Research Article

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2025.61.009617

Antifungal Susceptibility of Candida Spices Circulating in Ajman

Mohammed Akowch, Rawand Hani, Asmaa Alsalim, Devapriya Finney Shadroch, Sara M Ali, Ahmed Luai Osman, Salma Elnour Rahma and Mohammed Ibrahm Saeed*

Department of Medical Laboratory Sciences, Faculty of Health Science, Gulf Medical University, United Arab Emirates

***Corresponding author:** Mohammed Ibrahim Saeed, Department of Medical Laboratory, Faculty of Health Science, Gulf Medical University, Jurf1- Ajman, United Arab Emirates

ARTICLE INFO

Received: April 03, 2025

Published: April 28, 2025

Citation: Mohammed Akowch, Rawand Hani, Asmaa Alsalim, Devapriya Finney Shadroch, Sara M Ali, Ahmed Luai Osman, Salma Elnour Rahma and Mohammed Ibrahm Saeed. Antifungal Susceptibility of Candida Spices Circulating in Ajman. Biomed J Sci & Tech Res 61(4)-2025. BJSTR. MS.ID.009617.

ABSTRACT

Background: Opportunistic yeast Candida spiceis are causative of candidiasis. Biofilm generation has been a major contributor to resistance development. Because of the increasing prevalence of resistance, identifying the antifungal susceptibility is crucial for prescribing effective and customized treatment options and treating infections with antifungals.

Methods: A total of 83 Candida isolates were acquired from clinical samples and inoculated onto Sabouraud Dextrose Agar (SDA). The isolated spices were identified using the germ tube test. The disk diffusion method was used to study antifungal susceptibility disks such as azoles, polyenes, and echinocandins on SDA. Zones of inhibition were evaluated after 24 hours of incubation at 35 °C.

Results: Antifungal susceptibility varied by species, with flucytosine, Amphotericin B, and Econazole showing the maximum resistance (100%, 54.2%, 50.6%), whereas Clotrimazole showed the highest susceptibility (92.7%), followed by Nystatin (90.36%). Candida glabrata, on the other hand, had higher resistance to Ketoconazole (20%) and Econazole (60%). However, the antifungal drugs had a larger effect on Candida tropicalis. Clotrimazole had the highest susceptibility rate (82%), whereas Ketoconazole was more resistant in their analysis; these findings were equivalent to those observed in Nepal. However, in Yemen, Miconazole and Clotrimazole were the most sensitive, while Econazole was the least sensitive, which is consistent with the results of this investigation.

Conclusion: It is crucial for treating Candida species to rely on diagnostic laboratory culture and susceptibility profile data when prescribing successful antifungal medication since these can have a substantial impact on clinical decision-making and effective candidiasis treatment.

Keywords: Candida Albicans; Glabrata; Tropicalis; Krusei; Antifungal Susceptibility

Abbreviations: VC: Vaginal Candidiasis; UTI: Urinary Tract Infection; NAC: Non-Albican Candida; GTT: Germ Tube Test; SDA: Sabouraud Dextrose Agar

Introduction

Candida is a genus of yeast that is an opportunistic fungus, and it can live aerobically or facultatively anaerobic, and reproduce asexually by budding spores [1]. The candida species inhabit the human body, specifically the skin, mouth, and gastrointestinal tract [2]. But, in some circumstances, they can become opportunistic and lead to infections, especially among immunocompromised diseases individuals or those whom are undergone immunosuppressive treatments [3]. The recurrent vaginal candidiasis (VC) still stands as a challenge to women in different parts of the world [4]. The occurrence of hospital-acquired urinary tract infection (UTI) caused by Candida species is reported to range between 10% -15% [5]. Candida is a diverse group with over 17 types known to infect humans. But most infections are due to five species which cause about 95% of infections: *C. albicans*, *C. tropicalis*, *C. glabrata*, C. parapsilosis, and C. krusei [6].

Identifying the specific Candida species responsible for an infection is important for selecting the most effective antifungal treatment. A germ tube test is performed to identify Candida isolates from the culture medium [7]. The germ tube is a quick and straightforward way to differentiate *C. albicans* from other yeast species by observing germ tube growth within 2-4 hours [8]. However, its accuracy is not absolute, as around 5% of *C. albicans* isolates may not produce germ tubes, potentially leading to misinterpretation, especially with species like *C. tropicalis*. Antifungal drugs from several pharmacological classes are used to treat candidiasis by targeting certain cellular processes to either inhibit or eliminate the pathogenic yeast [2]. Each antifungal drug has a unique method for inhibiting (fungistatic) or directly killing (fungicidal) fungal infections [2].

