Comparative Analysis of the Inhibitory Efficacy of 50% and 80% Concentrations of Rambutan Seed Extract (*Nephelium lappaceum* L.) on the Growth of *Candida albicans*

Cindy Denhara Wijaya¹, Daryono², Rasyika Adani³

¹Department of Dental Public Health, Faculty of Medicine, Dentistry and Health Sciences, Universitas Prima Indonesia, Medan, Indonesia  
²Department of Public Dental Health Sciences, Faculty of Medicine, Dentistry and Health Sciences, Universitas Prima Indonesia, Medan, Indonesia  
³Dentistry Study Program, Faculty of Medicine, Dentistry and Health Sciences, Universitas Prima Indonesia, Medan, Indonesia

**ABSTRACT**

**Introduction.** Denture stomatitis is a prevalent issue among those who wear dentures, and it is caused by *Candida albicans*. Ketoconazole, anazole antifungal medication, is commonly employed to treat denture stomatitis. However, it is important to note that the usage of this agent might lead to hepatotoxicity and the development of resistance. The objective of the study was to assess the inhibitory efficacy of rambutan seed extract (*Nephelium lappaceum* L.) at concentrations of 50% and 80% on the proliferation of *Candida albicans*.  

**Methods.** This research employs a laboratory experiment using a design that includes a post-test only control group. The specimen is an uncontaminated culture isolation of *Candida albicans*. This study had four distinct groups: rambutan seed extract concentrations of 50% and 80%, a positive control group, and a negative control group. Each group was reproduced six times. Using digital calipers to measure the diameter of resistance. Upon completion of data collection, the acquired data was subsequently subjected to analysis utilizing one-way ANOVA and post hoc LSD statistical testing.  

**Results.** The research findings indicate that the average ± standard deviation inhibitory diameter of rambutan seed extract was 8.68 ± 0.585 ; 12.38±0.505 ; 22.43 ± 0.809 mm, respectively. In contrast, the negative control (DMSO) did not exhibit any inhibitory effects. The one-way ANOVA test revealed a statistically significant difference in the mean inhibitory diameter of rambutan seed extract at concentrations of 50% and 80% on the growth of *Candida albicans* (p=0.000; p≤0.05). The findings of the LSD post hoc test indicated a significant difference in inhibitory power between the 50% and 80% concentrations of rambutan seed extract, as well as between these concentrations and both the positive and negative controls. Additionally, there was a significant difference in the growth of *Candida albicans* between the 50% and 80% concentrations of rambutan seed extract (p≤0.05).  

**Conclusion.** The research findings indicate that the extract derived from rambutan seeds effectively inhibits the development of *Candida albicans*. An 80% concentration is the optimal concentration for maximum effectiveness.

1. **Introduction**

Denture stomatitis is a common issue that affects people who wear dentures. It involves pathological changes and chronic inflammation, which can be either localized or generalized. Symptoms include swelling and redness in the mucosa and supporting gingiva that come into contact with the denture. In most cases, this condition is asymptomatic. An epidemiological study indicates a substantial prevalence of denture stomatitis, ranging from 20 to...
67% among those who use full dentures. *Candida albicans*, a kind of microorganism, mostly causes denture stomatitis. Doctors commonly employ ketoconazole, an antifungal drug, to treat denture stomatitis. It works by upsetting the metabolic equilibrium of the fungal cell membrane, hence altering its permeability and function during the transportation of vital substances. The use of ketoconazole can cause liver toxicity and resistance. Hence, it is imperative to design antifungal medications derived from natural compounds that exhibit minimal adverse reactions.\(^1\)\(^-\)\(^5\)

Indonesia possesses a plethora of natural resources that serve as valuable traditional medicinal herbs. Medicinal plants are increasingly being advocated for usage in underdeveloped nations because of their apparent safety, little or nonexistent bad effects, and absence of resistance, particularly in comparison to synthetic medications. Rambutan, a fruit classified under the family Sapindaceae, serves as an example of such a botanical species. Rambutan thrives in tropical temperatures and is commonly found in southeast Asia, specifically in Indonesia, the Philippines, Thailand, and Northern Australia. People frequently discard the rambutan seed and it has not been extensively utilized. Rambutan seeds are typically seen as garbage. Rambutan seeds have several potentials derived from their secondary metabolites that can be used in the field of healthcare. Rambutan seeds contain tannins, flavonoids, and saponins, three bioactive components with antifungal properties.\(^6\)\(^-\)\(^10\) The objective of this study is to assess the effectiveness of the rambutan seed extract (*Nephelium lappaceum* L.) at 50% and 80% concentrations in inhibiting the growth of *Candida albicans*.

2. Methods

We conducted this laboratory-based experimental investigation in a controlled environment. The investigation was conducted with pure culture of the *Candida albicans* fungus. Six groups were used in this study, each performing six repeats. The experimental groups consisted of rambutan seed extract at concentrations of 50% and 80%, a positive control using ketoconazole, and a negative control using DMSO. The project has obtained clearance from the medical and health research ethics council of Prima Indonesia University.

