**“Prevalence Of Vulvovaginal Candidiasis Among Female Students in Abia State University Teaching Hospital Aba, Nigeria”**

**ABSTRACT**

**Background:** Vulvovaginal candidiasis is a common yeast mucosal infection mostly caused by fungi belonging to the Genus *Candida*. Women in their reproductive ages have had at least 1-2 episodes of this disease due to repeated exposure to the risk factors such as tightfitting under wear, multiple sexual partners, extended use of antibiotics, history of STIs vaginal douching, and so on.

**Aim:** This study was aimed to investigate the prevalence of vulvovaginal candidiasis among female students in Abia State University Teaching Hospital Abayi, Aba.

**Study Design:** A laboratory based, cross-sectional study was carried out on 100 high vaginal swabs collected from female students in Abia State University Teaching hospital, Aba, utilizing a structured questionnaire to acquire the sociodemographic, clinical factors, and behavioral factors data of the participants.

**Methodology:**100 High vaginal samples (HVS) and/or vaginal samples (VS) were collected from the study participants. These samples were analyzed with standard microbiology techniques. The swabs were cultured on Sabrouaud Dextrose Agar (SDA) and incubated at 37oC for 48hours. A wet mount was microscopically observed to identify the presence of yeast cells and Gram staining was subsequently conducted. Germ tube test was carried out for the differentiation of *Candida albicans* from other species of *Candida*. Urease test, Sugar fermentation test, and Sugar assimilation test were also carried out for further identification.

**Result:** 28% out of 100 high vaginal samples were diagnosed as vulvovaginal candidiasis from this study. Out of the 28 positive samples 20(71.4%) were *Candida albicans* while 8(28.6%) were *Candida tropicalis*. The age distribution of vulvovaginal candidiasis among female subjects age range of 22-26 years had the highest distribution of 14(50.0%) while age between 27-31 showed the least distribution of 5(17.9%) Out of 7 students who wore very tight underwear 5(17.9%) tested positive. The distribution of vulvovaginal candidiasis in relation to vaginal discharge /discomfort was 21(75.0%). In relation to the number of sexual partners had the highest distribution of 19(67.9%). The highest distribution of vulvovaginal candidiasis in relation to history of STI was 20(71.4%) while those with no medical history of STI showed 8(28.6%). Prolonged use of broad-spectrum antibiotics was associated with the highest distribution of 14(50.0%) in relation to behavioral risk factors of study subjects.

**Conclusion:** These findings indicate a notably high prevalence of vulvovaginal candidiasis among female students at Abia State University Teaching Hospital, Aba, highlighting the need for enhanced personal hygiene practices and improved hostel sanitation.

**Keywords**: prevalence, vulvovaginal candidiasis, *Candida albicans*, *Candida tropicalis*, germ tube.

**Keywords:** Abia State University, vulvovaginal candidiasis, germ tube*,* female students, *Candida albicans.*

1. **INTRODUCTION**

Candidiasis generally, is an opportunistic infection caused by a fungus, *Candida*. The Fungi are endogenous in man, occurring as part of the harmless commensals of the genital, gastrointestinal and respiratory tracts, human oral and other surfaces. Vulvovaginal candidiasis is an infection of the estrogenized vagina and the vestibulum that can spread to the outside of the labia minora, the labia majora, and the intercrural region (Farr *et al*, 2021). It is the second most common vaginal infection affecting women of reproductive age, which mainly causes inflammation of the vulva and vagina (Mohamed *et al*, 2022)

Vulvovaginal candidiasis (VVC) is a symptomatic vaginitis caused by infection with *Candida* yeast (Rosati *et al*, 2020). It is the most prevalent and common fungal infection affecting women worldwide; and it is characterized by curd-like vaginal discharge, itching, and erythema, (Achkar *et al*., 2010). It can be referred to as Candidiasis or Moniliasis.  It is mostly caused by the overabundance of an opportunistic pathogenic yeast, *Candida albicans* (approximately 90%), which is a common member of the vaginal flora (Kaur *et al*, 2021). *Candida albicans* was known to be the primary pathogen responsible for the infection, however, an epidemiological shift toward non-*Candida albicans* (NCA) is now observed across the globe. Other species such as *Candida glabrata,* *Candida krusei*, *Candida tropicalis*, *Candida akabanensis*, and *Candida parapsilosis* are emerging causative agents (Sobel, 2005) and in some clinical settings in a higher proportion than *Candida albicans*. Alarmingly, co-infection of *Candida albicans* and non-*Candida albicans* species (NCA) has been also reported. *Candida albicans* is the causative agent in most cases (El Ahmed *et al*., 2012). Under normal circumstances, the *Candida* Species are held in check by normal body defenses together with other members of the normal flora. For instance, the acidity of the vagina is maintained at pH 4.0-4.5 (Nyirjesy *et al*., 2008). This acidity level prevents some vaginal pathogens from establishing. However, physiological changes in the balance of the body system would affect both beneficial and harmful yeasts, bacteria and other organisms in the body. This accordingly would alter the acidity of the vagina reducing it to pH 5.0-6.5, thereby giving room for the establishment of pathogenic organisms such as *Candida* (Akinbiyi *et al*., 2008). Vaginal pH may increase with age, phase of menstrual cycle, sexual activity, contraception choice, pregnancy, presence of necrotic tissue or foreign bodies, and use of hygienic products or antibiotics (Nyirjesy *et al*., 2008).

