

# Analysis of kepok banana (*Musa paradisiaca* L) stems and roots extract in inhibiting the growth of *Candida albicans*



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## Abstract

**Objective:** The aim of this study to analysis the effectiveness of kepok banana (*Musa paradisiaca* L) stems and roots extract in inhibiting the growth of *Candida albicans* and determining part of stem or root that is more effective in inhibiting the growth of *Candida albicans* (a number of colonies).

**Material and Methods:** This study was an experimental study with a dilution method. The samples were *Candida albicans* colonies. The extraction was conducted using methanol maceration method. Viscous extracts were diluted using 10% dimethyl sulfoxide and filtered with Whatman paper filter. Those extracts were then divided into three separate groups; K(control), B(stem), A(root). Groups K, B

and A were added with Potato Dextrose Broth (PDB) media to reach concentrations of 25%, 12.5%, and 6.25%. The amount of *Candida albicans* colonies were counted and statistically analyzed using ANOVA and Post Hoc.

**Results:** Kepok Banana stems and roots extract was effective in inhibiting the growth of *Candida albicans* (a number of colonies). Root extract concentration of 25% had a better inhibitory effect compared to 12.5% and 6.25% concentration on both extracts. Root extract is better than stem extract.

**Conclusion:** Extracts of kepok banana stems and roots (*Musa paradisiaca* L.) are effective in inhibiting the growth of *Candida albicans*.

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**Keywords:** *Candida albicans*, *Musa paradisiaca* L., Root, Stem

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## Introduction

In the human body, *Candida albicans* lives as a saprophyte that can be found on the skin, genital tract, upper airway, and gastrointestinal tract including the oral cavity.<sup>1</sup> The treatment for *Candida albicans* infection can be done with the administration of antifungal drugs from the azole group. The widespread use of azole antifungal drugs has led to the development of drug resistance.

Another antifungal drug that can be used is chlorhexidine gluconate. The use of chlorhexidine gluconate has the side effect of causing teeth discoloration and causes loss in the sense of taste. Judging from the side effects that can be caused by these chemical drugs, therefore many medicinal plants are being studied scientifically as a substitute for chemical drugs.<sup>2</sup> One of the plants that have potential as a medicinal plant that is banana plant.

Banana stem extract concentration of 6.25%; 12.5%, and 25% had antibacterial activity. In a research conducted by Herry et al.<sup>2</sup> showed that in various concentrations, methanol extract of Mauli banana stems has antifungal effects because it contains several types of phytochemicals, for example, saponins, flavonoids, and tannins. Saponins functions as antibiotics, accelerating the growth of new cells, stimulates the formation of fibroblasts,

inhibiting the growth of bacteria, and is also antifungi.<sup>2,3</sup>

In this study used different varieties of banana plants from previous studies. The banana plant used in this research is kepok banana plant. In Makassar, kepok bananas are processed into a form of food called pisang epe. Pisang epe is a typical Makassar food that is very easy to find in Losari Beach and become part of the culinary tourism. Research conducted by Ayu et al.<sup>4</sup> showed that the extract every piece of kepok banana have an inhibitory effect to bacteria.<sup>4</sup> From the description, the authors are interested to analyze the activity of extracts of stems and roots of kepok banana plants in inhibiting *Candida albicans*.

## Material and Methods

This research was conducted in the Laboratory of Phytochemistry and Microbiology, Faculty of Pharmacy, University of Hasanuddin. The research design was experimental with a posttest-only with control design. The material used in this study is the stem and roots of Kepok banana plants, methanol, a suspension of *Candida albicans*, Potato Dextrose Agar (PDA), Potato Dextrose Broth (PDB), distilled water, 10% DMSO, and

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The tools used in this study is a rotary evaporator, Erlenmeyer tube, mixers, scales, knives, autoclave, sterile test tube, measuring 50 cc pipette, micropipettes, syringes, Whatman filter paper, Petri dishes, and an incubator.

The research procedure begins with the taking of stems and roots of Kepok banana. Banana stems and roots that have been taken then washed with flowing water and cut into small pieces, then dried by using the oven. After drying, it is followed by the extraction process. Extraction method used is maceration method that is soaking stem and root of banana that has been dried with methanol up to 1 cm above the surface of the sample. Soaking is done for 3 × 24 hours, filtered and the result was evaporated with rotary vacuum evaporator at a heating temperature of 40-50°C to obtain a thick extract.

Dilution of the extract was done by dissolving the viscous extract with 10% DMSO solution until the extract concentration reaches to 80%, then sterilized by filtration method using Whatman filter paper. Preparation of suspension of the extract tested was done. The extract of banana stem and root of Kepok banana with 80% concentration was taken amount of 0.39 ml; 0.78 ml and 1.56 ml, then each tube was added Potato Dextrose Broth (PDB) medium, the volume of each tube to 5 ml so that from the extract mixture and Potato Dextrose Broth (PDB) media obtained the concentration of 6.25%; 12.5% and 25%. Another tube without the extract was treated as a control (-). *Candida albicans* suspension of 100 µL was added on each tube.

