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# Prevalence and Identification of Candida Species in Oral Candidiasis among Immunocompromised Patients at a Tertiary Hospital in South Asia

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**A B S T R A C T**

When host defense fails, opportunistic fungal pathogens can take foundation in the oral cavity, an ecologically dynamic niche. Oral candidiasis is still one of the most common opportunistic fungal infections in individuals with compromised immune systems. Objective of the current hospital cross sectional study was to find out the prevalence and species distribution of Candida in 103 immunologically susceptible patients who were identified at Osmania General Hospital in Hyderabad. Oral swabs and mucosal scrapings were taken under direct microscopy, and then cultured on Sabouraud Dextrose Agar and CHROMagar Candida, and morphologically speciation was performed on corn meal agar. There was a pronounced male predominance. A majority of the isolates were non-albicans species, namely Candida tropicalis, occasionally Candida krusei and Candida glabrata was isolated. These results suggest an epidemiological movement of oral candidiasis towards non-albicans Candida species with a direct correlation to species-level identification for proper direct prudent antifungal drug and improvement in clinical responses in immunocompromised individuals.

**Keywords**

Oral candidiasis, *Candida* speciation, Immunocompromised host, non-albicans *Candida*, opportunistic fungal infection.

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## Introduction

The genus Candida has more than 200 yeast species, however, only a small subset in human disease are known. Of these, Candida albicans has historically been the prevalent etiological agent of mucosal- and systemic candidiasis. It has several virulence properties, including dimorphic growth, adhesion molecules, extracellular hydrolytic enzymes, and biofilm-forming capacity, that serve as a factor in the pathogenesis of it. Recently, a shift in the epidemiology of candidiasis has begun to occur. Candida non-albicans (e.g. Candida tropicalis, Candida glabrata, Candida krusei, Candida parapsilosis) are also being isolated from clinical specimens. These increasingly significant pathogens have emerged as clinically significant because of their unique virulence modes and their diverse response to different types antifungal agent.

Certain NAC species are innate or resistant both innate

and acquired to commonly prescribed antifungal agents, mainly azoles such as fluconazole. Oral candidiasis is especially common in immunocompromised patients. It is commonly seen among people with HIV, diabetes mellitus, hematological neoplastic disease and on chemotherapy or prolonged corticosteroid therapy. In individuals with later stage HIV infection, oral candidiasis is frequently an early marker of immune impairment in progression toward acquired immunodeficiency syndrome. Other clinical type of oral candidiasis can include pseudomembranous candidiasis (most commonly referred to as thrush), erythematous candidiasis; chronic hyperplastic candidiasis; or angular cheilitis. Such cases vary in their clinical manifestation but share a common etiological source of presence of overgrowth of Candida species in the oral mucosa. Laboratory diagnosis of oral candidiasis usually includes in-depth examination under a microscope and fungal culture. Direct microscopy is used for rapid identification of budding yeast cells and pseudohyphal elements whereas culture techniques are useful for isolation and identification of the selected species. Accurate identification is important, not only as regards to epidemiology but also as an indication for correct antifungal treatment. With the increasing load of opportunistic fungal infection and the increasing diversity of pathogenic Candida species, in clinical management, it is necessary for species distribution monitoring to be performed continuously. Local epidemiological pattern analysis was difficult, but it can guide clinicians to choose suitable empirical therapy and anticipate new antifungal resistance. Thus, the current study was undertaken to identify the prevalence and species distribution of Candida in oral candidiasis among immunocompromised patients in a tertiary care setting.

## Materials and Methods

### Study Design

The present investigation was conducted as a cross-sectional observational study aimed at determining the prevalence and species distribution of *Candida* among immunocompromised patients presenting with clinical manifestations of oral candidiasis.

### Study Setting

The study was carried out in the Department of Microbiology of Osmania Medical College in collaboration with the Sexually Transmitted Disease (STD) clinic of Osmania General Hospital, Hyderabad, a tertiary care teaching hospital that caters to a large number of patients with immunocompromising conditions.

