

## Original Research Article

# Comparative Study on the Antifungal Property of Banana and Papaya Peel Extract on *Candida albicans* when added to Glucose Yeast Peptone Agar

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**Abstract:** This study aims to compare the antifungal property of banana (*Musa paradisiaca*) and papaya (*Carica papaya*) peel extract to *Candida albicans* when added to Glucose Yeast Peptone Agar. In the study, *Candida albicans* was tested for its sensitivity to different concentrations of *Musa paradisiaca* and *Carica papaya* extracts using agar disc diffusion method. All extracts inhibited *Candida albicans* except for 100% concentration banana and papaya extracts. The results showed the extent of the antifungal property of banana and papaya peel extracts. Canesten (positive control) has the highest mean zone of 32, banana 30% with a mean of 13.33, papaya 50% and 30% with a mean zone of 13 and banana 50% with a mean zone of 12 while banana 100% and papaya 100% did not inhibit the growth of *Candida albicans*. Based on the results obtained, there is a significant difference between the antifungal property of banana and papaya ethanolic extracts as to concentrations (30%, 50% and 100%) and when compared to canesten and GYP without extract. Furthermore, among the entire concentrations, 50% banana exhibited the most effective antifungal activity against *Candida albicans*.

**Keywords:** banana, papaya, antifungal, *Candida albicans*, canesten, Glucose Yeast Peptone Agar, phytochemical.

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## INTRODUCTION

Fungi are among the most widely distributed organisms on Earth and are of great environmental and medical importance. Many fungi are free-living in soil or water; others form parasitic or symbiotic relationships with plants or animals. Fungi cause a number of plant and animal diseases: in humans, ringworm, athlete's foot, and several more serious diseases are caused by fungi [1]. *Candida albicans* is the most frequent isolated yeast which is normal flora of the gastrointestinal tract and mucocutaneous areas. Candidiasis may involve the mucous membranes of the mouth (thrush) or vagina (vulvovaginitis) [2].

Banana and papaya are common in the Philippines. They are accessible because they grow anywhere. Furthermore, banana and papaya are common ingredients in dishes and desserts. After cooking, peels are just thrown away. That's why this study aims to use ecological waste as antifungal agent to maximize the antimicrobial property of banana and papaya peels.

All parts of the banana plant have medicinal applications: the flowers in bronchitis and dysentery and on ulcers; cooked flowers are given to diabetics; the astringent plant sap in cases of hysteria, epilepsy, leprosy, fevers, hemorrhages, acute dysentery and diarrhea, and it is applied on hemorrhoids, insect and

other stings and bites; young leaves are placed as poultices on burns and other skin afflictions; the astringent ashes of the unripe peel and of the leaves are taken in dysentery and diarrhea and used for treating malignant ulcers; the roots are administered in digestive disorders, dysentery and other ailments; banana seed mucilage is given in cases of diarrhea in India. Antifungal and antibiotic principles are found in the peel and pulp of fully ripe bananas. The antibiotic acts against Mycobacteria [3]. Banana peel waste's extracts could be potential antimicrobial alternatives and may be effective to utilize as a natural source of antimicrobial agent in pharmaceutical industries [4].

Papaya is considered one of the most economically important and nutritious fruit in the Philippines. The fruit is not just delicious and healthy, but whole plant parts, fruit, roots, bark, peel, seeds and pulp are also known to have medicinal properties. The many benefits of papaya owed due to high content of Vitamins A, B and C, proteolytic enzymes like papain and chymopapain which have antiviral, antifungal and antibacterial properties. Papaya skin, pulp and seeds also contain a variety of phytochemicals, including natural phenols [5].

Canesten is the commonly used brand name of clotrimazole. Clotrimazole, an imidazole derivative with a broad spectrum of antimycotic activity, inhibits

biosynthesis of the sterol ergostol, an important component of fungal cell membranes. Its action leads to increased membrane permeability and apparent disruption of enzyme systems bound to the membrane. Studies in fungal cultures, the minimum fungicidal concentration of clotrimazole caused leakage of intracellular phosphorous compounds into the ambient medium with concomitant breakdown of cellular nucleic acids, and accelerated potassium efflux. The primary action of clotrimazole is against dividing and growing organisms[6].