After the preparation of the extract suspension was completed, incubation was done for 24 hours at 37°C, then dilution using NaCl solution with a ratio of 1: 9 (1 part extract and Muller Hinton media: 9 NaCl) to concentration to 1/10<sup>3</sup> in each group to facilitate the calculation of colonies. Samples were taken using a micropipette with a volume of 100 µL, placed on Potato Dextrose Agar (GDP) medium that has been prepared. Incubated again for 24 hours at 37°C, then the amount of fungal colonies were counted on each group.

**Results**

We report the activity of kepok banana stem and root extracts (*musa paradisiaca l.*) in inhibiting *candida albicans*. The calculation of the average amount of *candida albicans* colonies after treatment.

Figure 1 and figure 2 the results showed that the most bacterial colonies were found at 0% extracts of both root and banana stem (*musa paradisiaca l.*), while the colony was least in root and stem extracts with 25% concentration. The mean colonies in 25%, 12.5% and 6.25% concentrations of banana tree root extract and root of kepok banana (*moses paradisiaca l.*) were less than the colony average on control figure 3.

In table 1, there were statistically significant differences in results for each treatment (p <0.05).

In table 2, there were significant differences in the stem extract between 25% concentration and 6.25% concentration and control (-). Significant differences were also found at concentrations of 12.5% with a 6.25% concentration of stem extract and control (-). In root extract significant difference

**Table 1 Results of oneway analysis calculations anova figures candida albicans fruits extracts and roots of banana plants kepok (*musa paradisiaca L.*) 6.25%, 12.5%, 25%**

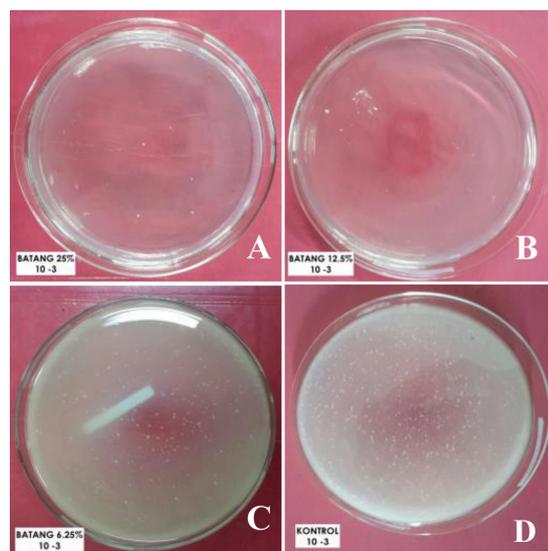
	Sum of squares	df	Mean square	F	sig
Between groups	17.954	3	5.985	6.830	0.047*
Within groups	3.505	4	0.876		
Total	21.459	7			

\* = There are significant differences (p <0.05)

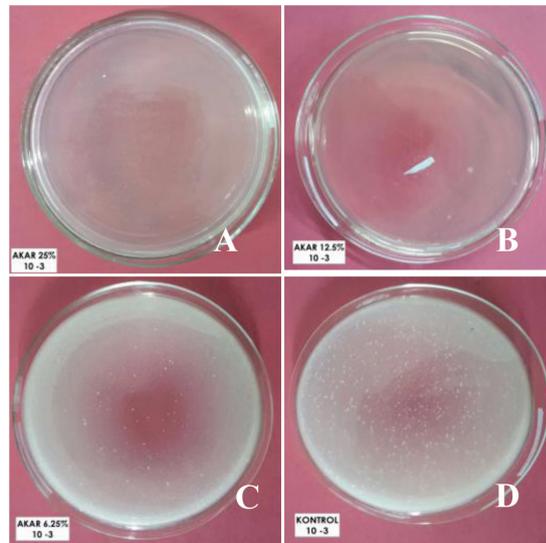
**Table 2 Results of the LSD Post Hoc test of differences between treatments**

	B25	B12.5	B6.25	A25	A12.5	A6.25	K(-)
<b>B25</b>		0.118	0.002*	0.902	0.576	0.050*	0.002*
<b>B12.5</b>	0.118		0.050*	0.095	0.292	0.635	0.042*
<b>B6.25</b>	0.002*	0.050*		0.002*	0.006*	0.117	0.751
<b>A25</b>	0.902	0.576	0.050*		0.497	0.040*	0.002*
<b>A12.5</b>	0.095	0.292	0.635	0.497		0.137	0.006*
<b>A6.25</b>	0.002*	0.006*	0.117	0.040*	0.137		0.091
<b>K(-)</b>	0.002*	0.042*	0.751	0.002*	0.006*	0.091	

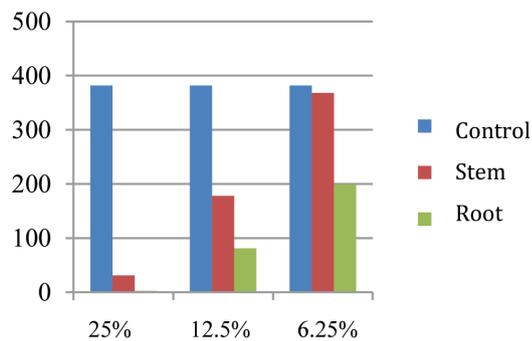
\* = There are significant differences (p <0.05)



**Figure 1** *Candida albicans* colonies which have been treated with stem extract. A (25%), B (12.5%), C (6.25%) and D (Control)



**Figure 2** *Candida albicans* colonies which have been treated with root extract. A (25%), B (12.5%), C (6.25%) and D (Control)



**Figure 3** Mean amount of *Candida albicans* colonies after treatment

was found between concentration 25% with concentration of 6.25% and control (-).

