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The prevalence of *Candida albicans* among students in the University of Africa, Toru-Orua

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Abstract
Candida albicans is one of the most prevalent opportunistic fungal pathogens associated with urinary tract infections in young adults and people living in crowded conditions. Especially in young adults and those living in crowded situations. A total of 100 urine samples were collected and analysed by microbiological cultural and microscopic techniques. Of the 100 urine samples analysed, 21 (21%) were positive for Candida albicans and 79 (79%) were negative for fungal growth. The gender distribution showed a higher prevalence among the female students, with 16 (26.7%) positive cases out of 60 samples, compared to 5 (12.5%) positive cases among 40 male students. Analysis based on geography showed that students residing in the dormitory had the highest prevalence of infection with 9 (30.0%) positive cases followed by A & K Road with 5 (20.0%), Angalabiri with 4 (16.0%) and Ebedebiri with 3 (15.0%) positive cases. Analysis based on geography showed that students residing in the dormitory had the highest prevalence of infection with 9 (30.0%) positive cases followed by A & K Road with 5 (20.0%), Angalabiri with 4 (16.0%) and Ebedebiri with 3 (15.0%) positive cases. The distribution by age revealed that younger students were more affected with a frequency of 28.0% among students aged 17–19 years, followed by students aged 20–22 years (22.9%) and students aged 23–26 years registered the lowest prevalence (15.0%). Higher frequency among females and hostel residents could be due to anatomical, sanitary and environmental reasons including close living situations that could facilitate fungal transmission. The study emphasized the public health significance of candidal infections among university students and the need for improved personal cleanliness, health education and routine screening programmes in higher institutions.

Keywords: *Candida albicans*, prevalence, urine samples, university students, fungal infection, Bayelsa State.

INTRODUCTION

Candida albicans is an opportunistic fungal pathogen of humans causing candidiasis and is still one of the most common causes of fungal infections globally. Candida species are typically found as benign commensals in the human body, particularly in the oral cavity, gastrointestinal tract and genital tract, but modifications in the immune system of the host or disruption of the normal microbial balance can convert these organisms into pathogenic agents capable of causing disease. The most commonly isolated species is Candida albicans and it has been associated with a wide spectrum of illnesses including oral thrush, vulvovaginal candidiasis, urinary tract infections and invasive systemic candidiasis [1].

Candida species are part of the natural flora of the lower vaginal tract in about 20–50% of healthy asymptomatic women [2] However, under favourable conditions these organisms multiply excessively and lead to symptomatic illnesses. Vulvovaginal candidiasis (VVC) is the most common fungal illness in women worldwide. It is anticipated that over 75% of women will have at least one episode of vulvovaginal candidiasis during their lifetime, and about 50% of women experience recurrent infections [3]. The infection is usually characterised by thick white, cream or yellow vaginal discharge,

vulvovaginal itching, irritation, inflammation and discomfort. Sometimes the discharge is watery and usually without odour, but the itching and irritation can have a major impact on the quality of life of afflicted individuals.

Several factors can make people susceptible to Candida infections. High carrier rate of Candida albicans has been found among pregnant women, diabetic patients, women on broad spectrum antibiotics and people living with HIV/AIDS due to their reduced immune defence and hormonal or metabolic abnormalities [4]. Antibiotics are of special importance since these medications kill protective bacterial flora that ordinarily prevent fungal overgrowth and create a favourable environment for Candida multiplication. Long-term use of corticosteroids and immunosuppressants also lowers the body's own defence against infection and predisposes to candidiasis.

Also essential in the pathogenesis of Candida infections are environmental and lifestyle variables. Warm and damp body conditions are favourable for the growth of Candida species and hence wearing overly tight garments or non-breathable nylon materials that retain moisture and heat might lead to infection [5]. Fungal colonisation and infection have also been connected with poor personal cleanliness, drug addiction, malnutrition and underlying systemic diseases such as vitamin B deficiency, hypothyroidism and lymphoblastoma [6]. Moreover, the lifestyle factors of young adults such as stress, poor food habits, and inadequate healthcare practices may further predispose them to candidiasis.

The vaginal microenvironment is maintained in a delicate balance by intricate interactions between indigenous bacteria, hormonal activity, vaginal pH and host immunity. One of the most abundant constituents of the normal vaginal flora is Lactobacillus acidophilus, which protects against the growth of harmful organisms by generating hydrogen peroxide and maintaining a low vaginal pH. However, this delicate balance can be disrupted by antibiotics, hormonal shifts, poor hygiene or invading infections, making the vaginal ecosystem ideal for Candida overgrowth [7] These changes improve the ability of Candida albicans to adhere to vaginal epithelial cells and to trigger the germination of yeast cells into invasive forms that lead to symptomatic infections.