Vulvovaginal Candidiasis (VVC) is classified by the World Health Organization (WHO), as a pathological condition that affects millions of women annually, it causes significant discomfort, interferes with sexual and intimate relationships, impairs work performance, and it is considered a major global public health concern. Vulvovaginal candidiasis is asymptomatic in about 20 to 50% of healthy women (Ali, 2011). Vulvovaginal candidiasis sometimes referred to as Vulvovaginitis can be recurrent or relapsing and its prevalence has been observed to be on the increase. Approximately 75% of the female population suffers at least one episode during their lives (El Ahmed *et al*., 2012; Emeribe *et al*., 2015). They added that most healthy women have at least 1-2 episodes of Vulvovaginal candidiasis during their reproductive years (Ferris *et al*., 2002). Similarly, Eckert *et al*. (2004); Emeribe *et al*. (2015) proposed that about 50% of university female students will by the age 24-25 years have had at least one episode of Vulvovaginal candidiasis investigated by a Physician, this increase has been suggested to be due to multiple interacting risk factors for the infection. Prolonged use of broad-spectrum antibiotics, pregnancy and underlying diseases such as poorly managed diabetes mellitus and HIV/AIDs, contraceptives, tightfitting 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. Poorly associated risk factors including the use of intrauterine devices (IUDS), diaphragms, sponge, oral-genital sex, condoms, intercourse and diet with high glucose content has been mentioned (Akingbade *et al*., 2013).

Guzel *et al*. (2011) also reported that only women already colonized with *Candida* are at risk of Vulvovaginal candidiasis following antibiotic treatment. It is thought that the association of vulvovaginal candidiasis and antibiotics is due to the fact that antibiotic use leads to the depletion of the vaginal bacterial microflora, which represents the dominant vaginal defense mechanism against *Candida*. The vaginal microbiota of healthy premenopausal woman is predominantly populated by *Lactobacillus* species (Cribby *et al*., 2008). In fact, *lactobacilli* are thought to be involved in several defense mechanisms against *Candida*. One proposed mechanism is that *Lactobacillus* species compete with *Candida* species for nutrients; however, a ‘‘shoulder-to shoulder’’ survival for *lactobacilli* and *Candida* has been shown on an experimental basis, proving that this is not the most effective mechanism. More importantly, lactobacilli compete with *Candida* cells for adhesion sites, such as epithelial receptors, to which *Lactobacillus* has higher affinity (Barbe, 2006). Some studies have found a decreased adhesion of *Candida albicans* to vaginal epithelial cells when *Lactobacillus* is present in comparison with the adhesion observed when only *Candida* is present; *Lactobacilli* secrete biosurfactants that physically decrease *Candida* binding (Boris and Barbe’s, 1998).

A Brazilian study found higher incidence of vulvovaginal candidiasis in women who use tight and/or synthetic underwear than in women who do not use those type of clothing (Holanda *et al*., 2007). Some authors proposed that the use of well-ventilated and cotton underwear could be of value in preventing vulvovaginal candidiasis. Thus, this study was aimed to investigate the prevalence of vulvovaginal candidiasis among female students in Abia State University Teaching Hospital, Aba, Nigeria.

1. **MATERIALS AND METHODS**

**2.1 Sample area and period**

This laboratory based, cross-sectional study was carried out at Medical Microbiology Laboratory, Abia State University Teaching Hospital, Aba, Nigeria from February to April, 2023. The hospital is located along Umueze road Abayi in Osisioma Ngwa Local Government Area of Abia State.