There are significant differences were also found in the root extract concentration of 12.5% with control (-). In comparison groups, stems and roots, a concentration of 25% and 12.5% of stems and roots of banana plants kepok have the same activity in inhibiting *Candida albicans* ( $p > 0.05$ ). Significant differences in root and root extract were found in the 6.25% concentration of stem extract with root extract concentrations of 25% and 12.5%. At root extract concentration of 6.25% there was significant difference with 25% stem extract but no significant difference with 12.5% and 6.25%.

## Discussion

The results of the study extracts of stems and roots of banana plants with a concentration of 6.25%, 12.5% and 25% showed a decrease in the amount of *Candida albicans* colonies which grew compared with the control (-). In the concentration of root

extract 25% found the amount of *Candida albicans* colony is lower than the concentration of 25% stem extract. The amount of *Candida albicans* colonies at 25% root extract concentration was also lowest compared with the extract concentrations of 6.25% and 12.5% of the roots and stems. The results of this study are in accordance with research by Ayu et al.<sup>4</sup> which states the extract of the kepok banana root is more effective in inhibiting bacteria compared with the stem / pseudo bark kepok.<sup>4</sup>

The decrease of the amount of *Candida albicans* colonies occurring at each concentration of Kepok banana extract in accordance with the antifungal test study conducted by Herry et al.<sup>2</sup> by dilution method using Maui banana stem extract with concentration of 6.25%; 12.5%, and 25%, respectively. In this study the greater the concentration the lower the amount of *Candida albicans* colonies. Reduced colony growth in *Candida albicans* because there are three contents in the kepok banana tree known to have antifungi effects, saponins, flavonoids, and tannins that have a way of working in inhibiting the growth of *Candida albicans*.<sup>2</sup> The root of banana kepok also contains saponin compounds, flavonoids and tannins so that has an antifungal effect.<sup>5</sup>

Saponin is a compound in the form of glycosides that are widespread in high-level plants. Saponin contributes as an antifungal with the mechanism of lowering the surface tension of the sterol membrane from *Candida albicans* cell wall, so its permeability increases. Increased permeability results in a more concentrated intracellular fluid drawn out so that *Candida albicans* cell death.<sup>2</sup>

Flavonoids are the largest group of natural phenol compounds and are polar compounds because they have a amount of hydroxyl groups, which will dissolve in polar solvents such as ethanol and methanol. Flavonoids are active compounds that can be used as antioxidants, antibacterials, anti-inflammatory, and antifungal.<sup>2</sup>

Another content is tannins. This compound is a complex compound of natural polyphenols found in plants. Tannins are divided into two groups: hydrolyzed tannins (ellagitannins and gallotannins) and condensed tannins (proanthocyanidins).<sup>2</sup>

Flavonoids and tannins which are phenol group compounds so as to react with the cell wall. Next it goes into the nucleus of the cell, and makes all the proteins in the fungi undergo denaturation so that the fungi cells become damaged and die.<sup>2</sup>

Banana stems and roots have the same compounds that can inhibit the growth of *Candida albicans* but there are differences in the amount of colonies at each concentration that is significantly different in amount. It can be affected by active compounds, filtered concentrations, the presence

of foreign organic substances which can decrease the effectiveness of antifungal chemicals by deactivating the chemicals.<sup>4</sup> The condition of the sample used may also affect the results of the study, based on a study conducted by Babu et al.<sup>6</sup> it is known that four different varieties of banana plants have different total amounts of phenols, polyphenols and alkaloids.<sup>6</sup> Another factor that affects the weakness or absence of the ability to suppress the growth of fungi from banana tree extracts to candida albicans is the condition of the microbes themselves. According to Fardiaz,<sup>7</sup> the ability of an antimicrobial agent is influenced by several factors, one of which is the properties of microbes that include type, concentration, age and microbial state.<sup>7,8</sup>

### Conclusion

From the results of research on the analysis of banana root and root extract (*musa paradisiaca* l.) in inhibiting the growth of candida albicans can be concluded that: extracts of kepok banana stems and roots (*musa paradisiaca* l.) are effective in inhibiting the growth of candida albicans. The extract of kepok banana root (*musa paradisiaca* l.) has more effective activity in inhibiting the growth of candida albicans (the amount of colonies).

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### Conflict of Interest

The authors report no conflict of interest.

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