New drugs both synthetic and natural must be sought to treat diseases. This implies that local medicinal plants need to be screened for antimicrobial properties of their extracts against known organisms. It has been widely accepted that the medicinal value of plants lies in the bioactive phytochemicals present in the plants.

**Statement of the Problem**

This study aims to compare the antifungal property of banana (*Musa paradisiaca*) and papaya (*Carica papaya*) peel extract to *Candida albicans* when added to Glucose Yeast Peptone Agar.

Specifically, it aims to determine the following:

1. What is the extent of the antifungal property of banana and papaya ethanolic extracts prepared at different concentrations (30%,50% and 100%)to *Candida albicans*?
2. Is there a significant difference between the antifungal property of banana and papaya ethanolic extracts as to concentrations (30%,50% and 100%)?
3. Is there a significant difference between the antifungal property of the peel extracts to *Candida albicans* when compared to:
  - a. Canesten (positive control)
  - b. Glucose Yeast Peptone without extracts (negative control)

**MATERIALS AND METHODS**

**Research Design**

The researcher conducted an experimental research design particularly Experimental Randomized Block Design for the study. Different concentrations of banana(*Musa paradisiaca*) and papaya (*Carica papaya*) peel extract were added to the Glucose Yeast Peptone Agar (GYP) for the purpose of determining the antifungal property of the banana and papaya peel extracts to the *Candida albicans*. Three replicates in each sample and canesten were used as positive control.

<i>Candida albicans</i>	Banana	Papaya	Positive control	Negative control
	100%	100%	Canesten	GYP
	50%	50%		
	30%	30%		

**Data Collection Procedure and Instruments**

All laboratory equipments and media were sterilized using autoclave at 15psi, 121 degrees Celsius for 15-20 minutes before using. Banana and papaya peel extraction was done and at the same time, microbial suspension was prepared from 24 hour old culture of the test organism. The suspending medium used was 0.1% peptone water. Pre-poured Glucose Yeast Peptone Agar (GYP) plates, about 3mm thick, were inoculated with the microbial suspension by swabbing the agar surface. The cotton swab on an applicator stick was dipped into the microbial suspension, rotated several times and pressed firmly on the inside wall of the tube above the fluid level to remove excess inoculum from the swab. The swab was streaked over the entire agar surface. This procedure was repeated two more times, rotating the plate 60 degrees each time to ensure even distribution of the inoculums. Three equidistant wells were made on the

agar plate using a cork borer (10mm diameter). Two hundred (200)µl of the sample was placed in each well. For the positive control, a single well was made on the center of the agar plate and 100µl of Canesten solution was placed in it. The GYP plates were incubated at 35 degrees celcius and observed after 24 hours. The clearing zone was measured in millimeters and the average diameter of the clearing zones was calculated.

**RESULTS AND DISCUSSION**

In the study, *Candida albicans* was tested for its sensitivity to different concentrations of *Musa paradisiacal* and *Carica papaya* extracts using agar disc diffusion method. All extracts inhibited *Candida albicans* except for 100% banana and papaya extracts. Furthermore, among the entire concentrations 50% banana exhibited the most effective antifungal activity against *Candida albicans*.

**Table 1: Effect of different concentration of ethanolic extracts of *Carica papaya* peel and *Musa paradisiaca* on growth performance of *Candida albicans***

Test organism	Sample	Clearing zone (mm)			AI
		1	2	3	
<i>Candida albicans</i>	A. Papaya, 100%	- <sup>a</sup>	-	-	0
	B. Papaya, 50%	13	13	13	0.3
	C. Papaya, 30%	13	13	13	0.3
	D. Banana, 100%	-	-	-	0
	E. Banana, 50%	12	12	12	0.2
	F. Banana, 30%	13	13	14	0.3
	Canesten <sup>b</sup> , 30µl	32			2.2
	Control 0% extract (GYP)	-			0

<sup>a</sup>Precipitate within 25mm diameter observed

<sup>b</sup>Contains 1% clotrimazole

Table 1 shows the effect of different concentration of ethanolic extracts of plant peels on the radial growth of *Candida albicans* in culture medium. Result shows that the papaya samples, 50% and 30%, inhibited the growth of *Candida albicans* with Antimicrobial Index (AI) of 0.3. The papaya sample, 100% did not inhibit the growth of *Candida albicans*. The banana samples, 50% and 30%, inhibited the

growth of *Candida albicans* with Antimicrobial Indexes of 0.2 and 0.3 respectively. The banana sample, 100% did not inhibit the growth of *Candida albicans*. Canesten inhibited the growth of *Candida albicans* with Antimicrobial Index (AI) of 2.2. The Glucose Yeast Peptone Agar without extracts did not inhibit the growth of *Candida albicans*.

