

Antifungal Activity of Liquid Soap Containing Turi Leaf (*Sesbania grandiflora* L.) Extract Against the Growth of *Candida albicans*

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Abstract. Vaginal discharge is one of the symptoms of infection in the female reproductive tract. The cause of vaginal discharge is the fungus *Candida albicans*. One of the medicinal plants that has the potential as an antifungal is the turi leaf (*Sesbania grandiflora* L.). Turi leaves (*Sesbania grandiflora* L.) contain flavonoids, saponins, and tannins which act as antifungals. The purpose of this study was to determine the antifungal activity of liquid soap from turi leaf extract against the growth of *Candida albicans*. The thick extract of turi leaves was formulated into liquid soap with F0 (Base), F1 (3%), F2 (7%) which was tested against *Candida albicans* fungus using the well diffusion method with a positive control, namely Resik V Godokan Sirih.. The results of the study on liquid soap from turi leaves (*Sesbania grandiflora* L.) can inhibit the growth of *Candida albicans* fungi with an inhibition zone diameter of F0 14.95 ± 0.17 mm (moderate), F1 15.33 ± 0.48 mm with a (strong), F2 17.21 ± 0.50 mm with a (strong). Resik V (positive control) has an inhibition zone diameter of 19.00 ± 0.85 mm (strong) category. The most optimum formulation of liquid soap from turi leaves (*Sesbania grandiflora* L.) extract in inhibiting the growth of *Candida albicans* fungi is F2.

Keywords: Antifungal; *Sesbania grandiflora* L; *Candida albicans*.

INTRODUCTION

Health Vaginal discharge also known as leukorrhea or fluor albus (Marhaeni, 2016) is frequently caused by *Candida albicans* infections, often arising because many women are unaware of proper vaginal cleansing methods; infections caused by *Candida* fungi are termed candidiasis (Wiratni *et al.*, 2017). Vaginal candidiasis can manifest as an acute or subacute condition resulting from the uncontrolled proliferation of the *Candida albicans* fungus (Ekawati *et al.*, 2023).

Many women lack knowledge regarding proper vaginal cleansing techniques. One common method involves the use of soap. Soap can be utilized for both the treatment and prevention of diseases caused by fungi and bacteria. A wide variety of soaps are available on the market including laundry soap, bath soap, hand soap, and household cleaning agents in forms such as creams, solids or bars, powders, and liquids. Liquid soap is currently widely produced due to its practicality and appealing form compared to other soap types (Ering *et al.*, 2020).

Turi leaves (*Sesbania grandiflora* L.) represent a herbal material with potential as an active ingredient in liquid soap formulations. Research by Rahmawati *et al.* (2023) indicates that turi leaves contain flavonoids, saponins, and tannins compounds proven to exhibit antifungal effects against *Candida* species. Based on the foregoing, the researcher is interested in conducting a study to evaluate the antifungal activity of a liquid soap formulation containing turi leaf extract (*Sesbania grandiflora* L.) against the growth of *Candida albicans*.

METHODS

This study is an experimental research project aimed at determining the antifungal activity of a liquid soap formulated with turi leaf (*Sesbania grandiflora* L.) extract against *Candida albicans*. The study employed a completely randomized design with varying concentrations. The sample material used was a concentrated extract of turi leaves (*Sesbania grandiflora* L.) produced by PT. Lansida Yogyakarta. The research was conducted at the Microbiology Laboratory and Pharmaceutical Technology Laboratory of the Cendekia Utama Kudus Institute of Health Technology between March and May 2024.

Equipment and Materials: The materials used in this study included turi leaf extract (*Sesbania grandiflora* L.) prepared with a 70% ethanol solvent, *Candida albicans* ATCC 10231 fungal culture, 70% ethanol, 5% DMSO (Dimethyl Sulfoxide) solvent, Resik V Godokan Sirih, PDL (Potato Dextrose Liquid) medium, PDA (Potato Dextrose Agar) medium, concentrated HCl, 2N HCl, Dragendorff's

reagent, Mayer's reagent, Wagner's reagent, FeCl₃ reagent, Sudan III, olive oil, KOH, Sodium Lauryl Sulfate (SLS), rose fragrance, and distilled water.

Phytochemical Screening of the 70% Ethanol Extract of Turi Leaves (*Sesbania grandiflora* L.)

1. Alkaloids: Identification using three reagents—Mayer's, Wagner's, and Dragendorff's.
2. Flavonoids: Identification using three reagents—Wilstätter, Bate-Smith, and 10%NaOH.
3. Saponins: Identification using distilled water.
4. Tannins: Identification using 1% FeCl₃ reagent.

Determination of Minimum Inhibitory Concentration (MIC)

MIC testing was conducted using the dilution method. Six sterile test tubes were each filled with 3.5 mL of PDL medium and 0.5 mL of *Candida albicans* fungal suspension. Four tubes received 1 mL of *Sesbania grandiflora* L. leaf extract at concentrations of 1%, 2%, 3%, and 50%, and were labeled 1 through 4. Tube 5 was labeled K(-) (negative control) and received 1 mL of 5% DMSO.

