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Phenotypic Characterisation Of Candida Species From Various Clinical Sample Obtained In A Tertiary Care Centre In Chengalpattu District

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ABSTRACT

Background - *Candida albicans is one of the most frequently isolated yeast in laboratories. Candida species have emerged as significant opportunistic fungal pathogens and the conventional methods of yeast identification are reported to be cumbersome with delayed diagnosis and initiation of treatment. Thus rapid identification and speciation of Candida species is essential in clinical laboratories.*

Materials and methods *- the present study was conducted in the Department of Microbiology, at Shri Sathya Sai Medical College & Research Institute from January 2024 to December 2024. A total of 84 Candida isolates that were cultured from various clinical samples were included in this study. Identification and speciation of Candida isolates were done as per the standard Microbiological procedures.*

Results *- Most of the Candida species was isolated from female patients (68%) and 32% were male patients. The most common age group affected by candidiasis was 21-40 years (n=41/49%) followed by 41-60 years (n=28/33.3%). Among all these specimens, urine culture yielded more number of Candida isolates (n=41/48.8%) followed by sputum (n=15/17.9%), pus (n=12/14.3%) and high vaginal swab (6/7%). Out of 84 isolates, (n=49/58.3%) were C. albicans and rest of the isolates were non-albicans Candida (n=35/41.7%). Among 35 non-albicans Candida, 14 were Candida tropicalis (16.7%), 12 were Candida parapsilosis (14.3%), 7 were Candida glabrata (8.3%) and 2 were Candida krusei (2.4%).*

Conclusion *- C. albicans is still the most significant clinically but other non albicans are also emerging significant pathogens and warrant routine discrimination in clinical laboratories.*

Key words - *Candida species, non-albicans Candida, candidiasis, phenotypic characterisation*

INTRODUCTION

Candida species are ubiquitous on the skin of healthy adults and form a natural component of the normal microbial flora inhabiting the mucous membranes of the respiratory, gastrointestinal, and female genital tracts [1]. Among them, *C. albicans* is particularly notable as it typically exists as a lifelong, harmless commensal organism. However, under certain predisposing conditions, *C. albicans* can transition from a benign colonizer to a pathogenic organism, leading to infections that range from superficial cutaneous manifestations to severe, life-threatening systemic infections [2]. One of the key virulence traits of *C. albicans* is its strong ability to adhere to surfaces such as catheters and other indwelling medical devices. This ability significantly contributes to its role in healthcare-associated infections [3,4]. The Centers for Disease Control and Prevention (CDC) has identified *C. albicans* as the third most commonly isolated pathogen from bloodstream infections in hospitalized patients, with associated mortality rates reaching up to 50%. Currently, *C. albicans* remains the most prevalent species responsible for invasive *Candida* infections, accounting for approximately half of all reported cases [5]. Nevertheless, there is a clear and concerning trend toward the increasing isolation of non-*albicans Candida* (NAC)

species in various clinical settings. The genus *Candida* comprises approximately 154 species, of which six are predominantly associated with human disease. These include *C. albicans*, *C. tropicalis*, *C. glabrata*, *C. parapsilosis*, *C. krusei*, and *C. glabrata*, collectively responsible for about 95% of invasive *Candida* infections. Over the past two decades, the incidence of *Candida* species has risen significantly, with non-*albicans* species replacing *C. albicans* in many clinical settings, particularly in bloodstream infections. The prevalence of non-*albicans Candida* species varies with antifungal usage, patient risk factors, geographic location, and healthcare-associated strain outbreaks. Several predisposing factors are linked to both superficial and deep candidiasis, often acting by altering normal flora or weakening host defenses. Usually, multiple factors contribute to the development of infection [2]. This study aims to isolate and speciate various clinical *Candida* isolates using different phenotypic methods.

