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Research Article

Prevalence and Risk Factors of *Candida albicans* Infection among Women of Childbearing Age Attending Ministry of Defence Headquarters Clinic, Garki, Abuja

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ABSTRACT
Candida albicans is the primary pathogen responsible for vulvovaginal candidiasis (VVC), a common infection affecting women. This study evaluated prevalence and risk factors among women of childbearing age attending the Ministry of Defence Headquarters Clinic in Garki. A cross-sectional study was employed to screen 250 women, with participants randomly selected. Well-structured questionnaires were administered to collect socio-demographic, behavioural, and health-related data. Then, high vaginal swabs (HVS) were collected aseptically and identified using standard morphological and microscopic analysis. Result shows that a notable number of participants were exposed to *C. albicans,* with an overall prevalence of 4% and risk factors included vaginal douches (54.4%), high sugar diet (53.6%), smoking (50%), and regular use of tight clothing (45.6%). Many of these participants also reported a previous diagnosis of candidiasis and existing ill health conditions. The infection occurred highest among women with formal education (26.7%), widows (11.8%), students (7.0%), and pregnant women in their third trimester (50%). Notable symptoms revealed by previous medical records included additional diagnoses such as vaginal yeast infection (62%), diabetes (5%), and fibroid (2%). While this study highlighted a low prevalence, there is need for routine screening and continuous health education to help mitigate the spread of this infection.

Keywords: *Candida albicans;* Candidiasis; Prevalence; Risk factors; Vulvovaginal candidiasis; Women

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INTRODUCTION

In humans, *Candida* appears to be one of the commonest opportunistic fungi, with different species triggering variable diseases. Vulvovaginal candidiasis (VVC), predominantly caused by *Candida albicans* is a widespread mucosal fungal infection that affects women of reproductive age globally (Tsega and Mekonem, 2019). This is an infection localized to the oestrogenised vagina and the vestibulum, but can spread to the external part of the labia minora and even the labia majora (and the intercrural region). Notably, VCC is considered the second most common cause of vaginitis, after bacterial vaginosis. Infections could be sporadic with mild clinical signs or recurrent that it leads to over four episodes within the space of four months (Disha and Haque, 2022). *Candida albicans* is typically a harmless commensal organism in the vaginal microbiota, but changes in host immunity, the vaginal microenvironment, or hormonal balance can encourage its excessive growth, resulting in the symptomatic infection. Clinical manifestations often encompass symptoms such as vulvar itching, irritation, unusual vaginal discharge, and discomfort. These symptoms can greatly affect one's quality of life and sexual health (Payne *et al.,* 2020; Ghaddar *et al.,* 2020; Hussen *et al.,* 2024).

Disha and Haque (2020) highlights that at least 20% of women experience vaginal colonization of *Candida* species, and this rises to 30% in pregnancy. Recent

studies have pointed that about 75% of women of childbearing age have experienced VCC (with at least a single episode), and about half of this population having at least one reoccurrence (Hussen *et al.,* 2024). The vulnerability of women of childbearing age can be linked to fluctuating oestrogen levels, pregnancy, the use of hormonal contraceptives, exposure to antibiotics, diabetes mellitus, and other immunosuppressive conditions. This condition is further exacerbated by poor dietary habits, inadequate hygienic practices, restricted healthcare availability and reliance on self-medication, and use of tight insulating under garment that increases temperature and moisture around the perineum (Balogun *et al.,* 2023).

In various parts of Nigeria, VCC has been frequently reported as a major cause of many gynaecological consultations. However, there are limited epidemiological data that reveals the extent of such infection amongst a diverse population of women of childbearing age in certain regions (Agabi *et al.,* 2023; Ojen *et al.,* 2024; Andemi *et al.,* 2025). For effective prevention, early diagnosis, and proper management of VCC, it is important to evaluate the prevalence and risk factors of this infection (Payne *et al.,* 2020; Ghaddar *et al.,* 2020). This study determines the prevalence and risk factors of *C. albicans* infection amongst women of childbearing age visiting the Ministry of Defence Headquarters Clinic in Garki, providing evidence-based data for public health interventions in decreasing the burdens of vulvovaginal candidiasis among the study population.