The tubes were incubated for 24 hours at 28°C, after which the MIC was determined by visually observing turbidity. The lowest extract concentration that appeared clearer than the negative control was designated as the MIC (Saputera et al., 2019).

Determination of Minimum Fungicidal Concentration (MFC)

Tubes that appeared clear during the MIC test were subjected to the MFC test. Fifteen milliliters of PDA were poured into sterilized Petri dishes and allowed to solidify. Subsequently, 0.1 mL from each dilution was pipetted and spread onto the PDA medium, followed by incubation for 24 hours at 28°C. The MFC was determined by observing the presence or absence of fungal growth on the agar medium after incubation. The lowest concentration demonstrating fungal death (absence of growth) was identified as the MFC value (Saputera et al., 2019).

Formulation of Liquid Soap Containing Turi Leaf Extract (*Sesbania grandiflora* L.)

Table 1. Formulation of Liquid Soap Containing Turi Leaf Extract (*Sesbania grandiflora* L.)

Ingredient	Fungsi	Unit	F0	F1	F2
Turi leaf extract (<i>Sesbania grandiflora</i> L.)	Active compound			MIC	MIC + 4%
Olive oil	Fatty acid	mL	15	15	15
KOH 40%	Base	mL	8	8	8
Sodium Lauryl Sulfate (SLS)	Surfaktan	gram	0,5	0,5	0,5
Rosae essen	Essen	mL	1	1	1
Aquadest	Solvent	mL	ad 50	ad 50	ad 50

RESULTS AND DISCUSSION

Phytochemical Screening of 70% Ethanol Extract of Turi (*Sesbania grandiflora* L.) Leaves

Table 2. Phytochemical Screening of Turi Leaves

No	Secondary Metabolites	Reagent	Research result	Conclusion
1.	Alkaloid	Mayer	No white precipitate formed	-
		Wagner	No orange-to brown precipitate formed	-
		Dragendorff	No orange precipitate formed	-
2.	Flavonoid	Wilstätter	Color change to orange	Flavone present
		Bate-Smith	No color change to dark red or purple	-
		NaOH 10 %	Color change to red	Phenol present
3.	Saponin	Aquadest	Foam formed, stable 30 seconds	+
4.	Tannin	FeCl ₃ 1%	Blackish-green color formed	+

Based on Table 2, the secondary metabolites present in the *Sesbania grandiflora* L. (Turi) leaf extract are flavonoids, saponins, and tannins.

Determination of Minimum Inhibitory Concentration (MIC)

Table 3. Result MIC

Extract concentration	Conclusion
3%	Somewhat clear (MIC)
2%	Turbid
1%	Turbid
C-	Turbid

Determination of the MIC (Minimum Inhibitory Concentration) value was conducted using turi (*Sesbania grandiflora* L.) leaf extract concentrations of 1%, 2%, and 3%. The MIC is defined as the lowest concentration capable of inhibiting the growth of a specific organism (Saputera et al., 2019). Higher extract concentrations result in reduced turbidity of the growth medium. The turbidity of the tubes was assessed visually by comparison with a negative control. Table 3 indicates that at concentrations of 1% and 2%, the turbidity was visually similar to that of the negative control, signifying an absence of fungal growth inhibition. The lowest concentration of turi leaf extract that appeared clearer than the negative control was 3%, indicating that this concentration represents the minimum inhibitory concentration capable of inhibiting the fungus *Candida albicans*.

Determination of Minimum Bactericidal Concentration (MBC)

Table 4. Result MBC

Extract concentration	Conclusion
50%	Fungus growth
3%	Fungus growth
2%	Fungus growth
1%	Fungus growth
C-	Fungus growth

Following the determination of the MIC (Minimum Inhibitory Concentration), testing was conducted to ascertain the MFC (Minimum Fungicidal Concentration). The Petri dishes used for the MFC test were examined for fungal growth after 24 hours of incubation. The results presented in the table show fungal growth in all dishes—across concentrations of 1%, 2%, 3%, and 50% indicating that turi leaf extract, even at a concentration of 50%, does not possess fungicidal activity against *Candida albicans*.

Turi Leaf Extract Liquid Soap (*Sesbania grandiflora* L.)