The process involves cleaning 500 grams of fresh rambutan seeds by rinsing them with running water, followed by draining and cutting them into smaller pieces. Mix the rambutan seeds further to achieve a smooth consistency. After that, immerse the finely crushed rambutan seeds in 3.75 liters of 96% ethanol within a sealed glass container for five days, with intermittent agitation. After soaking for five days, the liquid separates into two components: filtrate and dregs. After acquiring it, gather and keep the liquid that has passed through the filter in a sealed container. After that, we immersed the remaining substance in 1.25 liters of 96% ethanol for two days, stirring occasionally.

The test fungus (*Candida albicans*) was extracted by utilizing a sterile needle and a test tube containing 5 ml of 0.9% NaCl solution. The mushrooms were thereafter diluted and homogenized for a duration of 10 minutes using a vortex. Next, assess the turbidity against the McFarland turbidity threshold of 1.5 x 10^8 cfu/mL. The fungal suspension exhibited opacity in comparison to the McFarland turbidity threshold of 0.5. If the colonies seemed less turbid, they were included in the suspension; however, if they appeared more turbid, nutritional broth (NB) was introduced.

We prepared a solution by dissolving 38 grams of NA medium per liter of distilled water. The solution was heated to boiling point to guarantee full dissolution and then subjected to autoclaving at a temperature of 121°C for 15 minutes in order to sterilize it. Place the contents into a petri dish with a thickness of 5 millimeters. The agar medium is suitable for use once it has cooled. The fungal colonies were equally distributed using a sterile cotton swab over NA agar medium and Brain Heart Infusion Agar (BHIB) at a concentration of 100 µ, as measured by the McFarland standard. Next, immerse the blind disk in rambutan seed extract at concentrations of 50% and
Next, it is necessary to submerge the blind disk into both the negative and positive controls. Subsequently, place the agar media, together with the paper discs, inside the incubator and adjust the temperature to 37°C for a duration of 24 hours. Subsequently, employ a digital caliper to precisely determine the breadth of the drag zone. Measuring the diameter of the clean region surrounding the paper disk determines the inhibitory power, where microorganisms are unable to grow. We conducted the data analysis using the SPSS version 25 program. Univariate and bivariate analyses were used to ascertain disparities in the diameter of inhibitory zones among groups, with a significance level of p<0.05.

### Results and Discussion

Table 1 shows the inhibitory effect of rambutan seed extract (*Nephelium lappaceum* L.) on the growth of *Candida albicans* at 50% and 80% concentrations. One-way ANOVA test showed that the rambutan seed extract (*Nephelium lappaceum* L.) had a significant effect on the growth of *Candida albicans* at 50% and 80% concentrations (p = 0.000; p≤0.05). These results indicate that rambutan seed extract (*Nephelium lappaceum* L.) has inhibitory effects of 50% and 80% on the development of *Candida albicans*.

The study revealed variations in inhibitory efficacy between doses of 50% and 80%. An 80% concentration achieves the highest inhibitory power. This is because a higher concentration of the extract results in a larger quantity of active components, such as tannins, flavonoids, and saponins. These three substances possess antifungal properties. Flavonoid chemicals exert their effects on *Candida albicans* by disrupting the protein links inside the cell membrane, leading to the lysis of the membrane. This allows the flavonoids to enter the cell nucleus.11-14

Flavonoids' penetration into the cell nucleus can inhibit the growth of *Candida albicans*. Concurrently, tannin compounds have the ability to interact with enzymes upon entering the cytoplasm. The enzyme that interacts with this chemical experiences a loss of functionality, resulting in the inhibition of the metabolic activity that the enzyme catalyzes.15-18 The interaction of saponins with cell sterol membranes inhibits fungus growth, contributing to their antifungal properties. Saponins function by decreasing the surface tension of the sterol membrane present in the fungal cell wall.19-23

### Table 1. The inhibitory effects of rambutan seed extract (*Nephelium lappaceum* L.) on the growth of *Candida albicans*.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Inhibitory zones (mm)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ±SD</td>
<td></td>
</tr>
<tr>
<td>Rambutan seed extract 50%</td>
<td>8.68±0,585</td>
<td></td>
</tr>
<tr>
<td>Rambutan seed extract 80%</td>
<td>12,38±0,505</td>
<td>0,000*</td>
</tr>
<tr>
<td>Ketoconazole</td>
<td>22.43±0,809</td>
<td></td>
</tr>
<tr>
<td>DMSO</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Notes: One-way ANOVA; *Significance value.

### Conclusion

The inhibitory potency of rambutan seed extract at an 80% concentration surpasses that of a 50% concentration. The inhibitory potency also rises proportionally with the concentration of the extract.

### References

2. Bars PL, Kouadio AA, Bandialky ON, Guenhennec LL, de la Cochetiere MF. Host's