MATERIALS AND METHODS

This hospital-based descriptive study was conducted in the Department of Microbiology at Shri Sathya Sai Medical College & Research Institute, located in Chengalpattu district. The study included a total of 84 *Candida* isolates that were cultured from clinical samples obtained from patients over a 12-month period, spanning from January 2024 to December 2024. To maintain the accuracy and integrity of the data, repetitive isolates obtained from the same patients were carefully excluded from the analysis. Basic demographic information, including age and gender, was collected from all patients whose samples were included in the study.

The identification and speciation of the *Candida* isolates were carried out using standard microbiological techniques. These included Gram staining to observe cellular morphology, analysis of colony characteristics on culture media, germ tube formation tests for preliminary differentiation, sugar fermentation and sugar assimilation tests for metabolic profiling, and observation of colony color on Tetrazolium Reduction Medium (TTZ) and CHROM agar. All identification procedures were performed with the inclusion of appropriate control strains to ensure the reliability and reproducibility of the results.

RESULTS

Out of the total 84 *Candida* isolates recovered during the study period, a higher proportion were obtained from female patients, accounting for 68% of the cases, while the remaining 32% were from male patients, as illustrated in table 1. This distribution corresponds to a male-to-female ratio of 2.1:1. The age group most commonly affected by candidiasis was between 21 and 40 years, with 41 cases representing 49% of the total. This was followed by the 41 to 60 years age group, which accounted for 28 cases, constituting 33.3% of the total, as shown in table 1.

Table 1: Distribution of age group and gender

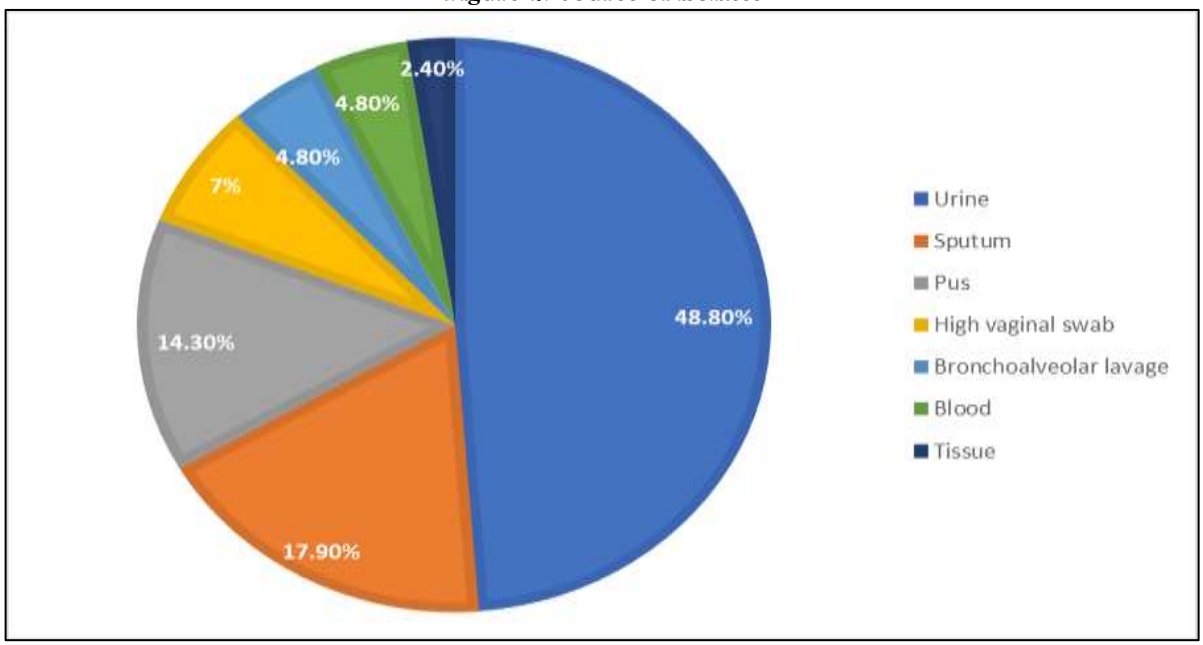
AGE GROUP(years)	FEMALES	MALES	TOTAL
0-20	6(10.5%)	3(11.1%)	9(10.7%)
21-40	28(49.1%)	13(48.1%)	41(49%)
41-60	19(33.3%)	9(33.3%)	28(33.3%)
>60	4(7.1%)	2(7.5%)	6(7%)
Total	57(68%)	27(32%)	84(100%)

