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High Prevalence of *Candida albicans* Observed in Asymptomatic Young Women in Owerri, Nigeria

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Abstract *Candida albicans*, normal flora of the vagina, is endogenous opportunistic yeast, which causes secondary infection in individuals with some underlying immune-compromised conditions. In this study, we investigated the prevalence and associated risk factors for *C. albicans* among asymptomatic female students of Imo State University Owerri (IMSU), southeast Nigeria. High Vaginal Swabs (HVS) specimens were randomly collected from freely consenting 284 female undergraduate students between the ages of 17 and 26 years, residing in six different hostels within the Owerri metropolis. The participants also completed a simple structured questionnaire assessing demographic data and risk factors of candidiasis. Each HVS specimen was cultured on Sabouraud Dextrose Agar (SDA) containing appropriate antibiotics to suppress bacterial growth and incubated aerobically at 37°C. *C. albicans* was identified by conventional microbiological techniques. The overall prevalence rate of *C. albicans* in the HVS specimen of 284 young women studied was 37.7%, with the highest rate of 45.0% observed among students between the age group 23-25 while the lowest prevalence (20.6%) was among those between ages 17-19 years. Analysis of the participants' response to the questionnaire indicates that *C. albicans* carrier rate may be associated with poor personal hygiene. Statistical analysis showed that prevalence rate of *C. albicans* among the students from different hostels was not significantly different in any of the sampled hostels $P<0.05$. This study indicates that the prevalence of vaginal candida colonization among female students is highly significant. Predisposing factors such as the use of tight underwear, indiscriminate use of antibiotics should be avoided and the need for good and adequate personal hygiene should be encouraged.

Keywords: *Candida albicans, female students, prevalence and risk factors*

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1. Introduction

Candida albicans is an opportunistic fungal pathogen that is responsible for candidiasis in the human hosts [19]. Candida species are part of the lower genital tract flora in 20-50% of healthy asymptomatic women [7]. Approximately 75% of all women experience at least one episode of vulvovaginal candidiasis during their lifetime and 50% of them suffer recurrent events [18]. Candidiasis is often associated with the production of a thick, white/cream/yellow discharge from the vagina tract, this discharge may be watery, often odourless and usually with an accompanying vulvo-vaginal itching and inflammation [18].

Carrier rates of *C. albicans* are higher in pregnant women, diabetic women, women treated with broad spectrum antibiotics and women with HIV/AIDS [3]. Candida infections usually occur in warm and moist parts of the body. Clothing that is too tight or made of nylon materials that can trap heat and moisture may lead to candida infection [1]. Other predisposing factors such as poor personal hygiene, administration of corticosteroids or immunosuppressive drugs, drug addiction, immunological deficiencies and systematic conditions such as vitamin B deficiency, hypothyroidism and lymphoblastoma supports the growth of *Candida spp.* [2,13,16,20,21]. The effect of antibiotics on proliferation of Candidiasis is based on the fact that these drugs militate against susceptible microflora antagonistic to the yeast, thereby enhancing their growth.

The microenvironment of the vagina is affected by dynamic interrelationships between *Lactobacillus acidophilus* and other endogenous flora, estrogen, glycogen, vaginal pH, and metabolic by-products of these microbiomes. *L. acidophilus* produces hydrogen peroxide (as a by-product of metabolism), which is toxic to pathogens and keeps the healthy vaginal pH acidic. Vaginitis occurs when the vaginal microflora has been altered by invading pathogens or biochemical changes in the environment [18]. Changes in the vaginal environment encourage the *Candida* population, enhance their adherence to vaginal epithelial cells, and facilitate germination of daughter yeast cells. These changes may transform asymptomatic colonization into symptomatic *Candida* infection. Vaginal infection due to Candida is very common in teenagers and pubertal females, hence, the choice of the age bracket under study. This study therefore investigated the prevalence and

associated risk factors of *C. albicans* among young female students in Owerri, southeast Nigeria.

2. Material and Methods

2.1. Study Population and Sample Collection

The study population comprised of 284 female undergraduate students of Imo State University Owerri between the ages of 17 and 28 years 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. The volunteered participants were divided into groups according to their age (17-19, 20-22, 23-25 and 26-28 years). The participants were enlightened on the purpose and importance of the study and were educated on how to obtain a High Vaginal Swab devoid of contamination with the vaginal orifice. A simple structured questionnaire assessing the demographic information, symptoms, and risk factors was also administered. Oral informed consent was obtained from all the volunteered participants and all personal information were kept confidential. All sampling procedures were in accordance with guidelines of the National Health Research Ethics Committee, Nigeria (www.nhrec.net). The High Vaginal Swab (HVS) specimens were properly labeled and then transported in sterile containers to the laboratory for processing and cultivation.