Candida infections are very common among teens and young adults, including university students. This age group is commonly exposed to many behavioural and environmental risk factors including poor sanitation, overcrowded settings, self-medication with antibiotics, irregular feeding practices, emotional stress and dangerous lifestyle habits. Anatomical and physiological factors significantly predispose female students to fungal infection and colonisation. Furthermore, the communal living in hostels might result in the spread of illnesses due to shared amenities and poor cleanliness practices[8].

Despite the increasing health burden of candidiasis, there is scanty published evidence on the prevalence and related risk factors of Candida albicans among students in higher institutions in Nigeria. In the University of Africa, Toru-Orua, anecdotal reports imply that a good number of students are suffering from symptoms associated with candidiasis[9]. However, scientific data is not available to estimate the true prevalence and epidemiological pattern of Candida albicans infections in the institution. The absence of knowledge makes it difficult to establish effective health education, prevention and early intervention programs for students[10].

Hence the present study was aimed to assess the prevalence of Candida albicans among students of the University of Africa, Toru-Orua. Moreover, the study also aims to find out relevant risk factors connected with the occurrence of candidiasis among students' population. The results of this study will provide useful epidemiological data that could help healthcare professionals, university management and public health authorities in designing effective awareness campaigns, encouraging early diagnosis and treatment and improving the overall health and well-being of students in the institution.

MATERIALS AND METHODS

Experimental study design:

The sample population includes 100 male and female students between the ages of 17 and 26years who gave their informed consent to participate in the study. Those recruited for this randomized cross-sectional study were non-pregnant students, no complain of symptoms of urinary tract infections and those who were not on antifungal therapy at the time of sample collection, or who had not taken antifungal drugs within one month prior to sampling. A total of 100 urine samples was collected from four different locations including, the university hostel, Ebedebiri, A & K Road and Angalabiri. The urine samples were collected using a sterile universal bottle.

Sample Area: The sample area is University of Africa Toru-Orua in Toru – Orua community, in Sagbama Local Government Area, Bayelsa State. This study was conducted on the 16th of July, 2025. Over the course of the year, the temperature varied from 22°C to 31°C and rarely below 17°C or above 32°C.

Sample Collection: A total of 100 samples were collected from the 16th of July, 2025 to 15th of August 2025 from the Samples Were Collected From four different locations and in each of the locations, samples were collected from both gender (male &female). The samples were preserved in the refrigerator under 3 degrees Celsius upon collection using clinical sample bottles. All collected samples were transported directly to the laboratory immediately after collection, with the original storage conditions been maintained.

Sterilization of Materials: The media were sterilized with the autoclave for 15 minutes at a temperature of 121°c and a presure of 15psi. glassware was also sterilized at 121°C for 15 minutes using the autoclave. Materials not suitable for autoclaving were sterilized by disinfecting thoroughly with 70% ethanol. The workbench was also thoroughly disinfected using 70% ethanol to avoid contamination.

Media Preparation: The first step in media preparation was to assemble the equipment and media. The following culture media were used in this study:

Sabouraud Dextrose Agar (SDA): Used for the isolation, cultivation, and maintenance of non-pathogenic species of fungi and yeast.

The culture media was prepared according to the manufacturer's instructions on the SDA container.

Mycological Analysis: The cultivation and isolation of filamentous fungi and yeast associated with the urine samples were done using culture-dependent methods.

1ml of each water sample was introduced into a well-labeled sterile test tube containing 10 ml of 0.85% normal saline. The tubes were vigorously agitated to dislodge microbes associated with the swab sample surfaces into the saline solution.

Afterward, test tubes containing 1 ml of normal saline were set up in test tube racks and labeled. A tenfold serial dilution was done. 1 ml of the inoculum from the original fungal stock (10 ml of normal saline tube) was aseptically transferred into the first dilution tube (10^{-1}). The samples were diluted four times to obtain an acceptable colony count. The tubes were covered tightly with cotton wool to prevent sample contamination. 1ml of the inoculums was aseptically collected with a micropipette and was dropped into the petri dishes then spread using a sterile glass spread rod and inoculated into the 20ml of the nutrient medium (SDA) which was poured into the petri dishes and allowed to set(solidify) and thereafter incubated at 37 degrees Celsius for 5 days.