Diabetes mellitus emerged as the most common risk factor among the study population, being present in 52 out of the 84 patients (61.9%). Also majority of *Candida* infections were identified among patients admitted to the Intensive Care Unit (ICU), accounting for 49 cases (58.3%), whereas a smaller proportion of infections occurred in non-ICU patients, representing 35 cases (41.7%).

Among the various clinical specimens processed, urine samples yielded the highest number of *Candida* isolates, with 41 cases (48.8%). This was followed by sputum samples, which yielded 15 isolates (17.9%), pus samples with 12 isolates (14.3%), and high vaginal swabs with 6 isolates (7%), as depicted in Figure 1. Furthermore, among

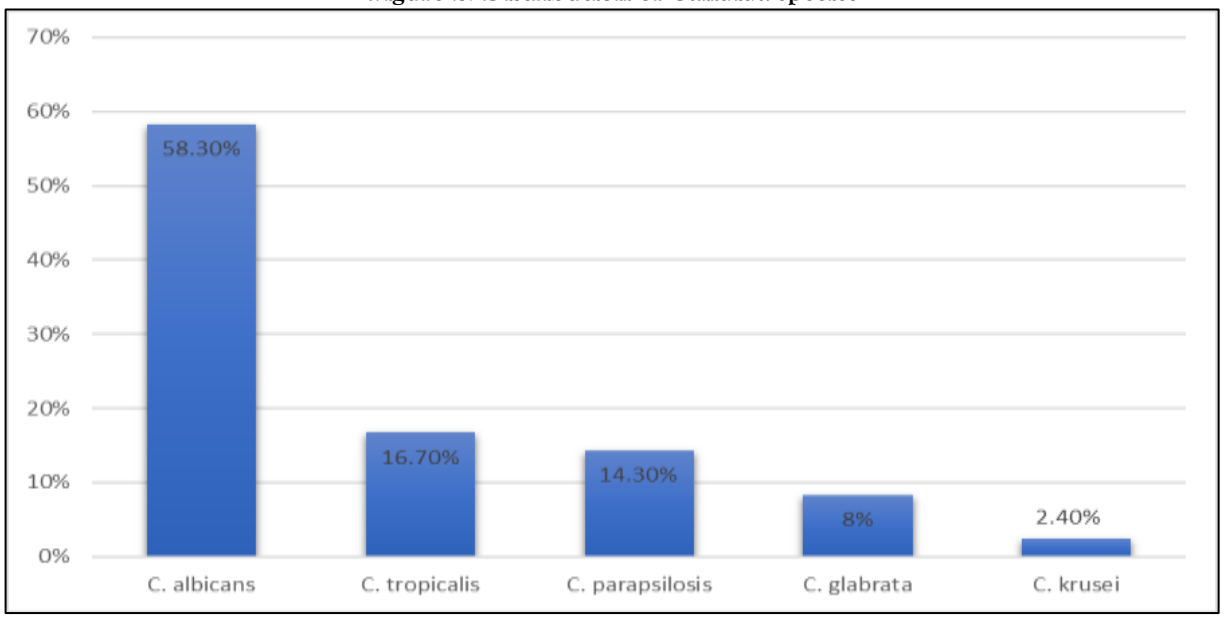
the *Candida*-positive urine samples, 28 patients (68.3%) were found to have been catheterized, highlighting urinary catheterization as an important associated risk factor.