MATERIALS AND METHODS

Study Area

This study was carried out at the Ministry of Defence Headquarters Clinic Garki, Area 10, located in Abuja the Federal Capital Territory (FCT) (Figure, 1). The FCT is the capital of Nigeria, and has a landmass coverage of about 7,315 square kilometres. This geographical area is located between 60° 47′ and 90° 25′ north of the equator, and between longitudes 60° 47′ and 70° 40′ to the east of the Greenwich meridian. This region features a tropical wet and dry climate, and the Ministry of Defence Headquarters Clinic Garki is ranked as one of the most relevant heath facilities in the FCT (Bashir *et al.,* 2021).

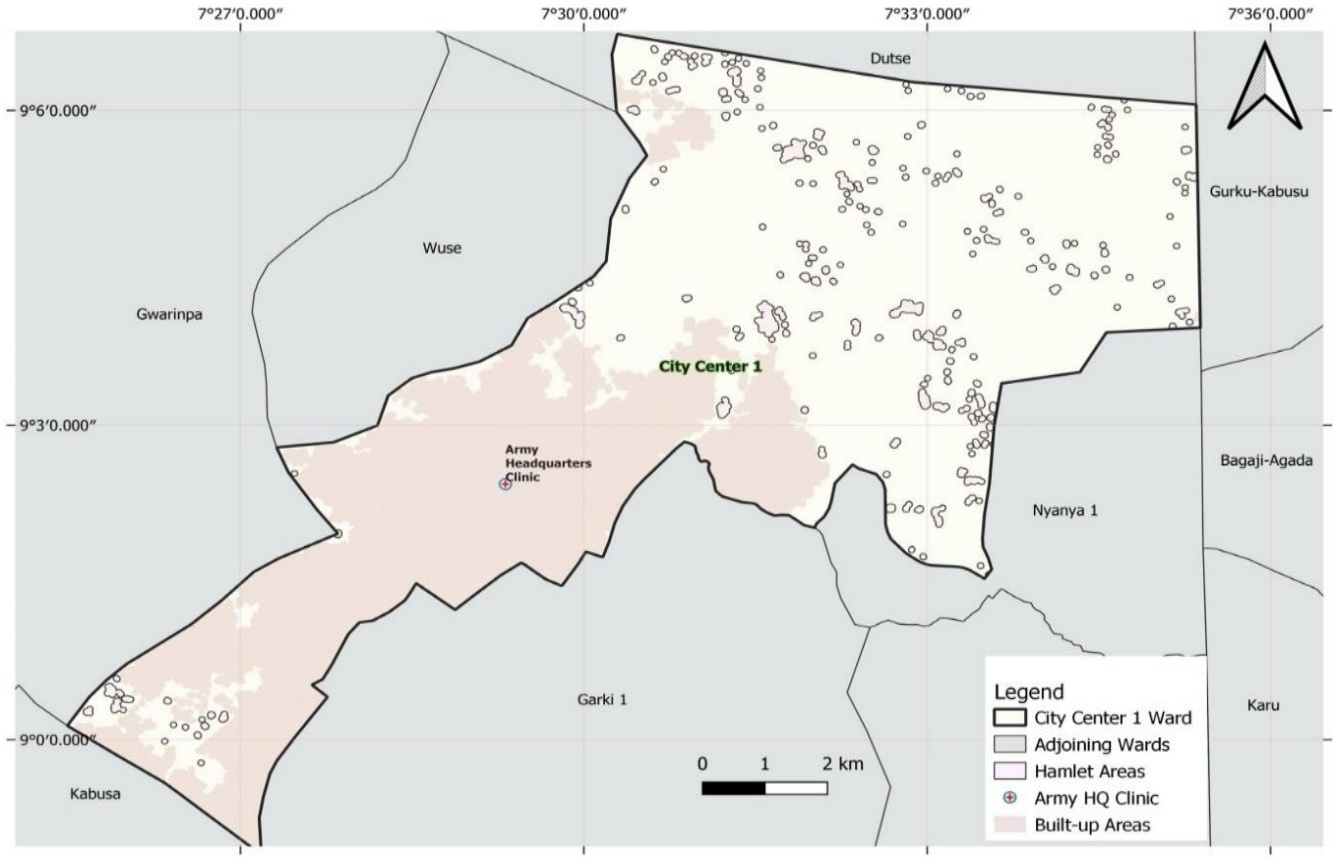

Figure 1: Map of Ministry of Defence Headquarters Clinic Garki, Area 10, Abuja Showing the Study Site (Source: Geopode. world/AFD, 2023)