However, resistance might evolve as a result of environmental variables that promote the spread or colonization of resistant species [2]. Azoles and polyenes, such as Amphotericin B, Nystatin, Clotrimazole, Econazole, and Ketoconazole, affect the fungal cell membrane, whereas echinocandins, such as Caspofungin and Micafungin, break the fungal cell wall [6]. Furthermore, various studies have shown that Candida biofilms mature and evolve statically in the presence of a minimum matrix, demonstrating a specific level of resistance to medicines such as fluconazole and Amphotericin B [6]. Moreover, data suggests that non-Albicans species, such as *C. krusei*, which has inherent resistance, and *C. glabrata*, which is resistant to fluconazole, are less susceptible to routinely used antifungals. *C. albicans* has also demonstrated resistance to azole-based antifungal drugs such *as Amphotericin B* [9]. As a result of this resistance, accurate identification of yeast species and antifungal susceptibility tests are required to determine the right treatment [9]. In another study conducted in Sana'a City, Yemen, 141 of 150 Candida spp. were identified from patients. Thus, a total of 141 women were included in the study, and yeasts were recovered in 93 (65.95%) of them, with *C. albicans* being the most prevalent species among the isolates, followed by *C. tropicalis* 24 (17.02%), *C. glabrata* 18 (12.76%), and *C. krusei* (4.25%) that were isolated from vaginal infected individuals [10].

Antifungal Susceptibility

A research study in Yemen used the disc diffusion method to determine the susceptibility of Candida isolates from female samples. The results showed that Miconazole and Clotrimazole were the most sensitive antifungals for vaginal Candida isolates [10]. However, these isolates were less sensitive to Econazole and fluconazole [10]. In a study conducted in Nepal, it was demonstrated that the different antifungal medicines had different effectiveness against different Candida speciation. The research has found out that Clotrimazole had the highest susceptibility rate of 82% and Miconazole was testified to have moderate susceptibility against 44% of the Candida isolates. Whereas, Ketoconazole had low efficiency, 86% of the isolates in this study were resistant to this antifungal agent. This study showed that *C. albicans* had a greater frequency of resistance against Ketoconazole as compared to NAC spp, with an 89.3% frequency. There was 20 % sensitivity for *C. krusei* against a background of other Non-Albican Candida (NAC)species but *C. tropicalis* & *C. glabrata* showed no sensitive results. *C. krusei* had a 20% sensitivity across NAC species, but *C. tropicalis* and *C. glabrata* had no sensitive results. *C. glabrata* exhibited higher fluconazole resistance (42.9%), but *C. krusei* did not. *C. albicans* isolates were more sensitive to fluconazole than NAC spp., at 71.5%. *C. krusei* demonstrated 20% resistance to *Miconazole*, whereas *C. glabrata* showed none. *Miconazole* was more effective against *C. albicans* isolates (53.6%) than NAC spp. Finally, *C. glabrata* showed greater resistance to Clotrimazole (14.2%), while neither *C. tropicalis* nor *C. krusei* did [11].

Methodology

Isolation and Identification of Candida

The study ethical approval was obtained from the IRB committee in Gulf medical university with reference number: IRB-COHS-STD-38-FEB-2024.

Sample Collection

Candida species were isolated from vaginal swabs, urine, hair, and sputum samples based on microscopic inspection of budding yeast.

Candida Isolation

The samples were inoculated onto Sabouraud dextrose agar and incubated overnight at 37°C. Candida growth was assessed based on colonial morphology and gram stain which verified the presence of oval-shaped, Gram-positive yeast cells.

Isolate Identification

The spices were initially identified as C.Albican and Non-Albican based on Germ Tube Test (GTT) results as follows: 6-8 candida isolates were inoculated into tubes containing 0.5 mL serum and incubated at 35 °C for 2-3 hours before being examined for germination tubes under a microscope at 40x magnification.

Candida Isolates Preservation

All Candida isolates were grown in pure culture on Sabouraud dextrose agar, then preserved by inoculation into 16% glycerol Glycerol-Sabouraud dextrose broth media and stored at -20 °C until utilized for antifungal susceptibility tests.