Figure 1: Source of isolates



Species identification revealed that out of the 84 *Candida* isolates, C. *albicans* was the most predominant species, accounting for 49 isolates (58.3%). This was followed by C. *tropicalis* with 14 isolates (16.7%), C. *parapsilosis* with 12 isolates (14.3%), C. *glabrata* with 7 isolates (8.3%), and C. *krusei* with 2 isolates (2.4%), as detailed in Figure 2.

Figure 2: Distribution of *Candida* species



DISCUSSION

In recent years, the incidence of opportunistic yeast infections has increased markedly, largely due to the global rise in the number of immunocompromised individuals. This growing population includes patients with conditions such as diabetes mellitus, cancer, HIV/AIDS, and those undergoing immunosuppressive therapies or

organ transplantation. As a result, there has been a notable surge in both superficial and invasive yeast infections caused by *Candida* species, including both *C. albicans* and non-*albicans* species across the world [6].

In the present study, *Candida* species were more frequently isolated from female patients, accounting for 68% of the cases, compared to 32% in male patients. This finding is consistent with the observations made in a previous study conducted by Mishra N *et al.*, 2022, in which a higher prevalence of *Candida* infections was also reported among females (71.6%) in comparison to males (28.4%) [7]. The increased susceptibility of females to candiduria can be attributed to anatomical and physiological factors. *Candida* species are known to commonly colonize the vulvovestibular region in women, which creates a reservoir for potential ascending infections. From this site, the organisms can migrate upwards, leading to colonization and infection of the urinary tract [8]. This anatomical predisposition contributes significantly to the higher prevalence of candiduria observed among female patients.

In the present study, candidiasis was found to be most prevalent among individuals in the 21–40 years age group, accounting for 49% of the total cases, followed by the 41–60 years age group, which comprised 33.3% of the cases. Similar findings were reported in a study conducted by Swathi e*t al.*, 2018, where the most commonly affected age group was also 21–40 years, with 28 cases (52.8%), followed by the 41–60 years group, which accounted for 14 cases (25.9%) [9]. Although candidiasis can occur across all age groups, previous reports—such as one from Mumbai by Dalal and Kelkar also indicated the highest incidence in the 21–40 years age group [10]. These observations are consistent with the findings of the current study, where the majority of *Candida* isolates were obtained from patients belonging to the 21–40 years age group, as illustrated in table 1.

Among the study participants, 52 out of 84 patients (61.9%) were found to have diabetes mellitus. Diabetes mellitus is a chronic metabolic disorder known to impair immune function, thereby increasing an individual's vulnerability to opportunistic fungal infections, including those caused by *Candida* species [3]. Candidal colonization of the urinary tract is particularly common in diabetic individuals, as well as in patients undergoing treatment with broad-spectrum antibiotics or immunosuppressive agents, and those with long-term indwelling urinary catheters [11,12,13]. Moreover, individuals with diabetes have been shown to exhibit a higher rate of *Candida* carriage compared to non-diabetics. This is likely due to favorable conditions for *Candida* proliferation, such as elevated glucose concentrations in saliva and other body fluids, as well as a reduction in pH, both of which promote fungal overgrowth.

In the present study, the majority of *Candida* infections were identified in patients admitted to the Intensive Care Unit (ICU), comprising 49 out of 84 cases (58.3%). The prevalence of candiduria has been shown to increase progressively with the duration of hospital and ICU stays, reflecting the impact of prolonged hospitalization on fungal colonization and infection risk. Furthermore, candiduria in ICU patients is recognized as an important clinical marker associated with increased mortality rates [3]. In critically ill individuals, the presence of candiduria should not be overlooked, as it may serve as an early indicator of invasive candidiasis, necessitating timely diagnosis and appropriate antifungal intervention.