**Table 2: Significant Difference on the Mean zone of inhibition of *Candida albicans* measured on the GYP with the plant extracts.**

Treatments/ Concentrations	Mean	SD	F-ratio	p-value	Interpretation
Papaya 100%	.00	.00	8390.286	.000	Significant
Papaya 50%	13.00	.00			
Papaya 30%	13.00	.00			
Banana 100%	.00	.00			
Banana 50%	12.00	.00			
Banana 30%	13.33	.58			
Canesten	32.00	.00			
GYP	.00	.00			

Table 2 shows the mean zone of inhibition of *Candida albicans* on the different concentrations of papaya and banana peel extracts and canesten. It further shows that the p-value obtained is less than the 0.05 level of significance; therefore the null hypothesis is

rejected. This means that there is a significant difference among the antifungal property of banana, papaya ethanolic extracts (30%, 50% and 100%), canesten and the control treatments.

**Table 3: Multiple Comparisons on the mean zone of inhibition of *Candida albicans* measured on the GYP with the plant extracts.**

	Papaya 50%	Papaya 30%	Banana 100%	Banana 50%	Banana 30%	Canesten	GYP
Papaya 100%	.000*	.000*	1.000	.000*	.000*	.000*	1.000
Papaya 50%	-	1.000	.000*	.003*	.769	.000*	.000*
Papaya 30%	-	-	.000*	.003*	.769	.000*	.000*
Banana 100%	-	-	-	.000*	.000*	.000*	1.000
Banana 50%	-	-	-	-	.000*	.000*	.000*
Banana 30%	-	-	-	-	-	.000*	.000*
Canesten	-	-	-	-	-	-	.000*
Control	-	-	-	-	-	-	-

\* Significant at 0.05 level

Table 3 shows the mean zone of inhibition of *Candida albicans* on the different concentrations of papaya and banana peel extracts and canesten. There is no significant difference between the six pairs of concentration, papaya 100% and banana 100%, papaya 100% and control, papaya 50% and papaya 30%, papaya 50% and banana 30%, papaya 30% and banana 30%, and banana 100% and GYP. While there is significant difference between the twenty two pairs of concentration, papaya 50% and papaya 100%, papaya 30% and papaya 100%, banana 100% paired with papaya 50% and papaya 30%, banana 50% paired with papaya 30%, 50%, 100% and banana 100%, banana 30% paired with papaya 100%, banana 50% and 100%, canesten paired with banana 30%, 50%, 100% and papaya 30%, 50%, 100%, and GYP paired with banana 30%, 50%, 100% and papaya 30%, 50%, 100% and canesten. This implies that the banana 50% is more effective compared to other concentrations of banana and papaya peel extracts.

### Summary of findings

Different concentrations of banana (*Musa paradisiaca*) and papaya (*Carica papaya*) were added to the Glucose Yeast Peptone Agar (GYP) for the purpose of determining the antifungal property of the banana and papaya peel extracts to the *Candida albicans*. Three replicates in each sample were made.

The results showed the extent of the antifungal property of banana and papaya peel extracts. Canesten (positive control) has the highest mean zone of 32, banana 30% with a mean of 13.33, papaya 50% and 30% with a mean zone of 13 and banana 50% with a mean zone of 12 while banana 100% and papaya 100% don't inhibit the growth of *Candida albicans*. It also shows that when multiple comparisons were made, a value less than 0.05 are obtained on banana 50% and canesten as well.

Based on the results obtained, there is a significant difference between the antifungal property of banana and papaya ethanolic extracts as to concentrations (30%, 50% and 100%) and when compared to canesten and GYP without extract.

### CONCLUSIONS

The study revealed that *Candida albicans* was sensitive to different concentrations of *Musa paradisiaca* and *Carica papaya* extracts except on 100% concentration. Furthermore, among all the concentrations used, banana extract at 50% concentration is more effective in inhibiting the growth of *Candida albicans* on GYP compared to the other concentrations of banana and papaya peel.

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