



## Prevalence of Vaginal Candidiasis among Female Students of a Hostel in the University of Calabar, Calabar

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### Authors' contributions

This work was carried out in collaboration between all authors. Authors ENM, CIM, UEG and UOE designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ENM, CIM and UOE managed the analyses of the study. Authors NAO, CFU and ENM managed the literature searches. All authors read and approved the final manuscript.

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### ABSTRACT

High vaginal swabs were collected from female students aged 17-31 years of the University of Calabar, Calabar following informed consent. Each student completed a questionnaire that explored information on their personal hygiene and behavioral risk factors. The samples were cultured and evaluated for the presence of *Candida albicans* using standard microbiological techniques. *Candida albicans* was detected in 20.0% ( $\frac{40}{200}$ ) of the subject samples. Persons aged 22-26 years had the highest prevalence (32.3%) while the age range of 27-31 years had the least prevalence (5.7%). *Candida albicans* was significantly associated ( $p < 0.05$ ) with the age of the study

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subjects. The use of broad spectrum antibiotics, wearing of non-ventilating tight nylon pants, pregnancy, use of oral contraceptive pills and vaginal douching were identified risk factors for vaginal candidiasis. This study revealed a high prevalence of vaginal candidiasis among apparently healthy female students population and makes need for an intervention.

**Keywords:** *Candida albicans*; females; prevalence; vaginal candidiasis

## 1. INTRODUCTION

Vaginal candidiasis; a yeast infection of the vulva and/or vagina caused by *Candida species* with *Candida albicans* being the major culprit, has been reported by researchers including Foxman et al. [1] as one of the common infections among women. Consistently, Emeribe et al. [2] and Nelson, [3] revealed that about 90% of this infection is caused by *Candida albicans* and 10% by other species of *Candida*. This infection has been reported as the common cause of vaginitis, second to bacterial vaginosis [4] and generally, the infections occur when there is an imbalance in the pH of the vagina. The over-growth of this fungus in the vagina leads to a burning sensation in the vagina vulva, the production of heavy white/yellow curd-like discharge and/or an itchy vulva, pruritus, dyspareunia, dysuria, irritation, soreness of the vulva and other discomforting symptoms that will ensure frequent hospital visits [2].

Vaginal candidiasis sometimes referred to as vulvo-vaginitis can be recurrent or relapsing and its prevalence has been observed to be on the increase [5]. Emeribe et al. [2] asserted that about 75% of females experience at least one episode of vaginal candidiasis during their life time. They added that most healthy women have at least 1-2 episodes of vaginal candidiasis during their reproductive years. Similarly, Eckert et al. [6] and Emeribe et al. [2] proposed that about 50% of college women will by the age 24-25 years have had at least one episode of vaginal candidiasis investigated by a physician.

Vaginal candidiasis has been reported globally as a condition afflicting women. According to Rathod et al. [7], most of the reported epidemiological data available only revealed a lack of laboratory confirmation of the infection which further compounds the problem. In line with this, Rathod et al. [7] reported 5% prevalence among women in India. Klufio et al. [8] reported 25% prevalence among pregnant women in New Guinea while Toua et al. [9] recorded 55.4% among pregnant women in Cameroon. In Nigeria, Umeh and Umeakanne,

[10] reported that about 28 million of women are affected annually. Consistently, the prevalence among female students in Bingham University was 26% [11]. This increase has been suggested to be due to multiple interacting risk factors for the infection. Extended use of broad spectrum antibiotics, pregnancy and underlying diseases such as poorly managed diabetes mellitus and HIV/AIDs, contraceptives, tight-fitting clothing, poor female hygiene as well as the use of tampons and vaginal douching have been observed by researchers as risk factors or socio-economic factors associated with vaginal candidiasis [6]. Poorly associated risk factors including the use of intrauterine devices (IUDs), diaphragms, sponge, orogenital sex, condoms, intercourse and diet with high glucose content has been mentioned [12]. Though, evidence in favour of sexual transmission exists but has not been proven beyond doubt. However, 12-15% of men have been reported to develop symptoms including itching and rash on the genital area following sexual relation with infected women [13].