**2.2 Sample design and population.**

A laboratory based, cross-sectional study was used to collect a total of 100 high vaginal swabs from female students in Abia State University Teaching Hospital, Aba. Consent and Socio demographic, clinical factors and behavioral factors data were obtained from each student prior to sample collection using questionnaires.

**2.3 Inclusion and exclusion criteria**

Female students aged 17-31 both symptomatic and asymptomatic were randomly selected, while menstruating female students were excluded.

**2.4 Sampling size determination**

The sample size of this study was calculated using the formula by Fishers (Mugneda and Mugneda, 2003)

N= Z2. P(1-P)

 d2

Where; N = sample size, Z= Constant defining the confidence interval at 95% and equal to 1.96, d= Standard deviation at 0.05, and P= Proportion of the target population of infection, this was gotten from previous study conducted at Kenyatta University, Nairobi, Kenya (Menza *et al*, 2013) =90.38%

N= 1.962 × 0.90(1-0.90)

 0.052

N= 3.84 × 0.90(0.1)

 0.0025

N= 0.3500

 0.0025

N= 140

Sample size = 140

A total of 40 female students who failed to participate in this study were subtracted from the initial sample size (140), the final sample size is 100.

**2.5 Data collection instruments and procedures**

High vaginal swabs (HVS) were collected aseptically with the aid of sterile speculum from female students with the assistance of medical laboratory scientists using sterile swab stick and immediately sent to the laboratory where they were analyzed with standard microbiology techniques. The sociodemographic, clinical factors, and behavioral factors data were collected using structured questionnaires.

**2.6 Microscopy examination and culture procedures**

The swabs were cultured on Sabrouaud Dextrose Agar (SDA) and incubated at 37oC for 48hours. On Sabouraud Dextrose agar media, appeared as-pasty, opaque, and pale-coloured colonies. A wet mount was microscopically observed to identify the presence of yeast cells.

**2.7 Identification of yeast isolates**

 Gram staining

 A single colony was picked using sterile inoculating wire to make a smear on each of the slides and allowed to air dry. The smears were heat-fixed by passing it over a Bunsen burner flame three times and stained properly. The slides were placed in a draining rack for the smear to air-dry. A drop of immersion oil was placed on each of the slides and were examined microscopically using ×40 objective lens to focus and ×100 objective lens to view. Fungi isolates appeared purple slightly larger than cocci which indicated that they are gram positive.

Germ Tube Test (GTT)

Germ tube test was carried out for the differentiation of *Candida albicans* from other species of *Candida*. 0.5ml of human serum was pipetted into small tubes, using a sterile wire loop, the serum was inoculated with a yeast colony from the cultured plate, and placed in an incubator at 37oC for 2 hours. A drop of the serum yeast culture was transferred to a glass slide using pasteur pipette, and covered with a cover slip. The preparation was examined using ×10 objective lens to focus and ×40 objective lens to view. Sprouting yeast cell (tube-like outgrowth) was looked out for known as the germ tube observed in *Candida albicans*.

Urease Test

Urease test was performed to identify those organisms that are capable of hydrolyzing urea to produce ammonia and carbon dioxide. Yeast isolates were inoculated into Christensens Urea Agar. The media were incubated at 30℃ for five days, and examined daily for a color change to pink which indicates the hydrolysis of urea.

Sugar Fermentation Test

 Sugar fermentation test indicates the process by which carbohydrate is fermented anaerobically by yeasts to produce ethanol and carbon dioxide. The fermentation is indicated by the production of acid and gas. Four set of test tubes were labelled and arranged properly in a test tube rack with each set containing 5ml of 5% glucose, lactose, maltose, and sucrose. The yeast isolates were inoculated into each four set of test tubes containing 5ml of 5% glucose, lactose, maltose, and sucrose respectively with invented Durham’s tubes, and incubated at 37℃ for 24 hours. Change of color from pink to stare yellow indicates fermentation of the sugars. Gas production was indicated by trapped air in the Durham’s tubes.

Sugar Assimilation Test

Sugar assimilation test indicates the utilization of carbon source in the presence of oxygen. A yeast cell suspension to be identified was prepared in distilled water to a density equivalent to McFarland Standard NO4. The surface of the Yeast Nitrogen Base Agar (YNB) was covered with the yeast cell suspension. The excess suspension was aspirated using sterile pasteur pipette, and the agar surface was allowed to dry for 5 minutes. Sterile forceps was used to place the disc of the selected carbohydrates unto the agar surface, about 30mm apart from each other, and the plate was incubated at 30℃ for 24 hours. The presence of growth was observed around each disc which indicates that a particular carbohydrate (glucose, maltose, lactose, and sucrose) has been assimilated by the yeast.