Antifungal Susceptibility Testing

The disk diffusion method was used to investigate antifungal susceptibility utilizing antifungal disks of Econazole, Ketoconazole, Miconazole, Amphotericin B, Clotrimazole, Nystatin, and Fluorocytosine in Sabouraud dextrose agar. Suspensions of colonies prepared in sterile normal saline and adjusted to cell turbidity equivalent to 0.5

McFarland standards were inoculated onto the surface of Sabouraud dextrose agar. The antifungal disks were added, and the plates were incubated at 35 °C for 24 hours. The zones of inhibition were measured in mm and compared to the manufacturer's susceptibility interpretation criteria, (Table 1).

Table 1: Anti-fungal Disks Zone Diameter.

Anti-fungal	Concentration	Zone Diameter in mm		
		Sensitive	Intermediate	Resistant
Nystatin	100 U	≥15	10-14	≤10
Clotrimazole	10 ug	≥20	12-19	≤12
Econazole	10µg	≥30	23-29	≤22
Ketoconazole	10µg	≥28	21-27	≤20
Miconazole	10 µg	≥20	12-19	≤11
Fluocytosine	1µg	≥20	12-19	≤11
Amphotericin B	20µg	≥15	10-14	≤9

Results

Based on the Germ tube test, 65 (78.3%) of the 83 isolates were Candida albicans, while only 18 (21.6%) were non-Candida albican (Table 2). The susceptibility profile of Candida species to Econazole was found to be susceptible (14.4%), susceptible dosage dependent (34.9%), and resistant (50.6%). Susceptibility to Ketoconazole was (45.7%, 45.7%, 8.4%), Nystatin (90.36%, 7.2%, 2.4%), Miconazole (43.37%, 44.5%, 12%), Clotrimazole (92.7%, 4.8%, 2.4%), and Amphotericin B (3.6%, 42.16%, 54.21%), respectively. and all isolates were (100%) resistant to Flycosytosin (Tables 2 & 3). Clotrimazole has the highest antifungal susceptibility, followed by Nystatin, Ketoconazole, and Miconazole. However, Flucytosine demonstrated the highest resistance levels, followed by Amphotericin B and Econazol (Tables 2 & 3). Candida glabrata was shown to be more resistant to Econazole in 60% of the study isolates compared to other Candida species, with a sensitivity of 30%. Only 13.6% of the samples examined for *C. albicans* exhibited sensitivity to Econazole, while no sensitive results were reported for *C. krusei* or *C. tropicalis* (Tables 2 & 3).

Table 2: Anti-fungal susceptibility testing of various Candida spp.

Candida Spp.		Flucytosine	Econazole	ketoconazole	Nystatin	Amphotericin B	Miconazole	Clotrimazole
C. albicans n-66	Susceptible	0	9 (13.6%)	32 (48.4%)	61 (92.4%)	2 (3%)	30 (45.4%)	62 (93.9%)
	Intermediate Susceptible	0	24 (36.3%)	29 (43.9%)	5 (7.5%)	29 (43.9%)	28 (42.4%)	4 (6%)
	Resistant	66 (100%)	33 (50%)	5 (7.5%)	0	35 (53%)	8 (12.1%)	0
C. glabrata n-10	Susceptible	0	3 (30%)	4 (40%)	8 (80%)	0	3 (30%)	8 (80%)
	Intermediate Susceptible	0	1 (10%)	4 (40%)	0	5 (50%)	5 (50%)	0
	Resistant	10 (100%)	6 (60%)	2 (20%)	2 (20%)	5 (50%)	2 (20%)	2 (20%)
C. tropicalis n-2	Susceptible	0	0	1 (50%)	2 (100%)	0	1 (50%)	2 (100%)
	Intermediate Susceptible t	0	1 (50%)	1 (50%)	0	1 (50%)	1 (50%)	0
	Resistant	2 (100%)	1 (50%)	0	0	1 (50%)	0	0

C. krusei n-5	Susceptible	0	0	1 (20%)	4 (80%)	1 (20%)	2 (40%)	5 (100%)
	Intermediate Susceptible	0	3 (60%)	4 (80%)	1 (20%)	0	3 (60%)	0
	Resistant	5 (100%)	2 (40%)	0	0	4 (80%)	0	0

Table 3: Sensitivity vs Resistance of Tested Isolates against the anti-fungal drugs.

