inhibiting bacterial growth equivalent to 0.2% chlorhexidine in vitro.

5. References

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