**2.8 Statistical Analysis**

Data obtained were analyzed using nominal regression and statistical package for social science (SPSS) version 21. Additionally, a χ2 test was used for comparison of nonnumerical variables. The results obtained were calculated at the 95% (*P* < 0.05) significance level.

1. **RESULTS**

**Table 1. Isolation and Characterization of the Candida species involved in the infection in Relation to Age of the Study Participants**

Out of 5 positive samples from female study subjects aged 27-31 screened for vulvovaginal candidiasis, 2(10.0%) were *Candida albicans* while 3(37.5%) were *Candida tropicalis.* The age range 22-26 years, out of 14 positive samples, 11(55.0%) were *Candida albicans* while 3(37.5%) were *Candida tropicalis*. Furthermore, 9 positive samples from female study subjects aged 17-21 screened for vulvovaginal candidiasis, 7(35.0%) were *Candida albicans* while 2(25.0%) were *Candida tropicalis.* Out of 100 high vaginal swab (HVS) samples from female study subjects aged 17-31 with mean age of 24.1 screened for vulvovaginal candidiasis, 28(28.0%) gave positive culture. The age distribution of vulvovaginal candidiasis among female subjects screened showed that the age range 22-26 years had the highest distribution of 14(50.0%). This was closely followed by the female study subjects aged 27-31 years with the distribution rate of 5(17.9%).

**Table 2. Morphology and Biochemical Characteristics of Yeast Isolates**

Yeast isolates gotten from positives cultures were identified using Gram staining method which showed the morphological characteristics, and the isolates were further identified using biochemical tests (Urease Test, Sugar Fermentation Test, and Sugar Assimilation Test) which showed the biochemical characteristics of yeast isolates from High Vaginal Swab (HVS) of female students in Abia State University Teaching Hospital, Aba.

**Table 3. Distribution of Vulvovaginal Candidiasis in Relation to the Tightness of Under wear**

Out of 7 female student participates who wore very tight under wears 5(17.9%) were positive, which showed the highest distribution, followed by those who wore tight under wears 65 and 16(57.1%) were positive and then loosed ones were 28 and 7(25.0%) were positive.

**Table 4. Distribution of Vulvovaginal Candidiasis in relation to Vaginal discharge/ discomfort.**

Based on the data collected, it was shown that 69 out of the 100 female students had vaginal discharge/ discomfort, while 31 had none. Out of the 69 students that had vaginal discharge/ discomfort, 21 tested positive, and had the highest distribution of 75.0%.

**Table 1. Isolation and characterization of the *Candida* species involved in the infection and its distribution in relation to age of the study subjects**

|  |
| --- |
| **Age (years) No. Examined No. Positive *Candida albicans Candida tropicalis*** |

17-21 31 9(32.1%) 7(35.0%) 2(25.0%)

22-26 43 14(50.0%) 11(55.0%) 3(37.5%)

27-31 26 5(17.9%) 2(10.0%) 3(37.5%)

TOTAL 100 28(28.0%) 20(71.4%) 8(28.6%)

 X2 =16.523, *P*-value =0.001, Significant at *P*<0.05

 **Table 2. Morphology and Biochemical characteristics of yeast isolates**

|  |
| --- |
|  **Morphology Sugar Assimilation Sugar Fermentation Other Reactions** |

 G M L S G M L S U GT

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Candida albicans* | 4-6 micrometer, white, smooth, creamy, hyphae, Pseuodohyphae, and spherical budding. | + + - + | AG AG - A\* | * +
 |
| *Candida tropicalis* | 4-8 micrometer, white, creamy texture, with slightly wrinkled edge, Pseudohyphae, and spherical budding. | + + - + | AG AG - AG |  + + |

Keys: + =Positive, - =Negative, \* =Strain variation, G =Glucose, M =Maltose, L =Lactose, S =Sucrose, U =Urease, GT =Germ tube, AG =Acid and Gas.