Microscopic Examination of Fungal Isolate

The examination and microscopic examination of fungal isolates require the observation of the microscopic features such as shape, size of hyphae shape of sporangia, conidia, condiophores and spores. Using a flamed inoculating needle, the edge of each colony is picked and slides of different colonies are made, a drop of Lact-phenol cotton blue stain is added to the slides and covered with cover slip and examine under the microscope using x100 and x400 magnification starting from third day of the culture. The microscope characteristics observed were recorded accordingly.

Lacto Phenol cotton Blue Staining Technique

Lacto phenol cotton blue wet mount that is widely used in the preparation of slides for microscopic examination of fungi

A drop of 70% ethanol was placed on a clean microscopic glass slide

The test fungal isolate was immersed in the drop of alcohol

Two drops of Lacto-Phenol cotton blue were added

The wet preparation was covered with a glass cover slip

The wet preparation was examined using low power objective and thereafter, 40x objective.

RESULTS

This result presents the findings obtained from the analysis of 100 urine samples collected from students of the University of Africa, Toru-Orua, to determine the prevalence of *Candida albicans*. The results are organized and presented according to prevalence, sample location, gender, and age distribution. Data are shown in tables and figures for clarity.

Overall Prevalence of *Candida albicans*: Out of 100 urine samples analyzed, *Candida albicans* was isolated in 21 (21%) samples, while 79 (79%) showed no growth of *Candida albicans*.

Table 4.1: Overall prevalence of *Candida albicans*

Parameter	Frequency (n=100)	Percentage (%)
Positive for *C. albicans*	21	21%
Negative	79	79%
Total	100	100%

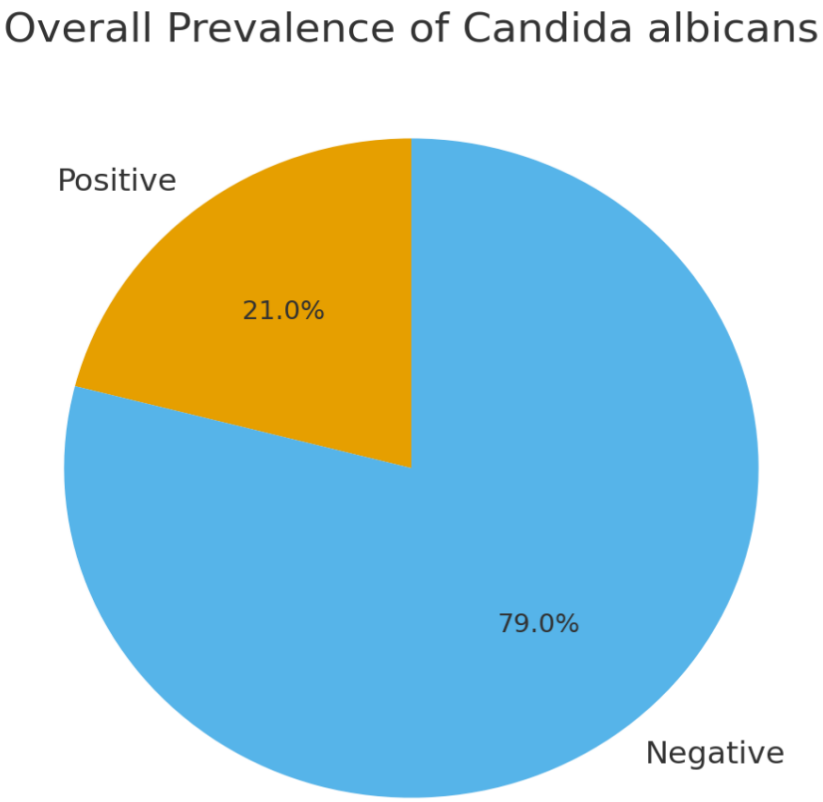

Fig 4.1: Overall prevalence of *Candida albicans*

4.1.2. Prevalence by Gender

Among the 21 positive cases, 5 (23.8%) were males and 16 (76.2%) were females. This indicates a higher prevalence of *Candida albicans* among female students compared to males.