### Study Duration

The study was conducted over a six -month period from April 2025 to October 2025.

### Study Population

The study population comprised immunologically vulnerable patients attending the STD clinic who presented with clinical features suggestive of oral candidiasis. These included individuals diagnosed with conditions known to impair host immunity or predispose to opportunistic fungal infections.

### Sample Size

A total of 103 patients fulfilling the inclusion criteria were enrolled in the study during the defined study period.

### Inclusion Criteria

Patients were included in the study if they met the following criteria:

- Presence of clinical lesions suggestive of oral candidiasis
- Patients with underlying immunocompromising conditions such as
    - Human immunodeficiency virus infection
    - Diabetes mellitus
    - Malignancy undergoing chemotherapy
    - Organ transplantation
    - Long-term corticosteroid therapy
    - Prolonged antibiotic usage
- Patients who provided informed consent for participation in the study

### Exclusion Criteria

The following patients were excluded from the study:

- Individuals who had received antifungal therapy within the preceding two weeks
- Patients with oral lesions of non-fungal etiology

- Patients unwilling to participate in the study

## Sample Collection

Clinical specimens were obtained from oral lesions including pseudomembranous plaques, erythematous patches, and mucosal scrapings using sterile cotton swabs Care was taken to collect samples from the active margins of the lesions to ensure adequate recovery of fungal elements.

The collected specimens were transported promptly to the microbiology laboratory for further processing.

## Direct Microscopic Examination

A portion of the collected specimen was subjected to direct microscopic examination.

## Potassium Hydroxide Mount

A smear of the specimen was prepared on a clean glass slide and treated with 10% potassium hydroxide (KOH)**.** The preparation was examined under light microscopy for the presence of budding yeast cells and pseudohyphae suggestive of *Candida* species.

## Gram Staining

Another smear was prepared and stained using the Gram staining technique. *Candida* organisms appeared as Gram-positive oval budding yeast cells with pseudohyphal extensions under microscopic examination.

## Culture and Isolation

Specimens were inoculated onto Sabouraud Dextrose Agar (SDA) and incubated at 37°C for 24–48 hours**.** Colonies suggestive of *Candida* species typically appeared as smooth, creamy, pasty white colonies.

## Species Identification

For differentiation of *Candida* species, isolates were subcultured onto CHROMagar Candida**,** a chromogenic medium that allows presumptive identification based on colony color and morphology. Further speciation was performed using corn meal agar morphology, where isolates were examined microscopically for characteristic features including:

- Chlamydospore formation
- Pseudohyphal arrangement
- Blastoconidia pattern

These morphological characteristics aided in confirming the species identity of the isolates.

## Data Collection

Demographic and clinical information including age, gender, underlying comorbid conditions were recorded using a structured data collection proforma.

## Statistical Analysis

The collected data were compiled and analyzed using descriptive statistical methods. The distribution of *Candida* species, demographic characteristics, and associated comorbidities were expressed as frequencies and percentages

## Results and Discussion

## Demographic Characteristics

A total of 103 immunocompromised patients with clinically suspected oral candidiasis were included in the study. Among them, 70 patients were male (68.18%) and 33 were female (31.81%)**,** resulting in a male-to-female ratio of approximately 1.8: 1, indicating a clear male predominance. The 40–50-year age group represented the largest proportion of affected individuals, suggesting that middle-aged adults with underlying immunocompromising conditions are particularly susceptible to oral candidiasis.

## Species Distribution of *Candida*

Culture and speciation revealed that Candida albicans remained the predominant isolate, identified in 33 patients (31.9%). However, a considerable proportion of infections were caused by NAC species.