Vaginal candidiasis is an endemic problem globally. In Nigeria, little data is available on the prevalence especially among apparently healthy females. Most reported studies are limited to patients seen in hospital settings. This study was therefore, aimed at contributing to our understanding of the natural history, risk factors and prevalence of candidiasis among female students of the University of Calabar, Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Area and Sample Collection

This study was conducted in the University of Calabar, Calabar within the months of November, 2016 to January, 2017. The University of Calabar (UNICAL) is situated in Calabar municipality, Cross River State, Southern Nigeria at longitude 8.3408 and Latitude 4.9524 with climate characterized by two major seasons; wet and dry seasons. It was a campus of the University of Nigeria until 1975 and consists of at least 12 faculties and a

population ranging from 25,000-49,000 people [14].

Though, majority of the students stay off campus, the University of Calabar has accommodation facilities (hostels) for male and female students, respectively with a capacity of approximately 1200 per hostel. University of Calabar has a total of five hostels out of which two are inhabited by female students. One of the two female hostels; hall eight consisting of an estimated 300 rooms with four occupants per room was randomly selected for this study.

## 2.2 Sample Collection

A total of 200 out of the 300 rooms in Hall eight hostel were randomly selected for this study. One female student between the ages of 17-31 who indicated interest from each of the rooms were randomly selected and recruited for this study as there was no inclusion or exclusion criteria, following counseling and informed consent from each participant. Ethical approval was obtained from the University of Calabar ethical committee. Participant's questions were addressed using a closed ended questionnaire given by researchers to ensure consistency of responses from the respondents. Questions were designed to address the following; age of participants, number of sex partners, knowledge of HIV status, number of who had been on broad spectrum antibiotics for a long period, number of who was pregnant, number of who had diabetes mellitus, those who used tight fitting nylon pants, those who have taken oral contraceptives recently and those practicing vaginal douching. High vaginal swabs were collected by a skilled nurse by inserting a sterile cotton wool swab into the vagina and rolled to collect vaginal discharge. The samples were properly packaged, labeled and transported immediately in Stuart transport medium to the laboratory for microbiological analysis.

## 2.3 Microbiological Analysis

Each patient's sample was inoculated onto freshly prepared Sabouraud dextrose agar (T.M., Media, Nigeria) plates and incubated at 37 °C for 48-72hrs. Following incubation, each plate was examined in turn and presumptive *Candida* colonies were maintained in agar slants for further characterization and identification. Colonial morphology, wet preparation, gram staining, germ tube test, chlamydospore formation and biochemical reactions were carried out for identification of the isolated organisms.

Each isolate was identified by comparing the cultural, morphological and biochemical characteristics with those of Domsch and Gams [15] scheme. The procedure was repeated for each isolate.

## 2.4 Data Analysis

Data generated from this research was analyzed using descriptive statistics such as percentage, chi square, and Fischer exact tests.

## 3. RESULTS

### 3.1 Prevalence of Vaginal Candidiasis According to Age of Study Subjects

Out of 200 high vaginal swab (HVS) samples from female students aged 17-31 with mean age of 24.0 screened for vaginal candidiasis, 40(20%) gave positive culture. The age distribution of vaginal candidiasis among female students screened showed that the age range 22-26 years had the highest prevalence of 20(32.3%). This was closely followed by students aged between 17-21 years with the prevalence of 15(29.4%) while the age between 27-31years showed the prevalence of 5(5.7%). Statistical analysis of the prevalence of vaginal candidiasis among different age range at ( $P < 0.05$ ) is shown in Table 1.

### 3.2 Prevalence of Vaginal Candidiasis According to Behavioral Risk Factors of Study Subjects

An evaluation of the questionnaire administered to each of the respondents showed the prevalence of vaginal candidiasis in relation to answers to some risk factors. Prolonged use of broad spectrum antibiotics was associated with the highest prevalence of 15(37.5%). This was closely followed by students who regularly used non-ventilating tight fitting nylon pants 9(22.5%). Students who used oral contraceptive pills had a prevalence of 7(17.5%). Furthermore, pregnant students, those who practiced douching as well as those who were not associated with any of the practices had a comparatively lower prevalence of 3(7.5%) as presented in Table 2.