2.2. Sample Cultivation, Isolation and Identification *C. albicans*

The HVS specimens were streaked directly onto Sabouraud Dextrose Agar (SDA) plates and incubated aerobically at 37°C for 48 hours. Yeast growth characteristic colonial morphology of *C. albicans* (white to cream colony with a smooth border, pasty and moist appearance) was noted. The yeast cells were confirmed to be *C. albicans* by germ tube test.

2.3. Germ Tube Test

Germ tube experiment was used as a rapid tool for identification of *C. albicans*. Using a sterile wire loop, a small portion of a pure colony of *C. albicans* was harvested and inoculated in to sterile test tubes containing 0.5 ml of human serum. The resulting suspension was incubated aerobically at 37°C for 3 hours. A drop of the yeast-serum suspension was placed on a clean microscope slide with 1 drop of cotton blue lactophenol stain and covered with a cover slip and examined microscopically, using the x10 and x40 objective lenses of the microscope. The appearance of small, sprouting tube-like outgrowths or filaments projecting from the cell surface confirmed production of germ tubes [4].

2.4. Statistical Analysis

Comparative prevalence rate of *C. albicans* among the students from different hostels were statistically analyzed by T-test and results were considered significant at 95% confidence level.

3. Results

In this study, out of 284 participants sampled, 107 were positive for *C. albicans* carriage, thus giving a total prevalence rate of 37.7%. There was even distribution of prevalence across the six different hostels, thus carrier rate of *C. albicans* among the students was not significantly different in any of the hostels ($P<0.05$) Table 1. Considering the different age groups of the participants, the highest prevalence rate of 45.0% was observed in students within the age bracket of 23-25 years while lowest prevalence rate observed (20.6%) was among the age group 17-19 years (Table 2).

Table 1. The Frequency and Distribution of *Candida albicans* among the Students Residing in Different Hostels

Sample Source	Number Sampled	Number Positive (%)
Victory Hostel	50	17 (34.0)
Steve-Jane Hostel	55	21(38.2)
Friendship Hostel,	52	20(48.5)
Spice Land Hostel,	30	12(40.0)
Mediatrix Hostel,	61	25(40.9)
UmugumaHostel	36	12(33.3)
Total	284	107(37.7)

Table 2. Prevalence of *Candida albicans* According to Age of the Students

Age Group (Years)	Number Sampled	Number Positive (%)
17-19	34	7 (20.6)
20-22	145	54 (37.2)
23-25	80	36(45.0)
26-28	25	10 (40.0)
Total	284	107(37.7)

Table 3 shows the elicited responses of students extracted from completed questionnaires. Most students whose HVS specimens yielded positive growth of *C. albicans* were those that make use of tight and nylon underwear (18.7%) as against those that wear cotton pants (7.0%). Also among students who used vaginal douches, 15.5% of them were among those whose HVS yielded growth of *C. albicans*. Out of the students who said they use water closet by squatting on it, 16.9% of them were among those who were positive for *C. albicans* carriage. Most students responded that they washed their private parts with water after visiting the washroom. High prevalence rate of 30% was observed in students who indicted that their toilet facility is very dirty agents 1.8% observed in those who said they make us of very clean toilet facility.

4. Discussion

It has being suggested that high incidence rate of *C. albicans* among young women may be due to increased physiological changes in estrogen and rich glycogen content of the vaginal mucosa there by providing adequate supply of utilizable sugar that support its proliferation [6,17]. Perhaps, this is the reason *C. albicans* is considered a major component of normal vaginal flora. Therefore, under certain favorable conditions such as use

of vaginal douching, broad spectrum antibiotics or corticosteroids and other risk factors that increase the incidence of vulvo-vaginal candidiasis, *C. albicans* will proliferate and cause clinical candidiasis.

In this study, we investigated the prevalence and associated risk factors of *C. albicans* among young women that were asymptomatic, of reproductive age and quite enlightened. The prevalence rate of 37.7% observed in the present study is comparable to similar findings in other parts of Nigeria; 26.0% in Karu, Nasarawa State [10]; 53.3% in Ilorin Kwara State [14]; 28.0%, 52.5% and 27.9% reported in other parts of Africa [5,9,11]. However, our result is quite different from prevalence rate of 77.0% reported by [15] among HIV- infected women in Sagamu, Ogun state, Nigeria and the 70.0% reported by [12] among females of reproductive age in Kano, Nigeria which was higher than the prevalence rate recorded in this study.

In our study, there was an even distribution of carrier rate among students from ages 20-28 years (37-45%). These findings revealed that the infection was almost uniformly distributed in the subjected age groups indicating that *Candida albicans* is more frequent within the age range of 20-28 years and those within this age range were found to be sexually active. This could also be due to the fact that as girls mature, hormonal changes takes place thereby making them more vulnerable to *Candida albicans* infection and also as well as due to the high oestrogen content of the vaginal epithelia [18].