## Associated Comorbid Conditions

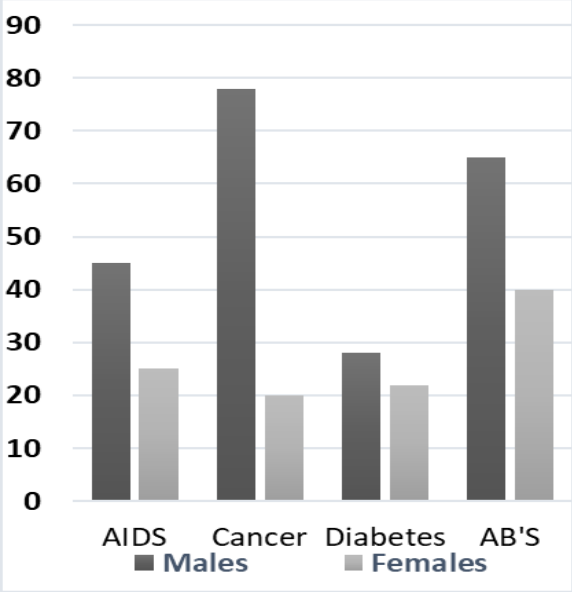
Among the underlying conditions, HIV infection emerged as the most common predisposing factor. A substantial proportion of HIV-positive patients with

candidiasis demonstrated CD4 T-cell counts between 51 and 100 cells/mm³, indicating advanced immuno-suppression.

Other significant comorbidities included:

- Diabetes mellitus
- Malignancies undergoing chemotherapy
- Long-term corticosteroid therapy
- Prolonged antibiotic exposure

Most affected individuals also belonged to lower socioeconomic strata, which may contribute to delayed healthcare access and increased disease burden




Oral candidiasis remains a significant opportunistic infection affecting individuals with weakened immune systems.

This study sheds light on the epidemiological characteristics of Candida species linked to oral candidiasis in immunocompromised patients at a tertiary care facility.

The observed male predominance in this research (70 males versus 33 females) aligns with findings from various prior studies. This disparity may be attributed to greater exposure to risk factors such as tobacco consumption, occupational stress, delays in seeking medical care, or a higher incidence of underlying systemic diseases among men.

A notable incidence rate within the 40–50-year age group indicates that middle-aged adults suffering from chronic systemic conditions are particularly vulnerable to opportunistic fungal infections. The combination of age-related immune changes and comorbidities like diabetes and HIV infection likely exacerbates this increased susceptibility.

In our analysis, *Candida albicans* was identified in 33 isolates, confirming its status as the most prevalent species. This supports the traditional view that C. albicans is the predominant pathogen in oral candidiasis due to its established virulence factors, which include adhesion capabilities to epithelial surfaces, phenotypic switching, and biofilm formation.

Nevertheless, a noteworthy proportion of isolates were identified as non-albicans Candida species, specifically ***Candida tropicalis*** (24 isolates) and ***Candida parapsilosis*** (14 isolates). The rise of these species indicates an evolving epidemiological pattern documented in recent global studies.

Non-albicans Candida species present increasing clinical challenges since many exhibit diminished susceptibility to standard azole antifungal medications; this situation could result in treatment failures if empirical therapy is initiated without proper species identification. The rising prevalence of these organisms highlights the critical need for routine laboratory speciation in managing candidiasis effectively.

Additionally, our study revealed a significant correlation between oral candidiasis and HIV infection, especially among patients with CD4 counts ranging from 51–100 cells/mm³. The progressive decline of CD4 T lymphocytes during HIV infection severely weakens mucosal immune defenses, facilitating opportunistic fungal colonization and subsequent infections.