### 3.3 Prevalence of Vaginal Candidiasis According to the Number of Sexual Partners

A further analysis of the prevalence of vaginal candidiasis according to sexual partners showed

that those who admitted to having one sexual partner had the highest prevalence 19 (47.5%) of vaginal candidiasis, followed by those who admitted not having any sexual partner. Those who admitted to having two sexual partners recorded a prevalence of 15.0% (6/40), those who had three sexual partners recorded a prevalence of 7.5% (3/40) while those who admitted having more than three sexual partners recorded a prevalence of 2.5% (1/40) as presented in Table 3.

#### 4. DISCUSSION

The result of this study have established the existence of vaginal candidiasis among female students attending the University of Calabar with a high prevalence rate of 20.0% ( $\frac{40}{200}$ ) at ( $p < 0.05$ ), among different age groups. As observed by Sobel et al. [13] vaginal candidiasis is a yeast infection that affects so many women of reproductive age. Similarly, Brande et al. [16] estimated that 75% of all women will experience at least one symptomatic yeast infection during their lifetimes. From this study, it can be seen that up to 40(20.0%) of women examined are infected with vaginal candidiasis. This finding is however lower than the estimation of Brande et al. [16].

Highest prevalence of 20(32.3%) was recorded in this study among female students between 22-26 years, followed by 15(29.4%) within the age range of 17-21 years and 5(5.7%) within the age range of 27-31 years as presented in Table 1. This study revealed that students who are at the beginning and peak of their reproductive years are more vulnerable to infections. This observation is consistent with the reports of Muller [17] and Emeribe et al. [2] who revealed that women in their reproductive years were more prone to vaginal candidiasis compared to other age groups. This according to them is because estrogen which induces the lining of the vagina to mature contain glycogen; a substrate on which *Candida albicans* thrives. Thus, the lack of estrogen production in younger and older women makes vulvo-vaginal candidiasis much less common in these age groups [18].

The relationship between the prevalence of vaginal candidiasis and some risk factors were evaluated in this study. The results revealed that HIV and pregnancy had the prevalence rates of 3(7.5%) and 1(2.5%), respectively. The prevalence of vaginal candidiasis observed in

this study is consistent with earlier observations of Winston, [19] who reported that this infection is mostly common in immune compromised individuals. This is so because HIV/AIDs have been reported to affect certain immune functions such as memory cell responses to common antigens like *Candida albicans* [20]. In addition, CD4<sup>+</sup> T-cells in the blood drops significantly, resulting in generalized immune dysfunction and increasing the possibility of becoming infected with the yeast. In accordance with this trend, United State Public Health Service (PHS) reported that any woman at risk for AIDs should be conscious of the possibility that recurrent cases of vaginal candidiasis may be an early sign of HIV infection.

Pregnancy has been reported by Ferrer, [5] to increase the risk of vaginal yeast infection. This according to him is due to changes in the level of sex hormones such as estrogen which provides optimal condition for the over growth of the yeast. This to a large extent explains the prevalence rate of vaginal candidiasis among pregnant students in this study. However, such yeast infection in pregnant women as revealed by Eckert et al. [6] has been observed to be self-limiting and may disappear after delivery.

**Table 1. Prevalence of vaginal candidiasis according to age of study subjects**

Age (years)	Number examined (n-200, %)	Percentage infected (n-40, %)
17-21	51(25.5%)	15(29.4%)
22-26	62(31%)	20(32.3%)
27-31	87(43.5%)	5(5.7%)

$P \leq 0.05$

The highest prevalence rate 15(37.5%) was found in students under prolonged use of broad spectrum antibiotics followed by 9(22.5%) among students under regular use of non-ventilating tight fitting nylon pants. According to Richard, [21], prolonged use of broad spectrum antibiotics can destroy the normal flora in the vagina which suppresses the growth of *Candida albicans*. This microbial flora has been known to secrete acidic materials which help to keep the pH of the vagina under check. Alteration in the normal pH influence the over growth of this fungus leading to candidiasis [22]. This explains why female students on prolonged use of antibiotics in this study had the highest prevalence of 37.5%. Similarly, the use of non-ventilating tight fitting nylon pant has been reported to foster fungal