Study Design and Population

A cross-sectional study was carried out, featuring women of childbearing age (18-49 years) attending the Ministry of Defence Headquarters Clinic Garki. This included single, married, pregnant, non-pregnant, symptomatic, and asymptomatic women. However, women within this age group who declined to participate, or are menstruating (at the moment of sampling), suffering from chronic diseases (HIV/AIDs, stroke, tuberculosis, and diabetes), using antifungal and antibiotic medications two weeks before the commencement of this study, were excluded (Payne *et al.,* 2020).

Determination of Sample Size

The sample size for this study was calculated using the 20.5% prevalence of *Candida albicans* infection reported by Hamafyelto and Ikeh (2017). This was calculated using the formula:

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where:

n = Sample size

z = Statistics corresponding to level of confidence of 95%, i.e cl=1.96 (Standard Deviation)

p – Expected prevalence-based study

d – Precision corresponding to effect size 5% (margin of error) at 95% cl (confidence level)

In calculation,

$$n = \frac{1.96^2 0.205(1-0.205)}{0.05^2} = 250$$

The sample size for the study was 250 women.

Ethical Clearance

Ethical clearance was obtained from the Ministry of Defence Health Research and Ethics Committee (MODHREC) FCT, Abuja (Reference number: NHREC/28/01/2020B). Permissions were also obtained from the Health Services Department, Ministry of Defence Headquarters, Abuja before commencement of the study. Also, informed consent was sought from each individual who took part in the study (Balogun *et al.,* 2023).

Data Acquisition

The data for this study were obtained from both primary and secondary sources. Primary data were obtained using structured questionnaires administered to capture the socio-demographic characteristics, pregnancy status (and trimester where applicable), type of underwear, frequency of infection, clinical signs and symptoms, and provisional medical diagnosis, and compliance history. Secondary data were made up of previous clinical history of the infection from the clinic's General Records Department (Balogun *et al.,* 2023).

Collection of Sample

Under aseptic conditions, samples of high vaginal swab (HVS) were collected from the participants at the clinic. Each patient had two sets of swabs taken by the appropriate professional (either an Obstetrics and Gynaecology Doctor or the Most Senior Midwife), and these were properly labelled. Each sample was promptly sent to the Microbiology Laboratory, Department at the Ministry of Defence Headquarters Clinic for cultural and microbiological analysis (Ghaddar *et al.,* 2020; Hussen *et al.,* 2024).

Culture Medium

Sabouraud Dextrose Agar (SDA) was used as the basic culture medium utilized for isolating clinical *Candida* species. This culture medium was prepared according to the manufacturer's instructions. Then using a swab stick, each vaginal sample was streaked on SDA plates and appropriately labelled. The plates were the covered and incubated at 37°C for 48 hours (Balogun *et al.,* 2023).

Gram Staining

Using a sterilized wire loop a fungal colony was picked from the cultured plate, and then smeared on a clean glass slide. It was dried and fixed by passing it over a Bunsen flame, after which it was flooded with 1% cystal violet stain and allowed to sit for 2 minutes. The smear was decanted and inundated with Lugol's iodine for one minute. It was then rinsed with clean tap water, excess water was decanted, and it was decolorized with acetone until no further colour was released. The smear was flooded with a diluted solution of safranin for two minutes, rinsed with tap water, and examined under a microscope (Payne *et al.,* 2020; Balogun *et al.,* 2023).

Potassium Hydroxide (KOH) Mount and Germ Tube Test (GTT)

For the KOH mount, vaginal swabs were combined with 10% KOH on a slide and analysed microscopically (x40) for budding yeast cells and pseudohyphae indicative of *Candida albicans*. A germ tube test was conducted for confirmation by incubating yeast colonies in human serum at 37°C for four hours and observing the formation of germ tubes (Oyewole *et al*., 2013; Hussen *et al.,* 2024).