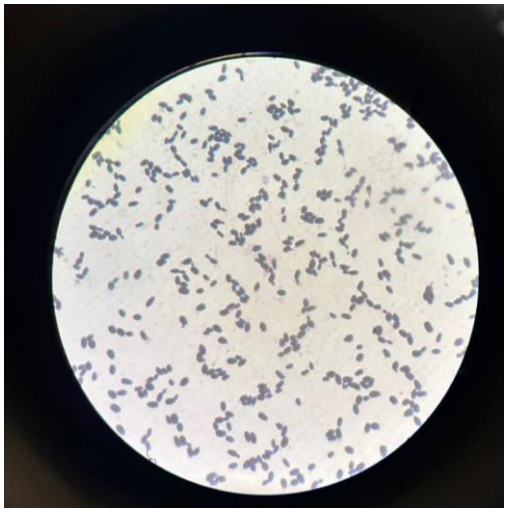
Additional risk factors such as diabetes mellitus, cancer diagnoses, and prolonged corticosteroid use further emphasize the multifactorial nature of oral candidiasis. These conditions compromise host immunity and disrupt the natural microbial equilibrium within the oral cavity, thereby encouraging fungal overgrowth.

**Species Distribution of *Candida***

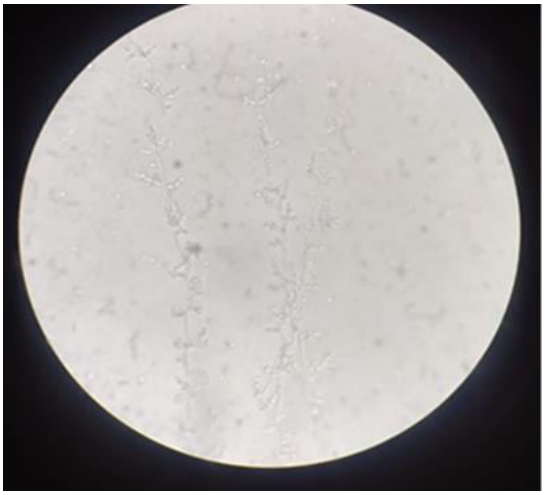
| Candida Species | Percentage | Number of Isolates (n=103) |
|---|---|---|
| ***Candida albicans*** | 31.9% | 33 |
| ***Candida tropicalis*** | 23.6% | 24 |
| ***Candida parapsilosis*** | 13.2% | 14 |
| ***Candida krusei*** | ~5% | 5 |
| ***Candida glabrata*** | ~4% | 4 |
| **Other / mixed isolates** | Remaining | 23 |

**Species differentiation on HiChrome agar**

**Growth of species on SDA agar**



**GPBYC on Gram Staining**
**(Gram positive budding yeast cells)**



**Candida tropicalis seen on Corn meal agar**

In summary, this study underscores the shifting epidemiology of Candida infections and highlights the growing necessity for identifying non-albicans species in routine clinical practice. Accurate laboratory diagnostics and precise species-level identification are crucial for guiding targeted antifungal treatment strategies and enhancing clinical outcomes for immunocompromised individuals.

In conclusion, the current study shows that Candida albicans are still more likely to remain as the main isolate in immunocompromised subjects whereas a large

prevalence can be attributed to non-albicans Candida species such as Candida tropicalis and Candida parapsilosis.

In fact, the close correlation in those affected with disease-promising infections (e.g., HIV infection, diabetes mellitus, cancer) underlined the fact that weak host immunity is an important reason for the susceptibility to the disease.

These studies underscore the need of such kind of routine species-level identification of Candida within clinical laboratories in clinical laboratory practice for expedited diagnosis, as well as for the control of the risk of developing Candida for the drug therapy in patients who are often at risk of developing CD8.

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## Author Contributions

Dr. Samiya Nishath: Conceptualization, sample collection, laboratory work, data analysis, interpretation of results, manuscript writing, and overall execution of the study. Dr. M. L. Kavitha Latha: Conceptualization, study design, supervision, critical review of methodology, and manuscript revision. Dr. D. Savitha: Guidance in sample processing, laboratory supervision, and manuscript review. Dr. Ajaz Ahmed: Critical review of methodology, and manuscript revision.

## Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Ethical Approval** Not applicable.

**Consent to Participate** Not applicable.

**Consent to Publish** Not applicable.

**Conflict of Interest** The authors declare no competing interests.

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