**Table 2. Risk-related prevalence of vaginal candidiasis**

Age range (Years)	No. examined	Risk factors							
		A	B	C	D	E	F	G	H
17-21	51(25.5)	4	0	0	0	2	4	3	2
22-26	62(31.0)	10	2	0	0	5	2	0	1
27-31	87(43.5)	1	1	0	1	2	1	0	-
Total	(n- 200%)	(n -15, 37.5%)	(n -3, 7.5%)	(n -0, 0.0%)	(n -1, 2.5%)	(n -9 , 22.5%)	(n -7, 17.5%)	(n -3, 7.5%)	(n -3, 7.5%)

Key: A = prolonged use of broad spectrum antibiotics, B = pregnancy, C = poorly managed diabetes mellitus, D = HIV Infected, E = Regular use of non-ventilating tight fitting nylon pant, F = Oral contraceptive pills, G=Vaginal douching, H= None of the above

**Table 3. Prevalence of vaginal candidiasis according to the number of sexual partners**

Age range (Years)	No. examined	0	1	2	3	>3
17-21	51(25.5)	5	6	3	1	0
22-26	62(31.0)	6	10	2	1	1
27-31	87(43.5)	0	3	1	1	0
Total	(n- 200, %)	(n-11, 27.5%)	(n-19, 47.5%)	(n-6,15.0%)	(n-3,7.5%)	(n-1,2.5%)

Key: 0=participants who admitted not having any sexual partner, 1= participants who admitted having one sexual partner, 2= Those who admitted having two sexual partners, 3= Those who admitted having three sexual partners, >3 =Those who admitted having more than three sexual partners.

growth [5]. This is because these tight fitting nylon pants discourage vagina aeration, increasing the moisture of the region and making the vagina warmth and dark. These conditions have been observed to support and promote the growth *Candida albicans* in the vagina, resulting in infections [12]. Thus, the 9(22.5%) prevalence reported in this study is in accordance with the above evaluation.

Prevalence rate of 7(17.5%) was recorded among students on frequent use of oral contraceptive pills. A previous study by Spinillo et al. [22] revealed that pills and estrogen based hormone replacement therapy often alter the pH of vagina, weakening the immune system and promoting the growth of *Candida albicans*. This report further confirms the results obtained in this study. Furthermore, women of reproductive age often use oral contraceptive as birth control. Thus, these students may be at risk of developing vaginal candidiasis as observed in this study since most of them were at the beginning and peak of their reproductive ages.

Vaginal douching was among the risk factors examined and women in this category had the prevalence rate of 3(7.5%). Most chemical ingredients found in douching solutions have been reported to cause irritation of the vagina and subsequent alteration of the vagina normal flora, leading to the development of yeast infections [6].

Similarly, women with illnesses including diabetes miletus have been reported to be at high risk of vaginal candidiasis [13]. *Candida albicans* has been observed to thrive effectively in the presence of sugar. Thus, in cases of poorly managed diabetes mellitus, the sugar level has been reported to be extremely high, providing optimal growth conditions for the yeast [11,12]. Regardless of whether one is young or not, vaginal candidiasis is a serious threat to women and must be managed adequately to avoid complications.

A low prevalence rate of 2.5% was observed among females who admitted to having more than three partners as compared to 47.5% who admitted to having just one partner. The high prevalence of vaginal candidiasis among those with only one sexual partner observed in this study may be due to the fact that the majority of the sampled participants admitted having only one sexual partner. However, the reason for the low prevalence among females with multiple

sexual partners is not clear and warrant additional investigation.

## 5. LIMITATIONS

The conclusions drawn from this study may not be a fair representation of the Candida status in the study location given the limitations of the study. Although, we had employed a random sampling technique, for convenience and non-approval of other hostels we carried out the study in one hostel. This informs the sample size of two hundred employed in this study.

## 6. CONCLUSION

Female students of the University of Calabar had a high prevalence of candidiasis. Factors including HIV, broad spectrum antibiotics, pregnancy and douching influenced the high rates observed in this study. Not only is it a life threatening infection in its complicated form, it poses a lot of discomfort and embarrassment to infected women. Prevention of vaginal candidiasis may include avoiding risk factors which influence the development of this infection. Therefore, effective prevention and control measures should be promptly designed to reduce the rate of women's exposure to these risk factors and favourably, minimize the rate of vaginal candidiasis in women generally.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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