Data Analysis

Questionnaire and laboratory data were inputted into Microsoft Excel 2010 and analysed with the Statistical Package for Social Science (SPSS) Software, version 20. Using Pearson's Chi-square test with a confidence level of 95% and a significance level of 0.05, associations were identified between socio-demographic and clinical variables and the prevalence of *Candida albicans* (Hussen *et al.,* 2024). Data obtained from this study were calculated and reported as percentages, presented in Tables and Figures. The prevalence rates were determined by the formula expressed by Rhodes *et al.* (2018):

$$\text{Prevalence} = \frac{number\ of\ positive\ samples}{total\ number\ of\ samples\ exermined}\ x\ 100$$

RESULTS

Socio-Demographic Characteristics of the Participants in this Study

A significant portion of the respondents were within the age of 20-30 years (42%), and most of these participants had tertiary education (40%). Almost half of the population (48.8) were single women by marital status, and most of them (23.6%) were unemployed (Table 1).

The overall prevalence of vulvovaginal candidiasis among the women in this study was 10 (4.0%) as shown in Figure 2.

Distribution of *Candida albicans* amongst the Study Population

This study further reports the prevalence of *C. albicans* amongst women of childbearing age, revealing an overall prevalence rate of 4% (10 out of 250 people). The age-specific prevalence revealed that women between ages 20 to 30 had the highest proportion of *C. albicans* infection (4.8%), while those around 41-49 years had the least prevalence (3.3%). Considering their educational status, the highest prevalence (26.7%) was recorded amongst women with non-formal education. Furthermore, widowed women had the highest proportion of the infection (4.5%), compared to single women that had the least prevalence (3.3%). Students also had the highest prevalence rate (7.0%), and employed women having the least (0%) prevalence rate. Amongst pregnant women tested, the infection rates recorded increase with the gestational age, as the highest prevalence (50%) was recorded amongst women in the third trimester. The result of the prevalence of *Candida albicans* infection amongst women of childbearing age is shown in Table 2.

Table 1: Socio-Demographic Characteristics of the Respondents in this Study

Socio-Demographic Information		No.	%	Standard Error (SEM)
Age	20-30yrs	105	42.0	0.0312
	31-40yrs	85	34.0	0.0300
	41-49yrs	60	24.0	0.0270
Level of education Attained	Graduate	100	40.0	0.0310
	Non-Formal	15	6.0	0.0150
	Post Graduate	23	9.2	0.0183
	Primary	22	8.8	0.0179
	Secondary	90	36.0	0.0304
Marital Status	Married	89	35.6	0.0303
	Separated	22	8.8	0.0179
	Single	122	48.8	0.0316
	Widowed	17	6.8	0.0159
Employment Status	Employed	52	20.8	0.0257
	Others	52	20.8	0.0257
	Retired	44	17.6	0.0241
	Student	43	17.2	0.0239
	Unemployed	59	23.6	0.0269

χ^2 = 0.526, df = 1 and *P* value = 0.0526

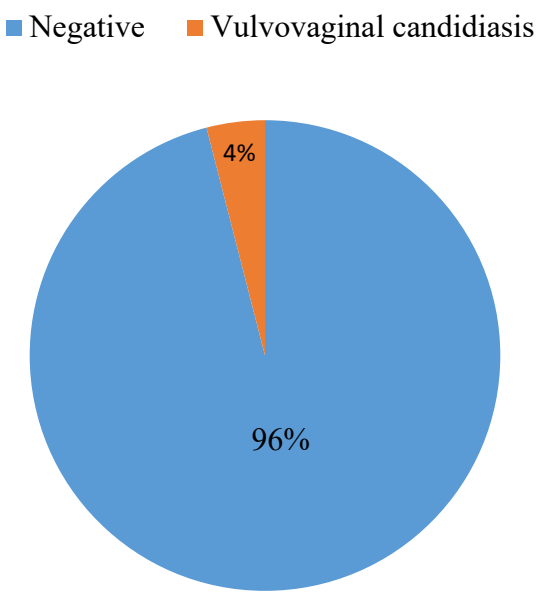

Figure 2: Overall prevalence of vulvovaginal candidiasis among Women of Childbearing Age Attending Ministry of Defence Headquarters Clinic, Garki, Abuja

Table 2 Distribution of *C. albicans* Amongst Women of Childbearing Age Based on Socio-Demographic and Clinical Characteristics