 **Table 3. Distribution of Vulvovaginal Candidiasis in Relation to the type of Under wear**

|  |  |  |  |
| --- | --- | --- | --- |
| **Under wear used** | **No. Examined** | **No. Positive** | **No. Negative** |
| Very tight | 7 | 5(17.9%) | 2(2.8%) |
| Tight | 65 | 16(57.1%) | 49(68.1%) |
| Loosed | 28 | 7(25.0%) | 21(29.1%) |
| TOTAL | 100 | 28(28.0%) | 72(72.0%) |

X2 =7.99, *P*-value=0.02, Significant at *P*<0.05

 **Table 4. Distribution of Vulvovaginal Candidiasis in Relation to Vaginal Discharge/Discomfort**

|  |  |  |  |
| --- | --- | --- | --- |
| **Vaginal discharge/discomfort** | **No. Examined** | **No. Positive** | **No. Negative** |
| Yes | 69 | 21(75.0%) | 48(66.7%) |
| No | 31 | 7(25.0%) | 24(33.3%) |
| TOTAL | 100 | 28(28.0%) | 72(72.0%) |
| X2=15.29,P-value= 0.0001, Significant at *P*<0.05 |  |  |  |
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 **Table 5. Distribution of Vulvovaginal Candidiasis in Relation to the Number of Sexual Partners**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Age(years)** | **No. Examined** | **No. Positive** | **0** | **1** | **2** | **3** | **>3** |
| 17-21 | 31 | 9 | 3 | 5 | 1 | 0 | 0 |
| 22-26 | 43 | 14 | 4 | 10 | 0 | 0 | 0 |
| 27-31 | 26 | 5 | 0 | 4 | 0 | 1 | 0 |
| TOTAL | 100 | 28(28.0%) | 7(25.0%) | 19(67.9%) | 1(3.6%) | 1(3.6%) | 0(0.0%) |

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

 **Table 6 Distribution Of Vulvovaginal Candidiasis In Relation To History Of STIs**

|  |  |  |  |
| --- | --- | --- | --- |
| **History of STIs** | **No. Examined** | **No. Positive** | **No. Negative** |
| Yes | 65 | 20(71.4%) | 45(62.5%) |
| No | 35 | 8(28.6%) | 27(37.5) |
| TOTAL | 100 | 28(28.0%) | 72(72.0%) |

 X2= 12.49, *P*-value = 0.0005, Significant at *P*<0.05

 **Table 7 Distribution of Vulvovaginal Candidiasis in Relation to Behavioral Risk Factors**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Age (years)** | **No. Examined** | **No. Positive** | **A** | **B** | **C** | **D** |
| 17-21 | 31 | 9 | 3 | 0 | 4 | 2 |
| 22-26 | 43 | 14 | 9 | 0 | 3 | 2 |
| 27-31 | 26 | 5 | 2 | 0 | 2 | 1 |
| TOTAL | 100 | 28(28.0%) | 14(50.0%) | 0(0.0%) | 9(32.1%) | 5(17.9%) |

Keys: A=prolonged use of broad-spectrum antibiotics, B=pregnancy, C=oral contraceptive pills, D= none of the above

**Table 5. Distribution of vulvovaginal candidiasis in relation to the number of sexual partners.**

 A further analysis of the distribution of vaginal candidiasis according to sexual partners showed that those who admitted to having one sexual partner had the highest distribution 19(67.9%) of vulvovaginal candidiasis, followed by those who admitted not having any sexual partner. Those who admitted to having two sexual partners recorded a distribution of 3.6% (1/28), those who had three sexual partners recorded a distribution of 3.6% (1/28). While there was no student who admitted to having more than three sexual partners.

**Table 6. Distribution of vulvovaginal candidiasis in relation to history of STIs (Sexually Transmitted Infections)**

Out of 100 female students studied, 65 had previous history of STIs of which 20(71.4%) tested positive. 35 had no medical history of STIs however, 8(28.6%) tested positive.

**Table 7. Distribution of vulvovaginal candidiasis in relation to behavioral risk factors**

An evaluation of the questionnaire administered to each of the participants showed the distribution of vulvovaginal candidiasis in relation to answers to some risk factors. Prolonged use of broad-spectrum antibiotics had highest distribution of 14(50.0%), followed by female students who used oral contraceptive pills with a distribution of 9(32.1%). Furthermore, those who were not associated with any of the practices had a comparatively lower distribution of 5(17.9%).

**4. DISCUSSION**

Vulvovaginal candidiasis is one of the most common infections affecting young women in tertiary institutions. In this study, various parameters were observed such as subjects age, tightness of under wear, clinical symptoms of vaginal discomfort/ discharge, number of sexual partners, history of STIs, and behavioral risk factors (prolonged use of broad-spectrum antibiotics, oral contraceptive pills and pregnancy).

The results obtained in this study established the existence of vulvovaginal candidiasis among female students in Abia State University Teaching Hospital, Aba, Nigeria at (*P*<0.05) among different age groups. As observed by Sobel *et al*. (2005), vulvovaginal candidiasis is a yeast infection that affects so many women of reproductive age. Similarly, Brande *et al*. (2006) 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 20.0% of women examined are infected with vaginal candidiasis. This finding is however lower than the estimated (Brande *et al*., 2006).