In the present study, *Candida* species were most commonly isolated from urine samples, comprising 41 out of 84 isolates (48.8%), followed by sputum samples with 15 isolates (17.9%), and pus samples with 12 isolates (14.3%). The predominance of *Candida* isolates from urine is consistent with findings from multiple studies that have reported a rising incidence of *Candida* infections in the genitourinary tract across both medical and surgical settings. Candiduria may reflect either colonization or active infection of the lower urinary tract or renal parenchyma [14]. In India, *Candida* species are recognized as the fifth most common causative agents of nosocomial urinary tract infections [15]. According to available data, urinary tract candidiasis represents the most persistent form of nosocomial fungal infection. Furthermore, there has been a notable shift in the distribution of *Candida* species, particularly in hospital settings, with non-*albicans Candida* species increasingly contributing to cases of nosocomial fungal urinary tract infections.

Furthermore, in our study, among the *Candida*-positive urine samples, 28 patients (68.3%) were found to be catheterized, emphasizing urinary catheterization as a significant associated risk factor for candiduria. Urinary tract infections (UTIs) in catheterized individuals are recognized as the most common healthcare-associated infections among hospitalized patients [16]. *Candida* species are among the most frequently identified causative agents responsible for nosocomial UTIs [17]. Numerous studies have demonstrated that many *Candida* species possess the ability to adhere to the surfaces of catheters and form biofilms, which not only enhance their survival in the urinary tract but also contribute to resistance against antifungal treatment. The Infectious Diseases Society

of America (IDSA) recommends the removal of indwelling urinary catheters in asymptomatic patients with candiduria who do not present any underlying risk factors. For patients belonging to high-risk groups, the IDSA advises treatment with oral fluconazole to prevent the progression to more severe forms of candidiasis [18].
In our study, *C. albicans* accounted for 58.3% of the total isolates, while the remaining 41.7% were identified as non-*albicans Candida* species. These findings are consistent with those reported by Zaini *et al.,* 2006, who observed that 63.5% of isolates were *C. albicans*, while 36.5% were non-*albicans Candida* species [19]. The predominance of *C. albicans* in this study may be due to the clinical specimens obtained from hospitalized patients of prolonged hospital stay, pregnancy or catheterised individuals.
Among the 35 isolates (41.7%) identified as non-*albicans Candida*, *C. tropicalis* was the most frequently isolated species, accounting for 16.7% of the total. This finding is consistent with a previous study in which the authors reported *C. tropicalis* as the most common species among non-*albicans Candida*, with an isolation rate of 15.09%. Similarly, a study conducted by Basu *et al.,* also reported *C. tropicalis* as the predominant non-*albicans* species, followed by *C. krusei* and *C. glabrata* [13]. The global rise in opportunistic fungal infections can be attributed to the increasing population of immunocompromised individuals, including those with chronic illnesses, undergoing immunosuppressive therapy, or with prolonged hospitalizations. Consequently, early identification of clinically significant yeast infections is essential to ensure timely and appropriate antifungal therapy.

CONCLUSION

Opportunistic fungal infections are rising globally due to the increasing number of immunocompromised individuals. Among non-*albicans Candida* (NAC), *C. parapsilosis* is becoming as prevalent as *C. tropicalis*. Early detection of clinically significant yeast infections is essential for effective antifungal treatment. Further research with larger sample sizes and clinico-epidemiological correlations is needed to better understand the prevalence and aetiopathogenesis of these infections in our community.