Physical Testing of Liquid Soap

Table 5. Characteristic Liquid Soap

Formulation	Organoleptic Test	pH test	Foam Height test (mm)	Weight Test (g/mL)	(mg/ml) Homogeneity test
F0	- Odor : Rosae scent - Color : White - Form : Liquid	6,2	14	1,06	Homogeneous
F1	- Odor : Rosae scent - Color : Brown - Form : Liquid	6,0	15	1,07	Homogeneous
F2	- Odor : Rosae scent - Color : Brown - Form : Liquid	5,6	17 (g/ml)	1,08	Homogeneous
Resik V	- Odor : characteristic betel scent - Color : Brown - Form : Liquid	3,5	50 mm	1,1	Homogeneous

Organoleptic testing of formulation F0 yielded a rose scent, a white color, and a liquid form. Formulation F1 exhibited a rose scent, a brown color, and a liquid form. Formulation F2 also showed a rose scent, a brown color, and a liquid form. The "Resik V" product displayed the characteristic scent of betel leaf, a brown color, and a liquid form. The *turi* leaf extract liquid soap formulation met the standards established by SNI regarding its liquid form, scent, and characteristic color.

pH testing yielded the following results: F0 had a pH of 6.2, F1 had a pH of 6.0, and F2 had a pH of 5.6. These results meet the SNI standard for feminine hygiene liquid soap (pH range of 5.5–8.5); a pH within this range does not disrupt the normal bacterial flora of the vagina (Muthmainnah, 2020). Testing of the commercial product Resik V yielded a pH of 3.5, which aligns with the normal pH range for the intimate area (3.5–4.5). An appropriate pH value is a quality requirement for liquid soap, with measurements conducted using a pH meter (Chusniasih *et al.*, 2018).

Foam height testing yielded the following results: F0 had a foam height of 14 mm, F1 had 15 mm, F2 had 17 mm, and Resik V had 50 mm. These foam height results comply with the SNI standard for liquid soap, which specifies a range of 13–220 mm. While foam height is often linked to aesthetic appeal for consumers, feminine hygiene cleansers should ideally produce low foam to avoid causing irritation or allergic reactions (Rahmi *et al.*, 2017).

Specific gravity testing yielded the following results: F0 was 1.06 g/mL, F1 was 1.07 g/mL, F2 was 1.08 g/mL, and Resik V was 1.1 g/mL. A substance's specific gravity is influenced by its constituent ingredients and physical properties. These results demonstrate that the specific gravity of the produced liquid soaps meets the SNI standard range of 1.01–1.1 g/mL (Irmayanti *et al.*, 2014).

Homogeneity testing indicated that F0, F1, F2, and Resik V were homogeneous, as no coarse particles were observed after the preparations were placed on a glass surface. Based on the results of the homogeneity test, all liquid soap formulas demonstrated good physical quality in terms of homogeneity.

Antifungal Test of Liquid Soap

Table 6. Inhibition Zone Diameter of Turi Leaf Extract Liquid Soap against the Growth of *Candida albicans*

Formulation	Zona Inhibitor Diameters of Fungi <i>Candida albicans</i> (mm)	Category
F0	14,95 ± 0,17	Medium
F1	15,33 ± 0,48	Strong
F2	17,21 ± 0,50	Strong
K+	19,00 ± 0,85	Strong

The antifungal test results are presented in Table 6. The average inhibition zone diameters for the turi leaf extract liquid soap against *Candida albicans* growth were 14.95 mm for F0, 15.33 mm for F1, and 17.21 mm for F2. Formulation F1 (3% extract concentration) did not result in an increase in the inhibition zone diameter. The largest inhibition zone diameter was observed in F2 (17.21 mm), which falls into the "strong" category. This inhibitory activity indicates significant differences in inhibition zone diameters. The observed difference in inhibitory power where F2 (7% extract) demonstrated greater inhibition is attributed to the fact that the extract's maximum inhibitory capacity was achieved at the 7% concentration. Consequently, the 7% turi leaf extract feminine hygiene liquid soap produced the widest inhibition zone against *Candida albicans* compared to the other concentrations.

The positive control (Resik V) exhibited inhibitory activity against *Candida albicans* with a diameter of 19.00 mm also classified as strong yielding a different result. This indicates that the antifungal activity of F2 did not yet match that of the positive control. Differences in inhibition zone diameters were observed among the formulations. The smallest inhibition zone diameter was found in F0, as it served as the base formulation without the addition of turi leaf extract. Differences in inhibition zone diameters between F1 and F2 were due to the varying concentrations of extract added to the formulations; higher extract concentrations influenced the size of the inhibition zone.

CONCLUSION

1. Minimum Inhibitory Concentration (MIC) of *Sesbania grandiflora** L. (turi) leaf extract against the fungus *Candida albicans** ATCC 10231 was observed at a concentration of 3%.
2. No Minimum Fungicidal Concentration (MFC) of *Sesbania grandiflora** L. leaf extract capable of killing the fungus *Candida albicans** ATCC 10231 was determined, even when using the highest extract concentration of 50%.
3. The liquid soap formulation containing *Sesbania grandiflora** L. leaf extract met the quality requirements for a good liquid soap product.
4. The optimal formulation for inhibiting the growth of *Candida albicans** ATCC 10231 was F2, which

produced an inhibition zone diameter of 17.21 mm, falling into the "strong" category.

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