Based on the results of isolation and characterization of *Candida* species, the study showed that *Candida albicans* had the highest occurrence 71.4% compared to *Candida tropicalis* which had 28.6% occurrence lower than *Candida albicans*. Previous diagnosed cases showed that *Candida albicans* infection occurred in the vast majority of the patients while infections with *Candida tropicalis* occurred less frequently (Michael *et al*, 2022). This is mostly due to the fact that a *Candida albicans* infection stems from the commensal population of the organism in the human microflora (Guzel *et al.,* 2011). These results are in consistent with the reports of Nelson *et al*. (2013) and Emeribe *et al*. (2015). They revealed that about 90% of this infection is caused by *Candida albicans* and 10% by non-*Candida* species. Since *Candida albicans* is the most causative pathogen for vulvovaginal candidiasis, the isolation of non-*Candida albicans* species from high vaginal swab is rare (Makanjuola *et al*., 2018). Detection of *Candida albicans* is somewhat easier and could be done using wet preparation and germ tube, however, confirming non-*Candida albicans* isolates requires extra diagnostic techniques such as Sugar assimilation, Sugar fermentation and Urease tests (Leaw *et al*., 2007). The higher prevalence was reported in Uganda (45%) (Mukasa *et al*., 2013)) and interestingly this study adopted Sugar assimilation, Sugar fermentation and Urease tests. This can be compared to a lower prevalence reported in Kenya (25%) in which wet preparation was used to identify Vulvovaginal candidiasis (Nelson *et al*., 2013).

Based on the age group of the subjects, it was observed that those between the ages of 22-26 had the highest distribution of 50.0% of vulvovaginal candidiasis, followed closely by those between the ages of 17-21 with a distribution of 32.1% and the least was observed among ages of 27-31 (17.9%). There was statistically significant of relationship between the prevalence of vulvovaginal candidiasis with Age (*P*<0.05). High sexual activity with this age group may be responsible for the high distribution recorded (Emeribe *et al*., 2015). This is also a pointer that sexual activity is a risk factor for Vulvovaginal candidiasis even though it is not a sexually transmitted disease. This study revealed that students who are at the peak of their reproductive age are more vulnerable to infections. This observation is consistent with the reports of (Muller, 2003; Emeribe *et al*., 2015; Ezeigbo *et al*., 2015) 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 vulvovaginal candidiasis much less common in these age groups, but in contrast to (Alo *et al*., 2012), who reported 36-40 years old women as highest vulvovaginal candidiasis prevalent age group.

Our results showed a higher distribution of 17.9% was recorded for the use of very tight under wears. The use of very tight under wears reduce airflow which may increase moisture and warmth status of vagina thereby encouraging yeast infections (Ferrer, 2000). These conditions have been observed to support and promote the growth of *Candida albicans* in the vagina, resulting in infections (Akingade *et al*., 2013). Tight garments can also reduce healthy blood circulation. This agrees with the findings made by (Nwadioha *et al*., 2010) on the etiologic agents of abnormal vaginal discharge among females of reproductive age in Kano, Nigeria.

Our study showed high percentage rate of vaginal discomfort/discharge 75.0% than those with no vaginal discomfort/discharge 25.0%. This report is in agreement with the findings of Jumbo *et al*. (2010). It is reason to say that young women consult health care centers more often than women without such symptoms (Jumbo et al., 2010). Fule *et al*. (2015) found this to be the major symptom in 52.4% of their subjects of vulvovaginal candidiasis and Ugwa (2015) found this to be the most common symptom in 47.4% of their cases. *Candida* positivity in female students presenting vaginal discharge was 30.4% which is similar to a report by Fule *et al*. (2015). Significant relationship between vulvovaginal candidiasis and vaginal discomfort/discharge (*P*<0.05) was observed.

This study showed a high distribution rate of 20(71.4%) of vulvovaginal candidiasis in relation to History of STIs which is in conjunction with the recent study by Joy *et al* (2021).