Table 4.2: Prevalence by gender

Gender	No. of Samples	Positive	Negative	Prevalence (%)
Male	40	5	35	12.5%
Female	60	16	44	26.7%
Total	100	21	79	21%

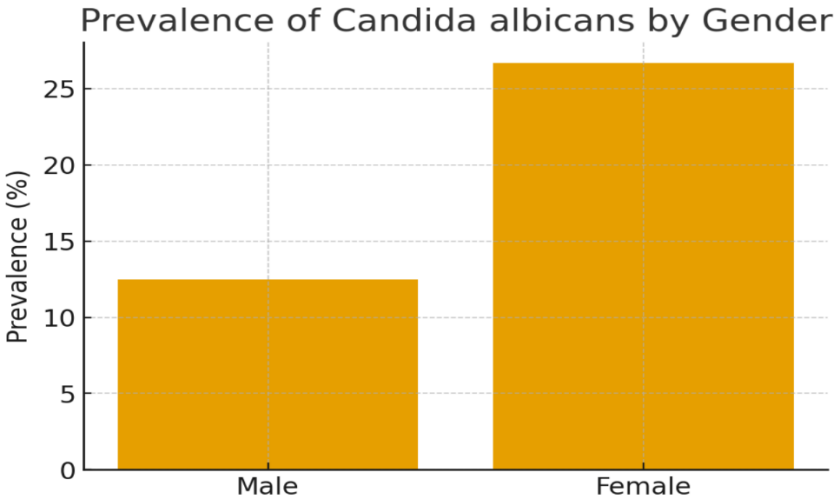

Fig 4.2: Prevalence of *Candida albicans* by gender

4.1.3. Prevalence by Location

Samples were collected from four areas: Toru-Orua Hostel, A & K Road, Ebedebiri, and Angalabiri. Distribution of *C. albicans* was observed across all locations, with hostel samples showing the highest prevalence.

Table 4.3: Prevalence by sample area

Location	No. of Samples	Positive	Negative	Prevalence (%)
Hostel	30	9	21	30.0%
A & K Road	25	5	20	20.0%
Ebedebiri	20	3	17	15.0%
Angalabiri	25	4	21	16.0%
Total	100	21	79	21.0%

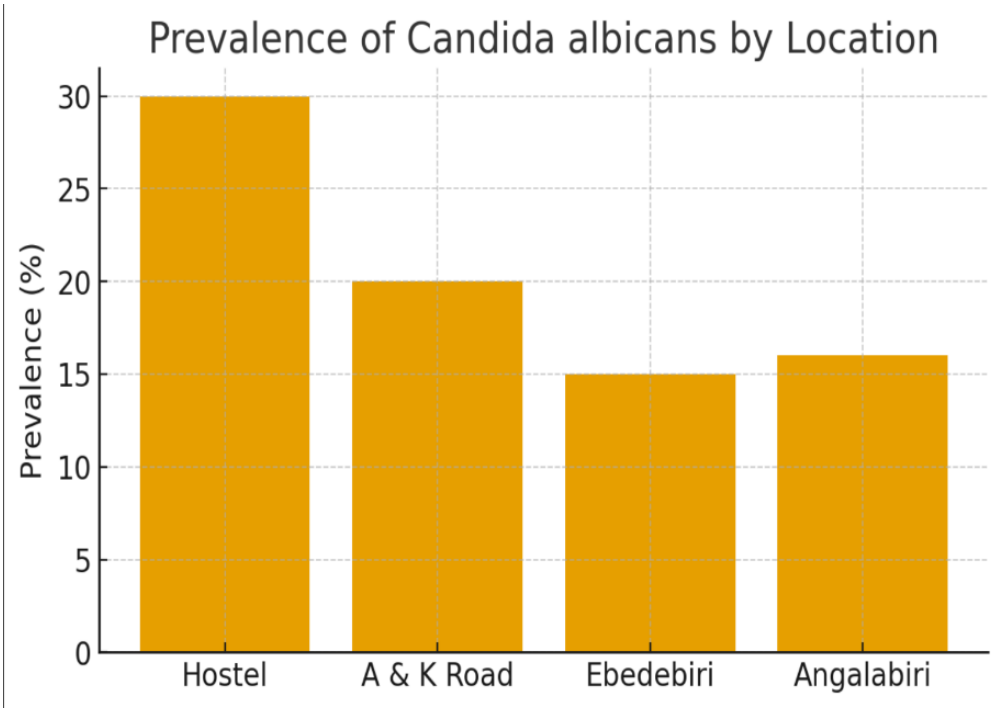

Fig 4.3: Prevalence of *Candida albicans* by location

4.1.4. Prevalence by Age Group

The age range of sampled students was 17–26 years. Distribution showed that *Candida albicans* occurred more frequently in younger students (17–21 years) than in older ones (22–26 years).