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REFERENCE

1. Pfaller MA, Papas PG, Wingard JR. 2006. Invasive fungal pathogens: current epidemiological trends. Clin. Infect. Dis. 43(Suppl. 1): S3-S14.
2. Falagas ME, Roussos N, Vardakas KZ. Relative frequency of albicans and the various non-albicans Candida spp among candidemia isolates from inpatients in various parts of the world: A systematic review. Int J Infect Dis 2010; 14: e954-66.
3. Prasad KN, Agarwal J, Dixit AK, Tiwari DP, Dhole TN, Ayyagari A. Role of yeasts as nosocomial pathogens and their susceptibility to fluconazole and amphotericin B. Indian J Med Res. 1999; 110: 117.
4. John H, Rex JH, Michael A. Antifungal Susceptibility Testing: practical aspects and current challenges. Clin Microbiol Rev. 2001; 14: 643-58.
5. Kangogo MC, Wanyoike MW, Revathi G, Bii CC. Phenotypic characterization of Candida albicans from clinical sources in Nairobi, Kenya. African Journal of Health Sciences. 2011; 19(3): 19-23.
6. Hobson RP. The global epidemiology of invasive Candida infections-is the tide turning? J Hosp Infect. 2003; 55: 159-68.
7. Mishra N, Kumari D, Mishra A. Prevalence of Candida Species in Urinary Tract Infections from a Tertiary Care Hospital at Lucknow, Uttar Pradesh, India: A Retrospective Study. Natl. J. Lab. Med. 2022;11.
8. Sobel JD, Fisher JF, Kauffman CA, Newman CA. Candida urinary tract infections—epidemiology. Clinical Infectious Diseases. 2011 May 15;52(suppl_6):S433-6.
9. S. Swathi, Taruni, Rajkumar Sade and Nagababu Pyadala. Phenotypic Characterisation of Candida Species from Clinical Isolates in Tertiary Care Teaching Hospital Hyderabad, India. Int.J.Curr.Microbiol.App.Sci (2018) 7(8): 3849-3854
10. Dalal PJ, and Kelkar SS. Clinical patterns of Candida infections in Bombay. Indian J Dermatol Venereol Leprol. 1980; 46(1): 31-32.

11. Dharwad S, and Dominic RMS. Species identification of Candida Isolates in Various Clinical Specimens with Their Antifungal Susceptibility Patterns. Journal of Clinical and Diagnostic Research. 2011; 5(6) Suppl-1: 1177-81.
12. Mohandas V, and Ballal M. Distribution of Candida Species in different clinical samples and their virulence: Biofilm formation, proteinase and phospholipase production: A study on hospitalized patients in Southern India. J Glob Infect Dis. 2011; 3(1): 4–8.
13. Basu S, Gugnani HC, Joshi S, Gupta N. Distribution of Candida species in different clinical samples. J Glob Infect Dis. 2011; 3: 40-45.
14. Hartstein AI, Garber SB, Ward TT, Jones SR, Morthland VH. Nosocomial urinary tract infection: A prospective evaluation of 108 catheterized patients. Infect. Control. 1981;2:380-86.
15. Anaissie E, Samonis G, Kontoyiannis D, Costerton J, Sabharwal U, Bodey G, et al. Role of catheter colonization and infrequent hematogenous seeding in catheter-related infections. Eur J Clin Microbiol Infect Dis. 1995;14(2):134-37.
16. Paul N, Mathai E, Abraham OC, Michael JS, Mathai D. Factors associated with candiduria and related mortality. J Infect. 2007;55(5):450-55.
17. Nayman Alpat S, Özgunes¸ I, Ertem OT, Erben N, Doyuk Kartal E, Tözun M et al. Evaluation of risk factors in patients with candiduria. Mikrobiyol Bul. 2011;45(2):318-24. Turkish. PMID: 21644075.
18. Pappas PG, Kauffman CA, Andes DR, Clancy CJ, Marr KA, Ostrosky-Zeichner L, et al. Clinical practice guideline for the management of candidiasis. Update by the Infectious Diseases Society of America. Clin Infect Dis. 2016;62(4):e1-e50
19. Zaini F, Shoar MG, Kordbacheh P, Khedmati E, Safara M, Gharaeian N. Performance of Five Phenotypical Methods for Identification of Candida Isolates from Clinical Materials. Iranian J Publ Health. 2006; 35(1): 25-32.