The distribution rate of 50.0% was found in female students under prolonged use of broad-spectrum antibiotics. Distribution rate of 32.1% was recorded among female students who frequently use oral contraceptive pills. This was in agreement with the study conducted by Ekwi and Ngwa, (2023) where participants who took antibiotics had the highest prevalence of vulvovaginal candidiasis (70%) followed by contraceptive pills (68.4%). The results revealed that pregnancy had the distribution rate of (0.0%) which is in contrast with the work reported by (Toua *et al*, 2019), which stated that pregnancy increases the risk of vaginal yeast infection due to significant changes in the female sex hormones, such as estrogen and progesterone, which provides optimal condition for the over growth of the yeast. However, such yeast infection in pregnant women as revealed by (Eckert *et al*., 2004) has been observed to be self-limiting and may disappear after delivery.

A distribution rate of 67.9% was observed in those that admitted to having just one partner. The high distribution of vulvovaginal 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 to having only one sexual partner. However, the reason for the low distribution among females with multiple sexual partners is not clear and warrant additional investigation.

**4. CONCLUSION**

This report revealed the prevalence of vulvovaginal candidiasis among female students in Abia State University Teaching, Aba. Prevalence rate obtained in this study is high. Number of sexual partners, prolonged use of broad-spectrum antibiotics, history of STIs, Frequent use of oral contraceptive pills, tight under wears, as well as age, have been implicated as possible risk factors which have 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 preventive and control measures should be promptly designed to reduce the rate of female students exposed to these risk factors and favorably, minimize the rate of vulvovaginal candidiasis generally in women.

**CONSENT AND ETHICAL APPROVAL**

An introductory letter was obtained from Abia State University Teaching Hospital Research Ethical Committee. Privacy and confidentiality were observed at all stages of this study.

**COMPETING INTERESTS**

Authors have affirmed that no competing interests exist.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**REFERENCES**