Variable	Category	Examined (n)	Number of Positives (%)	Number of Negatives (%)	*p*-value
Age (years)	20–30	105	5 (4.8)	100 (95.2)	0.838
	31–40	85	3 (3.5)	82 (96.5)	
	41–49	60	2 (3.3)	58 (96.7)	
Educational Status	Non-formal	15	4 (26.7)	11 (73.3)	0.387
	Primary	22	2 (9.1)	20 (90.9)	
	Secondary	90	2 (2.2)	88 (97.8)	
	Graduate	100	2 (2.0)	98 (98.0)	
	Postgraduate	23	0 (0.0)	23 (100)	
Marital Status	Single	122	4 (3.3)	118 (96.7)	0.415
	Married	89	3 (3.4)	86 (96.6)	
	Widowed	17	2 (11.8)	15 (88.2)	
	Separated	22	1 (4.5)	21 (95.5)	
Employment Status	Employed	52	0 (0.0%)	52 (100%)	0.002
	Others	52	3 (5.8%)	49 (94.2%)	
	Retired	44	2 (4.6%)	42 (95.4%)	
	Student	43	3 (7.0%)	40 (93%)	
	Unemployed	59	2 (3.4%)	57 (96.6%)	
Pregnancy Stage (n = 40)	1st Trimester	20	0 (0.0)	20 (100)	0.346
	2nd Trimester	12	2 (16.7)	10 (83.3)	
	3rd Trimester	8	4 (50.0)	4 (50.0)	
Underwear Type	Cotton	169	7 (4.1)	162 (95.9)	1.000
	Synthetic	81	3 (3.7)	78 (96.3)	

Risk Patterns and Health-Related Behaviours of the Study Participants and the Prevalence of *C. albicans*

This study found that behavioural factors such as use of vaginal douches/scented feminine hygiene products (54.4%), high sugar diet (53.6%), smoking (50.0%), and

wearing tight clothing (45.6%) were commonly reported by participants. Notably, 28% of the participants reported that they rarely engage in sexual intercourse and 50.4% of the respondents claimed they use condoms for sexual intercourse. The result of the behavioural patterns and lifestyle risks that may be associated with *C. albicans* infection are shown in Table 2. Similarly, 47.2% of these respondents confirmed that they had been previously diagnosed of candidiasis, and 48.8% of them reported that they were currently on medications, including antibiotics and contraceptives. Notably, 50.4% of these respondents had an underlying ill health condition (Table 3).

Clinical Presentation and Symptoms Reported by Respondents

The respondents in this study reported some clinical presentations and symptoms that are associated with *C. albicans* infection. Most of these participants reported vaginal itching (17.6%) while the appearance of thick cheese-like discharge was the least reported (10.4). Also, a significant proportion of the population (38.0%) confirmed that they experienced such symptoms for more than five weeks (Table 5).

Medical History of Tested Participants Having *Candida albicans* Infection

Medical history revealed that women who had previously tested positive had vaginal yeast infection (62%), diabetes (5%), and fibroid (2%) (Table 6).

Table 3: Behavioural Pattern and Lifestyle Risks that May Be Associated with *Candida albicans* Infection

Variable	Category	Frequency (n)	Percentage (%)	Number of Positives (%)	*p*-value
Smoking	Yes	125	50.0	8 (6.4%)	0.004
	No	125	50.0	2 (1.6%)	
Use of vaginal douches or scented	Yes	136	54.4	4 (2.9%)	0.492
feminine hygiene products	No	114	45.6	6 (5.3%)	
Alcohol Consumption	Yes	110	44.0	7 (6.4%)	0.008
	No	140	56.0	3 (2.14%)	
Family History of Vaginal Yeast	Yes	113	45.2	7 (6.2%)	0.017
Infection	No	137	54.8	3 (2.2%)	
Wearing Tight-fitting Clothing	Yes	114	45.6	6 (5.3%)	0.029
	No	136	54.4	4 (2.9%)	
High Sugar/Processed Diet	Yes	134	53.6	7 (5.2%)	0.078
	No	116	46.4	3 (2.6%)	
Frequency of Sexual Intercourse	Always	56	22.4	5 (8.9%)	0.003
	Often	62	24.8	3 (4.8%)	
	Rarely	70	28	1 (1.4%)	
	Never	62	24.8	1 (1.6%)	
Condom Use	Yes	126	50.4	4 (3.2%)	0.012
	No	124	49.6	6 (4.8%)	
Frequency of Underwear Change	Always	70	28.0	1 (1.4%)	0.006
	Often	68	27.2	1 (1.5%)	
	Rarely	61	24.4	3 (4.9%)	
	Never	51	20.4	5 (9.8%)	