Many factors have been linked to the relatively higher predisposition of females to *C. albicans* colonization than their male counterparts. It has being indicated that the relatively short and straight anatomy of the female genitourinary tract and dynamic interrelationships between *Lactobacillus acidophilus* and other endogenous flora in the vagina contribute to candida colonization, others have associated female preponderance to candida colonization to unprotected sex, age, and genitourinary disorders as well as use of estrogen-based contraceptives (Hooton et al., 1996). Poverty, lack of water supply, sharing of panties is probably, additional implicated factors contributing to high incidence of candidiasis [14]. However, from the present study it was observed that host behavior, specifically improper use of WCs such as squatting on the WC seats coupled with poor sanitary conditions of washrooms may have impact on the prevalence rate of *C. albicans* among the study population. Although a direct association between candida colonization and risk factors was not vigorously pursued statistically, however, matching of questionnaire responses of the participants (Table 3) with their *C. albicans* carrier rate revealed that some of the students whose HVS specimen tested positive for *C. albicans* engaged in some improper hygienic practices. For instance, some of the *C. albicans* carrier students squat on WCs instead sitting on it; cleanse their vagina from back to front instead of from front to back, as well as use of vaginal douches, which possibly could have disadvantaged them in terms of *C. albicans* risk compared to their colleagues who observed proper personal hygiene. Another factor that has been linked to candida colonization is nature of underwear. This study reveals that participants who use tight and nylon underwear had the higher prevalence rate of 18.7% when compared to 7% observed in those that use cotton underwear. The use of synthetic and tight underwear reduces airflow, which may increase moisture and warmth thereby encouraging yeast infections. Also some women have allergies to synthetic material that may cause health changes that encourage yeast infections [12].

Table 3. Prevalence of *Candida albicans* in Relation to the Response of the Students to Questionnaire

Hostels	**VH**	**SH**	**FH**	**SH**	**MH**	**UH**	**Prevalence**
Number Sampled	**n = 50(%)**	**n = 55(%)**	**n = 52(%)**	**n =30(%)**	**n= 61(%)**	**n = 36(%)**	**n=284(%)**
Variables							
Type of Underwear							
Nylon	9 (18.0)	9 (16.3)	11(21.2)	7(23.3)	12 (19.7)	5 (13.9)	53(18.7)
Cotton	3 (6.0)	5 (9.1)	3 (5.8)	1 (3.3)	5 (8.2)	3 (8.3)	20(7.0)
Cotton and Nylon	5 (10.0)	7 (12.7)	6 (11.5)	4 (13.3)	8 (13.1)	4 (11.1)	34(12.0)
Total positive	17 (34.0)	21(38.2)	20(38.5)	12(40.0)	25 (40.9)	12 (33.3)	107 (37.7)
Use of VD							
Yes	10 (20.0)	8 (14.5)	7 (13.5)	3 (10.0)	12 (19.6)	4 (1110)	44(15.5)
No	40 (80.0)	47(85.5)	45(86.5)	27(90.0)	49 (80.3)	32(88.9)	240(84.5)
Pattern of WC use							
Squat	8 (16.0)	8 (14.5)	9 (17.3)	6 (20.0)	11 (18.0)	6 (16.7)	48(16.9)
Sit	6 (12.0)	8 (14.5)	8 (15.4)	5 (16.7)	8 (13.1)	4 (11.1)	39 (13.7)
Stand	3 (6.0)	5 (9.1)	3 (5.8)	1 (3.3)	6 (9.8)	2 (5.6)	20(7.0)
Total positive	17 (34.0)	21(38.2)	20(38.5)	12(40.0)	25 (40.9)	12 (33.3)	107 (37.7)
Nature of WC							
Very clean	1 (2.0)	0 (00.0)	2 (3.8)	1(3.3.9)	1 (1.6)	0 (00.0)	5(1.8)
Quite clean	3 (6.0)	4 (7.3)	3(5.8)	2(6.7)	3 (4.9)	2 (5.6)	17(6.0)
Dirty	12(24.0)	17(30.9)	15(28.8)	9 (30.0)	21 (34.4)	10 (27.8)	84 (30.0)
Total positive	17 (34.0)	21(38.2)	20(38.5)	12(40.0)	25 (40.9)	12 (33.3)	107 (37.7)

Key: VD: vaginal douche. VH = Victory Hostel, SH = Steve-Jane Hostel, FH = Friendship Hostel, SH= Spice Land Hostel, MH= Mediatrix Hostel, UM= Umuguma Hostel.

In conclusion, this study indicates that prevalence of vaginal candida colonization among female students is highly significant. Predisposing factors such as the use of tight and nylon underwear, indiscriminate use of antibiotics should be avoided. The practice of good personal hygiene will go a long way to prevent and reduce the spread of the infection.

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