1. Achkar, J.M. & Fries, B.C. Candida infections of the genitourinary tract. Clinical Microbiology Review. 2010; 23: 253-273.
2. Akinbiyi, F. O., Mokobia, C. N. & Ande, A. B. Prevalence of trichomonisis among Pregnant Women in Benin City. Sahel Medical journal. 2008; 20:67-71.
3. Akingbade, O. A., Akinjinmi, A. A., Awoderu, O. B., Okerentugba, P. O. & Okonko, I. O. Prevalence 0f Candida albicans amongst women attending health centres in Abeokuta, Ogun State, Nigeria. New York Science Journal. 2013; 6:53-59.
4. Ali, J., Okonko, I.O., Odu, N.N., Kolade, A.F. & Nwanze, J.C. Detection and Prevalence of Candida isolates among patients in Ibadan, South-Western, Nigeria. Journal of Microbiology and Biotechnology Research. 2011; 1(13):176-84.
5. Alo, M.N., Anyim, C., Onyebuchi, A.K. & Okonkwo, E.C. Prevalence of asymptomatic co-infection of candidiasis and vaginal trichomoniasis among pregnant women in Abakaliki, South-Eastern Nigeria. Journal of Natural Science Research. 2012; 2:87-91.
6. Boris, S. & Barbe ´s, C. Adherence of human vaginal lactobacilli to vaginal epithelial cells and interaction with uropathogens. Infection and Immunity. 1998; 66:1985–9.
7. Eckert, L.O., Hawes, S.E., Stevens, C.E., Koutsky, L.A., Eschenbach, D.A. & Holmes, K.K. Vulvovaginal candidiasis: Clinical manifestations, risk factors, management algorithm. Obstetrics and Gynecology. 2004; 92:757 65.
8. Ekwi, D. N & Ngwa F A. Vulvovaginal candidiasis in patients attending the Buea Regional Hospital-Cameroon: Prevalence and risk factors. Journal Of Public Health and Community Medicine. 2023; 1(1): 13-20.
9. El Ahmed, H.H., Cañadas-De la, F.A., Fernández- Castillo, R., GonzálezJiménez, E., Cantero-Hinojosa, J. & Lardón-Fernández, M. Generalized Cutaneous Candidiasis in Newborn at Term. Biomedica. 2012; 32(2): 170–173.
10. Emeribe, A., Abdullahi, N. I., Onyia, J. & Ifunanya, A. L. Prevalence of Vulvovaginal Candidiasis among Non-Pregnant Women attending a Tertiary Health Care Facility in Abuja, Nigeria. Research and Reports in Tropical Medicine. 2015; 6: 37-42
11. Ezeigbo, O.R., Anolue, F.C., & Nnadozie, I.A. Vaginal candidiasis infection among pregnant women in Aba, Abia State, Nigeria. British Journal of Medicine and Medical Research. 2015; 3:36-39.
12. Faraji, R., Rahimi, M. & Assarehzadegan, M. Prevalence of vaginal candidiasis infection in women referred to Kermanshah hygienic centers, Iran in 2010. Life Science Journal. 2012; 9:1280–3.
13. Farr A., Effendy I., Frey Tirri B., *et al*. Guideline: vulvovaginal candidosis (AWMF 015/072, level S2k) Mycoses. 2021;64(6):583–602.
14. Geiger, A.M. & Foxman, B. Risk factors for vulvovaginal candidiasis: a case-control study among university students. Epidemiology. 1996; 7:182–7.
15. Guzel, A.B., Ilkit, M. & Akar, T. Evaluation of risk factors in patients with vulvovaginal candidiasis and the value of chromID *Candia* agar versus CHROMagar *Candida* for recovery and presumptive identification of vaginal yeast species. Medical Mycology. (2011); 49:16-25.
16. Joy, N. D., Chizaram, W. N., Joy, O. I., & Emeka, O. Prevalence of candidiasis among female patients attending Federal Medical Centre Owerri, Imo State, Nigeria. GSC Advanced Research and Review. 2021; 09(01):001–006.
17. Jumbo, G.T., Opajobi, S.O., Egah, D.Z., Banwat, E.B. & Denen, A.P. Symptomatic vulvovaginal candidiasis and genital colonization by Candida species in Nigeria. Journal of Public Health Epidemiology. 2010; 2(6):147-151.
18. Kaur, H, Wadhwa, K, Jain, K, Yadav, A. Multidrug-resistant *Candida* Auris: a global challenge. Journal of Applied Biology and Biotechnology. 2021;9(1):104–13.
19. Makanjuola, O., Bongomin, F. & Fayemiwo, S.A. An update on the roles of non-Candida albicans species in vulvovaginitis. Journal of Fungi. 2018; 4:121.
20. Menza Nelson, Wanyoike Wanjiru, Muturi W. Margaret. Prevalence of Vaginal Candidiasis and Determination of the Occurrence of Candida Species in Pregnant Women Attending the Antenatal Clinic of Thika District Hospital, Kenya. Open Journal of Medical Microbiology. 2013; 3:4.
21. Michael, O. I., Gabriel, I. M., Olayinka, O. O. *et al.* Prevalence of vulvo-vaginal candidiasis among women attending clinics in selected Hospitals in Oyo State, Southwest, Nigeria. Journal of Public health and Epidemiology. 2022; 14 (1): 45-52.
22. Mohamed, A.O., Mohamed, M.S., Mallhi, T.H., Hussain, M.A., Jalloh, M.A., Omar, K.A., *et al*. Prevalence of vulvovaginal candidiasis among pregnant women in Africa: a systematic review and meta-analysis. Journal of Infection in Developing Countries. 2022;16(08):1243–51.
23. Muller, J. Characteristics of fungus carriers as a source of infection. Zentralbl fur Hygiene Unweltmed. 2003; 194:162-72.
24. Nelson, M., Wanjiru, W. & Margaret, M.W. Prevalence of vaginal candidiasis and determination of the occurrence of Candida species in pregnant women attending antenatal clinic of Thika District Hospital, Kenya. Open Journal of Medical Microbiology. 2013; 3:264-72.
25. Nwadioha, S.I., Egah, D.Z., Alao, O.O. & Iheanacho, E. Risk factors for vaginal candidiasis among women attending primary health care centers of Jos, Nigeria. Journal of Clinical Medicine Research. 2010; 2(7):110–113.
26. Nyirjesy, P., Weitz, M., Grody, M. & Lorber, B. Over-the-counter and alternative medicines in the treatment of chronic vaginal symptoms. Obstetrics and Gynecology. 2008; 90:50–3.
27. Rosati, D., Bruno, M., Jaeger, M., Ten Oever, J. & Netea, M. G. Recurrent vulvovaginal candidiasis: an immunological perspective. *Microorganisms*. **8** (2), 144 2020.
28. Sobel, J.D. Genital candidiasis. Medicine. 2005; 33:62–5.
29. Toua V, Djaouda M, Gaké B, Menye DE, Christie E, Tambe E, et al. Prevalence of vulvovaginal candidiasis amongst pregnant women in Maroua (Cameroon) and the sensitivity of Candida albicans to extracts of six locally used antifungal plants. Int Res J Microbiol. 2019;4(3):89–97.
30. Ugwa, E.A. Vulvovaginal Candidiasis in Aminu Kano Teaching Hospital, North-West Nigeria: Hospital-Based Epidemiological Study. Annals of Medical and Health Sciences Research. 2015; 5:274-278.