Table 4: Health and Reproductive-Related Risk Factors

Variable	Category	Frequency	Percentage (%)	Number of Positives (%)	*p*-value
Previous Diagnosis of	Yes	118	47.2	3 (2.5%)	0.974
Candidiasis	No	132	52.8	7 (5.3%)	
Number of Times	Never	59	23.6	2 (3.4%)	0.075
Diagnosed	Once	67	26.8	2 (3.0%)	
	Twice	66	26.4	2 (3.0%)	
	≥ Three Times	58	23.2	4 (6.9%)	
Underlying Medical	Yes	126	50.4	6 (4.8%)	0.000
Condition	No	124	49.6	4 (3.2%)	
Current Medication Use	Yes	122	48.8	4 (3.3%)	0.034
	No	128	51.2	6 (4.7%)	

Table 5: Symptoms Experienced and Their Durations Reported By Participants within the Past Three Months

Variable	Category	Frequency (n)	Percentage (%)	Number of Positives (%)	*p*-value
Symptoms	Vaginal itching	44	17.6	3 (6.8%)	0.348
	Whitish/yellow vaginal discharge	43	17.2	4 (9.3%)	
	Vaginal burning	37	14.8	2 (5.4%)	
	Painful urination	37	14.8	2 (5.4%)	
	Foul-smelling discharge	34	13.6	1 (2.9%)	
	Vaginal irritation	29	11.6	1 (3.4%)	
	Thick cheese-like discharge	26	10.4	1 (3.8%)	
Duration	1-2 Weeks	33	13.2	5 (15.2%)	0.704
	3-4 Weeks	42	16.8	3 (7.1%)	
	More than 5 Weeks	95	38	2 (2.1%)	

Table 6: Medical/Gynaecological History Associated with Tested Women Having *Candida albicans* Infection

Diagnosis	Occurrence of *Candida albicans* Infection (%)
Vagina yeast infection	62
Diabetes	5
Urinary Tract Infection	7
Abdominal pain	2
History of Antibiotic Use	12
Fibroids	2
Pregnancy	10

DISCUSSION

Candida spp. remains the most common opportunistic fungus in humans, with *Candida albicans* as the major causative agent of vulvovaginal candidiasis. The present study highlights the prevalence and risk factors of *Candida albicans* among women of childbearing age attending the Ministry of Defence Headquarters Clinic in Garki. The sociodemographic and perceived risk factors included in this study have been reported in previous studies (Hussen *et al.,* 2024; Gedefie *et al.,* 2025; Eskezia *et al.,* 2025). The behavioural and lifestyle risk patterns reported by the participants suggest a significant exposure to well-established risk factors of candidiasis. A significant proportion of the population had reported the use of vaginal douches or scented feminine hygiene products, smoking, and consumption of a high-sugar or processed diet (53.6%). Also, a good number of the participants revealed that they had been previously diagnosed with candidiasis, had underlying health conditions, and are currently using some kind of medication. These findings align with the reports of Morales-Ramírez *et al.* (2024), which highlighted environmental, social, hygienic, and health determinants related to candidiasis. Notably, the sexual patterns and use of condoms were determined in this study. While VCC may not appear to be a "sexually transmitted infection," these hold epidemiological significance, as unprotected sexual intercourse can cause changes in vaginal pH and microflora due to exposure to semen and other sexually transmitted pathogens, thus raising the risk of fungal and bacterial infections (Workowski and Bolan, 2021). Decreased occurrence of VVC has been recorded amongst women who use condoms, indicating a potential protective effect on vaginal health when used consistently (Oliveira *et al.,* 2017).