Antifungal Drug	Ketoconazole		Econazole		Nystatin		Amphotericin B		Flucytosine		Miconazole		Clotrimazole	
Susceptible	38	45.78%	12	14.4%	75	90.36%	3	3.6%	0	0	36	43.3%	77	92.7%
Intermediate Susceptible	38	45.78%	29	34.9%	6	7.2%	35	42.16%	0	0	37	44.5%	4	4.8%
Resistant	7	8.4%	42	50.8%	2	2.4%	45	54.2%	83	100%	10	12%	2	2.4%
Comment	Moderate sensitive		High resistant		High sensitive		Highly resistant		High resistant		Moderate sensitive		High sensitive	

Candida glabrata has the highest resistance (20%) to Ketoconazole, followed by Candida albicans (7.5%), with no resistance identified for *C. tropicalis* or *C. krusei*. Candida tropicalis, on the other hand, demonstrated higer susceptibility to Ketoconazole. Nystatin resistance was found in 20% of *C. glabrata* isolates, but *C. tropicalis* and *C. albicans* had 100% and 92.4% sensitivity, respectively (Tables 2 & 3). Amphotericin B was less effective; *C. glabrata* and *C.tropicalis* isolates were all resistant to this antifungal, and *C. krusei* showed resistance to this antifungal at (80%) (Tables 2 & 3). Miconazole was highly effective (100%) towards *C. krusei*, *C. tropicalis* and *C. albicans* were more responsive (50% and 45.4%, respectively) and *C. glabrata* showed 20% resistance to Miconazole (Tables 2 & 3). Clotrimazole was found to be the most effective antifungal against Candida tropicalis (100%) and *C. krusei* (100%), followed by *C. albicans* (93.9%) and *C. glabrata* (80%) (Tables 2 & 3). It was substantially noticed that all isolates were found to be susceptible to *Clotrimazole* as the best medicine of choice for Candida isolated spices, whereas Flucytosine appears to have the minimum effect against all isolates were found resistant among all studies isolated candida spices (Tables 2 & 3) (Figure 1).

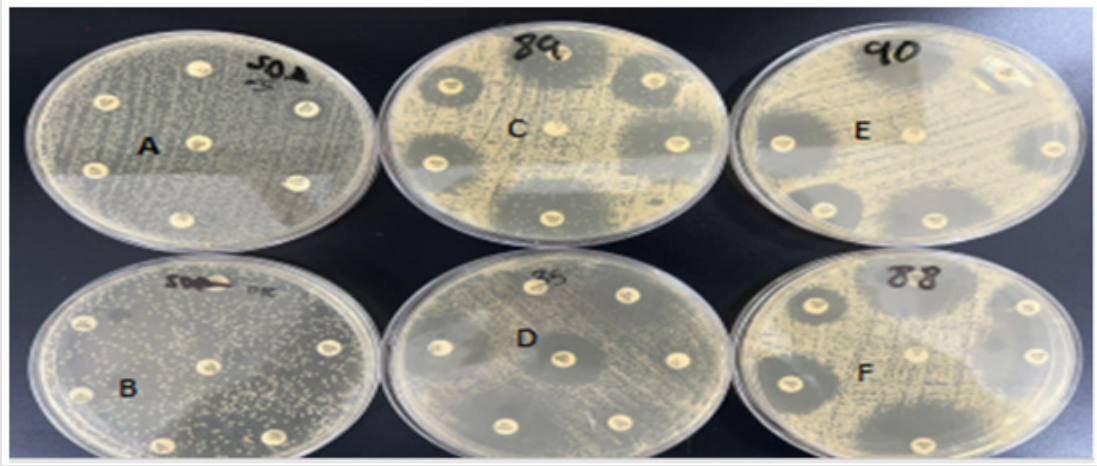

Figure 1: Antifungal susceptibility test using disc diffusion method. Samples A & B Showed complete resistance to all Antifungals. Sample D & E were sensitive to Ketoconazole, Nystatin Micoconazole & Clotrimazole. Sample C & F were sensitive to Ketoconazole, Nystatin Micoconazole, Amphotiricin & Clotrimazole.