Table 4.4: Prevalence by age group

Age Group (years)	No. of Samples	Positive	Negative	Prevalence (%)
17–19	25	7	18	28.0%
20–22	35	8	27	22.9%
23–26	40	6	34	15.0%
Total	100	21	79	21.0%

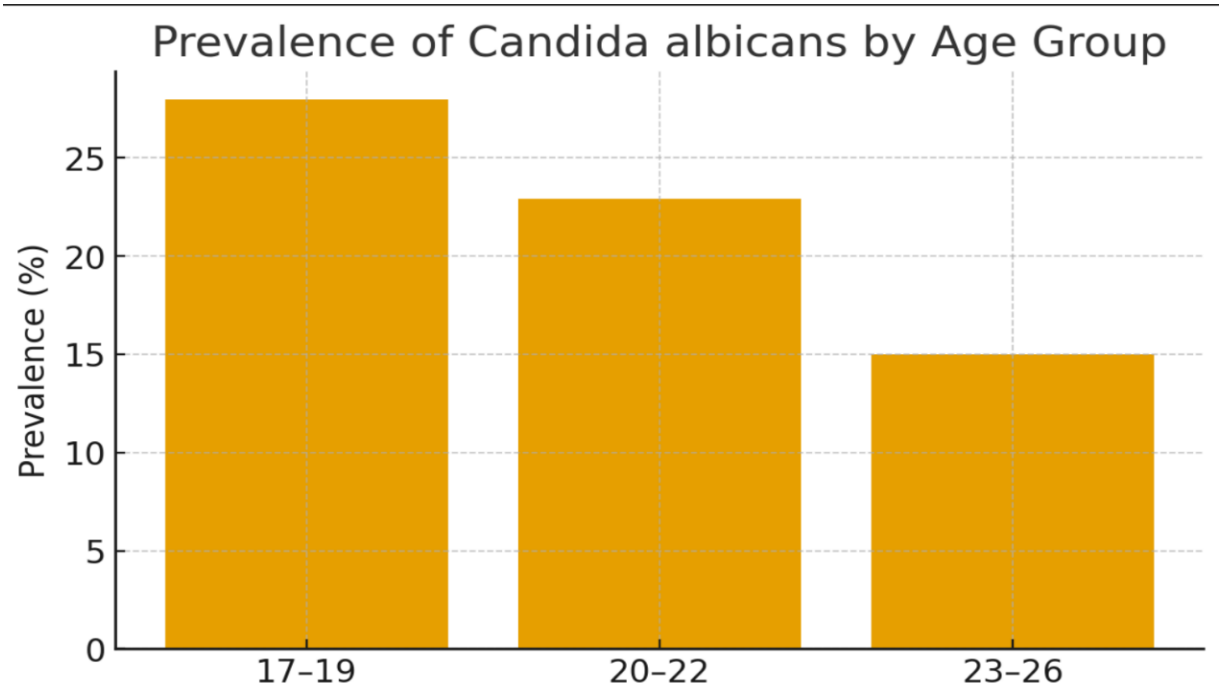

Fig 4.4: Prevalence of *Candida albicans* by age group

4.1.5. Microscopic Characteristics of Isolates

Microscopic examination of isolates stained with lactophenol cotton blue revealed typical features of *Candida albicans*, such as:

Oval or spherical budding yeast cells.

Presence of pseudohyphae.

Small blastoconidia attached to the pseudohyphae.

These morphological characteristics confirmed the identity of the fungal isolates as *Candida albicans*.

4.1.6. Statistical Observation

The overall prevalence of *Candida albicans* among the study population was **21%**.

Female students (26.7%) had a significantly higher prevalence than males (12.5%).

Hostel students had the highest occurrence (30%), possibly due to close living conditions and higher chances of cross-infection.

Prevalence decreased with age, with younger students (17–19 years) showing higher infection rates.

Out of 100 samples analyzed, 21 (21%) were positive for *Candida albicans*.

Female students had a higher prevalence (26.7%) compared to males (12.5%).

The highest prevalence was observed in hostel students (30%), while the lowest was found in Ebedebiri students (15%).

Younger students (17–19 years) showed higher rates of infection compared to older students (23–26 years).

Microscopic analysis confirmed budding yeast cells and pseudohyphae consistent with *Candida albicans*.