With an overall prevalence of 4% in this study, which appears low, it still indicates the presence of VVC in the population. In comparison, Agabi *et al.* (2023) reported an overall *C. albicans* prevalence of 32.0% among women attending a gynaecology clinic in Jos, Nigeria. Variations in the exact prevalence reports across different studies may be linked to differences in sample sizes, age distributions, diagnostic methods, and hygienic and lifestyle practices among participants (Ali *et al.,* 2024). The occurrence of *C. albicans* infection was highest amongst women in the age bracket of 20–30 years, and also significantly higher amongst women of 31-40 years. A recent study conducted at Asokoro District Hospital, Abuja, Nigeria, reported the highest occurrence among women aged 26-35 years (Aigbogun *et al.,* 2025). This pattern could be associated with increase sexual activity, hormonal changes, and the use of contraception among this age range (Peprah *et al.,* 2022). The occurrence of *C. albicans* was particularly high among women with non-formal education (26.7%), and no infections were recorded among postgraduates. Such occurrences mostly indicate that awareness of personal hygiene, health-seeking behaviour, and preventive practices may be affected by one's level of education (Otoo-Annan and Senoo-Dogbey, 2024). Likewise, the prevalence among widowed women was 11.8%, which is

higher than that of other marital categories. Nevertheless, this finding may be affected by the small sample size of this subgroup.

Although this study also highlights no possible association (p > 0.05) between pregnancy and *C. albicans* colonization, the prevalence among pregnant participants rose sharply with gestational age, reaching a peak of 50% in the third trimester. This aligns with the findings of Balogun *et al.* (2023). Such an occurrence may be ascribed to hormonal shifts (increase oestrogen production) that modify the vaginal environment (higher glycogen deposits), rendering it more favourable for fungal overgrowth (Hussen *et al.,* 2024; Gedefie *et al.,* 2025). Disha and Haque (2021) have also discussed the chance of pregnant women developing symptomatic VCC after a course of oral antibiotics. Notably, regular use of broad-spectrum antibiotics eliminates beneficial bacteria such as *Lactobacillus* spp. That normally defends the vagina from germination of *Candida* spp. Also, the continuous overuse or misuse of such drugs, including antifungal agents used in treating vaginal candidiasis, may trigger resistance (Ali *et al.,* 2024; Morales-Ramírez *et al.,* 2024). Overall, Medical history revealed that participants who tested positive previously had vaginal yeast infection (62%), diabetes (5%), and fibroid (2%). There were statistically significant associations (p < 0.05) of prevalence with employment status, smoking, alcohol intake, family history, tight clothing, sexual frequency, use of condoms, underwear change frequency, underlying medical conditions, and current medication use.

While this study highlights the prevalence and risk factor, it didn't extend to identifying other *Candida* species that may also be responsible for VCC. Also, this study is limited to women of childbearing age visiting the Ministry of Defence Headquarters Clinic in Garki. Thus, there's a need for extensive studies to capture more *Candida* species, and to be conducted across more health facilities.

CONCLUSION

This study established an overall prevalence of 4% of vulvovaginal candidiasis among women of childbearing age visiting the Ministry of Defence Headquarters Clinic in Garki. that out of the 250 participants (women of childbearing age), the majority of them were exposed to behavioural risk factors such as vaginal douches (54.4%), high sugar diet (53.6%), smoking (50%), and wearing tight clothing (45.6%). Also, a significant number of them were previously diagnosed with candidiasis (47.2%), and 48.8% were on medications like antibiotics and contraceptives. The overall *C. albicans* infection prevalence rate of 4%, with a higher proportion of this population being women aged 20-30 years (4.8%). Furthermore, this infection was significantly recorded in non-formal education (26.7%), students (7.0%), widowed women (11.8%), and pregnant women in their third trimester (50%). There were statistically significant associations ($p \leq 0.05$) of prevalence with employment status, smoking, alcohol intake, family history, tight clothing, sexual frequency, use of condoms, underwear change frequency, underlying medical conditions, and current medication use.

AUTHOR CONTRIBUTIONS

Babalola, A.D.: Conceptualization, screening, questionnaire interview, laboratory analyses, data analysis and interpretation, and manuscript drafting.

Dikwa, K.B.: Supervision, data interpretation, validation, and revision

Onusiriuka, B.C.: Supervision, data interpretation, validation, and revision.

Rabe, Y.: Interpretation of results and manuscript drafting.

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