Discussion

The study aimed to determine the prevalence and distribution of several Candida species. Candida albicans was the predominant isolated species (79.5%), with non-Candida albicans (NCA) accounting for 20.48%. After that, germ tube testing revealed that 65 (78.3%) samples were positive and 18 (21.6%) were negative. Germination identification test revealed four species of Candida, with *C. albicans* accounting for 79.5%. *C. glabrata* was the most prevalent NCA species isolated, accounting for 12%, followed by *C. krusei* (6%), and *C. tropicalis* (2.4%). The findings differed from those of other studies, including one conducted in Yemen, which found differing species distributions. Candida albicans accounted for 65.95% of the cases, followed by *C. tropicalis* (17%), *C. glabrata* (12.76%), and *C. krusei* (4.25%). In our investigation, *C. glabrata* was the most prevalent NAC (7.2%), followed by *C.krusei* and *C.tropicalis* (6% and 2.4%, respectively). The study found that all Candida isolates were resistant to flucytosine. Furthermore, this study revealed that *C. glabrata* is extremely resistant to Econazole, with 60% resistance and 30% susceptibility when compared to *C. albicans*. There was 20% of *C. glabrata* had Ketoconazole resistance, although resistance was lower in Candida albicans. In comparison, *C. tropicalis* showed a higher average sensitivity to Ketoconazole. Candida tropicalis and *C.albicans* showed high levels of susceptibility, whereas 20% of *C. Glabrata* tested resistant. Similarly, in a study conducted in Nepal, the Sensitivity rate was highest when Clotrimazole was used (82%) and Miconazole exhibited moderate efficacy at 44% of Candida isolates. Whereas, Ketoconazole showed low efficiency, with 86% of isolates demonstrating resistance to this antifungal agent.

Conclusion

Antifungal susceptibility profiles varied between species, with Clotrimazole demonstrating the most efficacy and Flucytosine exhibiting the greatest resistance. *C. glabrata* had excellent resistance to Econazole, whereas *C. tropicalis* was more responsive to particular antifungal medications. These findings underline the important of formulating treatment strategies based on the identified Candida species and their susceptibility profiles, which may have a significant impact on clinical decision-making in candidiasis management.

Acknowledgement

our appreciation to the Gulf medical University, faculty of health sciences and for ethical approval of the study and to department of medical laboratory science for supports and facilities provided.

Conflict of Interest

all author contributed equally in the research design, experimental, interpretation of results, manuscript preparation and review and declared no conflict of interest.

References

1. Tamo SPB (2020) Candida infections: Clinical features, diagnosis and treatment. Infectious Diseases and Clinical Microbiology 2(2): 91-102.
2. Seyoum E, Bitew A, Mihret A (2020) Distribution of candida albicans and non-albicans candida species isolated in different clinical samples and their *in vitro* antifungal suscetibity profile in Ethiopia. BMC Infectious Diseases 20(1): 231.
3. Bhattacharya S, Sae-Tia S, Fries BC (2020) Candidiasis and mechanisms of antifungal resistance. Antibiotics 9(6): 312.
4. Rosati D, Bruno M, Jaeger M, ten Oever J, Netea MG, et al. (2020) Recurrent vulvovaginal candidiasis: An immunological perspective. Microorganisms 8 (2):144.
5. Sobel JD, Fisher JF, Kauffman CA, Newman CA (2011) Candida urinary tract infections—epidemiology. Clinical Infectious Diseases 52(suppl_6): S433-S436.
6. Sardi JC, Scorzoni L, Bernardi T, Fusco-Almeida AM, Mendes Giannini MJ, et al. (2013) Candida species: Current epidemiology, pathogenicity, biofilm formation, natural antifungal products and new therapeutic options. Journal of Medical Microbiology 62(1): 10-24.
7. Alam MZ, Alam Q, Jiman-Fatani A, Kamal MA, Abuzenadah AM, et al. (2014) Candida identification: A journey from conventional to molecular methods in medical mycology. World Journal of Microbiology and Biotechnology 30(5): 1437-1451.
8. Sudhan SS, Sharma P, Sharma M, Shrivastava D (2016) Identification of candida species in the clinical laboratory: A review of conventional, commercial and molecular techniques. International Journal of Medical Research Professionals 2(6).
9. Mutua F, Revathi G, Machoki J (2010) Species distribution and antifungal sensitivity patterns of vaginal yeasts. East African Medical Journal 87(4): 156-162.
10. Mehta R, Wyawahare AS (2016) Evaluation of hicrome candida differential agar for species identification of candida isolates from various clinical samples. International Journal of Contemporary Medical Research 3(4): 1219-1222.
11. Khadka S, Sherchand JB, Pokhrel BM, Parajuli K, Mishra SK, et al. (2017) Isolation, speciation and antifungal susceptibility testing of Candida isolates from various clinical specimens at a tertiary care hospital, Nepal. BMC Research Notes 10(1): 218.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2025.61.009617

Mohammed Ibrahim Saeed. Biomed J Sci & Tech Res

Submission Link: https://biomedres.us/submit-manuscript.php