DISCUSSION

The results of this study revealed that the total prevalence rate of *Candida albicans* among the students of the University of Africa, Toru-Orua was 21%. The prevalence implies that Candida albicans is still an important opportunistic fungal pathogen among university students and suggests that variables in the university environment may favour fungal colonisation and infection. The prevalence found in this study is similar to prior reports from similar populations. The prevalence rate among university students in Nigeria was reported to be 19.6% by [11] while [12] reported a slightly higher incidence of 25% among female undergraduates. The present results are consistent with findings from other studies, which could be attributable to the common socio-environmental factors, lifestyle behaviours and hygiene-related difficulties that are frequent in student populations in higher institutions.

In this study, the distribution of *Candida albicans* infection by gender showed a significantly higher prevalence in female students (26.7%) compared to male students (12.5%). This observation is in agreement with the findings of [13] who indicated that females are more susceptible to candidiasis due to biological and anatomical reasons. The female genital tract is a suitable environment for growth and colonisation of Candida species, especially in the presence of hormonal imbalance, inadequate hygiene or changed vaginal flora. Also, females are more prone to fungal infections than males due to the shorter urethra and the presence of the vaginal mucosal surface. Similar findings were also reported by [14] with greater percentage of Candida isolates among young female adult. The increased occurrence in the present study among female students may be due to other variables such as the usage of tight clothing, poor menstrual hygiene, stress, self-medication with antibiotics and food habits.

Distribution of *Candida albicans* by residential location the prevalence rate of Candida albicans was highest in hostel students (30%). This shows that the communal living arrangements could have a major role in the transmission and duration of Candida infection. Student hostels are generally overcrowded, with shared toilet and bathroom facilities, low ventilation and poor cleanliness all of which may encourage the spread of infective organisms. In similar study, it was found that students who lived in hostels had increased incidence of fungal infections due to poor environmental hygiene and close interpersonal contact [15],[16]. Thus, the current results highlight the significance of environmental and hygienic factors in the epidemiology of Candida infections among university students.

The age distribution analysis in this study indicated that the highest prevalence of Candida albicans infection was in students of 17–19 years of age (28%) followed by students of 20–22 years of age (22.9%) and the lowest prevalence was reported in students of 23–26 years of age (15%). The results obtained accord with the report by [17], who reported that younger persons were more susceptible to colonisation and infection by Candida. The higher occurrence among younger students could be associated with increased hormonal activity, decreased immunity, poor sanitary practices, academic adjustment stress, and dangerous lifestyle behaviours. Younger students, particularly those who are new to university life, may also not have enough awareness on personal and reproductive health practices. Similar epidemiological trends were described by [18] who reported that younger populations generally show higher vulnerability to Candida infections due to behavioural and physiological reasons.

Microscopic inspection of the fungal isolates in this investigation showed the classic features of *Candida albicans* including oval budding yeast cells, pseudohyphae and blastoconidia. These physical traits are well-known diagnostic characteristics of *Candida albicans* and support the identity of the isolates collected from urine samples. These results are in accordance with the description by [19] who pointed out the usefulness of lactophenol cotton blue staining for the identification and confirmation of fungal microorganisms. The presence of pseudohyphae and budding yeast cells associated with tissue invasion and virulence also confirms the pathogenic potential of isolates.

The findings of this study are in line with earlier publications which indicate that Candida albicans is a common opportunistic fungal infection in the student population. The increased occurrence among females, hostel residents and younger students suggests that some demographic and environmental factors may predispose persons to infection. The study consequently underscores the need for better personal and environmental hygiene, periodic medical screening and customised health education initiatives in tertiary institutions. Increased understanding of the causes, risk factors, prevention and early treatment of candidiasis may help decrease the burden of Candida infections in university students[20].

The total prevalence rate of Candida albicans among students at the University of Africa, Toru-Orua was found to be 21%, showing that candidiasis is still a significant public health issue in the student community. The infection was greater among female students (26.7%) than male students (12.5%). Gender associated biological and physiological factors may increase susceptibility among females. The largest occurrence was among hostel residents (30%) which indicates the role of shared accommodation, overcrowding and environmental cleanliness in the transmission of fungal infections[21].

The study also revealed that younger students aged 17–19 years were more affected than older students aged 23–26 years which suggests that age-related behavioural, hormonal, and lifestyle factors may contribute to increased vulnerability. Microscopic inspection revealed the presence of budding yeast cells, pseudohyphae and blastoconidia, typical of Candida albicans and thus established the authenticity of the isolates collected.

CONCLUSION

Candida albicans is a major opportunistic fungal pathogen among the university students and special attention should be paid to females, dormitory residents and younger students. The outcomes of this study underscore the relevance of health education, personal cleanliness, environmental sanitation and frequent medical screening in the reduction of the occurrence and transmission of candidiasis in higher institutions.

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