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Prevalence of *Candida albicans* and *Trichomonas vaginalis* Among Women of Childbearing Age in Wukari Metropolis, Taraba State

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Abstract

Vulvovaginal infections caused by *Candida albicans* and *Trichomonas vaginalis* remain important reproductive health concerns among women of childbearing age, yet epidemiological evidence from Wukari Metropolis is limited. This study examined the prevalence of *C. albicans* and *T. vaginalis* and their associations with sociodemographic, clinical, and behavioral factors among women of childbearing age in Wukari Metropolis. Vaginal swab specimens were collected from 163 consenting participants and examined macroscopically and microscopically, while *C. albicans* isolates were confirmed using the germ-tube test. No *T. vaginalis* infection was detected; therefore, subsequent analyses focused on *C. albicans*. The overall prevalence of *C. albicans* infection was 60.1%, with the highest prevalence recorded among women aged 40–49 years (100%) and the lowest among those aged 30–34 years (35.5%; $\chi^2 = 42.30$, $p < .001$). Infection prevalence was significantly higher among women with informal education (86.4%) or primary education (87.9%) than among those with tertiary education (41.9%; $\chi^2 = 26.69$, $p < .001$). Married women also had

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a higher prevalence than unmarried women (69.2% vs. 48.6%; $\chi^2 = 7.13$, $p = .008$). Diabetes and HIV infection were important risk factors, with *C. albicans* detected in 100% of participants with diabetes and 75% of those living with HIV, yielding a combined prevalence of 91.3% ($\chi^2 = 4.11$, $p = .043$). Significant clinical associations were observed for dyspareunia (80.2%), dysuria (69.7%), and vaginal discharge (52.4%; all $p < .05$). Self-medication was also significantly associated with infection (74.3%; $\chi^2 = 10.38$, $p = .006$), as was the use of feminine hygiene products ($\chi^2 = 4.37$, $p = .037$). These findings demonstrate a high burden of *C. albicans* infection despite the absence of *T. vaginalis* and highlight the influence of educational status, marital status, underlying health conditions, clinical symptoms, and personal health practices. The study provides locally relevant epidemiological evidence to support targeted screening, health education, and prevention strategies for vulvovaginal candidiasis among women of childbearing age in Wukari Metropolis.

Keywords: *Candida albicans*; *Trichomonas vaginalis*; Reproductive-Age Women; Risk Factors; Vulvovaginal Candidiasis

INTRODUCTION

One of the primary public health concerns is still sexually transmitted diseases (STIs). There are over 30 sexually transmitted pathogens, and every day, almost one million people contract a treatable STD (Ibáñez-Escribano and Nogal-Ruiz, 2024). Sexual contact can spread pathogens such as bacteria, viruses, protozoa, fungi, and other parasites (Plagens-Rotman *et al.,* 2022). Infections of the vaginal area impact women across the globe. These conditions cause significant discomfort and can lead to harmful complications during pregnancy and delivery, as documented by Abdullahi and Danyaya in 2021. The most frequently occurring types encompass yeast infections of the vulva and vagina, bacterial vaginosis, and *Trichomoniasis* (Huang *et al.,* 2023).

Microbial infections, especially those caused by protozoan and fungal pathogens, constitute a significant worldwide public health concern according to Ormsby and Colleagues in 2023. Two key organisms, *Trichomonas vaginalis* and various *Candida* species, are primary contributors to sexually transmitted diseases, impacting millions globally with women being disproportionately affected, as noted by Chiu and others in 2021. These infections touch the lives of countless women annually and have strong associations with serious complications including premature birth, inflammatory conditions of the pelvic

organs, and uterine infections following abortion procedures, documented by Yuan and co-researchers in 2021. The organism *Trichomonas vaginalis* is a motile protozoan parasite equipped with flagella that causes *Trichomoniasis*, ranking among the most prevalent non-viral sexually transmitted diseases as reported by Ali in 2024. This parasite typically establishes residence in the vaginal canal, cervical area, and glands surrounding the urethra. Research by Abdullahi and Danyaya in 2021 indicates that roughly one-quarter of women harboring *Trichomoniasis* infections show no clinical signs. However, when symptoms do manifest, patients may experience redness and inflammation of the vulvovaginal region, painful urination, itching, swelling, bubbly discharge that appears yellow-gray to green in color, and increased vaginal acidity levels (Abdullahi and Danyaya, 2021).

Despite being regarded as a "nuisance" illness, *Trichomoniasis* has been included in the WHO Global Health Strategy on STIs for the years 2022–2030 because to the dangers and problems it poses. Due to the imbalance in the vaginal microbiota, the proinflammatory immunological response, and the raised vaginal pH, *T. vaginalis* not only increases the chance of contracting HIV by 1.5 times but also promotes its transmission (Ibáñez-Escribano and Nogal-Ruiz, 2024). According to Ibáñez-Escribano and Nogal-Ruiz (2024) and Verhoeven *et al.* (2024), women who have *Trichomoniasis* frequently have coinfections with several urogenital pathogens, such as *human papillomavirus, Treponema pallidum, Neisseria gonorrhoeae, Chlamydia trachomatis, or herpes simplex virus types* 1 and 2. Infertility, poor pregnancy outcomes, and pelvic inflammatory disease (PID) are additional severe consequences (Shroff, 2023).

Candida species are dimorphic yeasts capable of causing opportunistic infections known as candidiasis (Sharma & Chakrabarti, 2023). Although these fungi are widespread in nature and commonly reside on human skin, they can become pathogenic in individuals with weakened immune systems, infecting the mouth, throat, bloodstream, and genital tract (Nisha *et al.*, 2024). Notable species include *C. tropicalis, C. glabrata*, and *C. albicans* (Karkowska-Kuleta *et al.*, 2020). Among them, *C. albicans* accounts for roughly 85–95 % of vaginal Candida Infections, leading to symptoms such as itching, irritation, and abnormal discharge, especially in immunocompromised individuals (Sharif *et al.*, 2024; Anh *et al.*, 2021). Non-albicans Candida (NAC) species, including *C. glabrata, C. tropicalis, C. parapsilosis, C. krusei,* and *C. dubliniensis,* are, nevertheless, increasingly being reported globally (Anh *et al.,* 2021).

According to the epidemiology of vaginal *Candida* infection, by 25 years old, up to 50% of all women will have gone through two or more vulvovaginal candidiasis (VVC) episodes (Mbakwem-Aniebo *et al.,* 2020). Age at the onset of sexual activity represents a key predisposing factor for vulvovaginal candidiasis (VVC), alongside a wide array of host and behavioral influences. Host-related contributors include hyper-estrogenic conditions such as pregnancy or hormone replacement therapy, uncontrolled diabetes, states of immunodeficiency, prior or prolonged antibiotic exposure, glucocorticoid therapy, and inherited susceptibility. Behavioral and environmental elements; use of intrauterine devices, oral contraceptives, spermicides, or condoms, as well as personal hygiene practices, persistent wearing of tight clothing, and sexual habits—have likewise been linked to heightened VVC risk (Denning, 2024; Anh *et al.*, 2021; Mbakwem-Aniebo *et al.*, 2020).

MATERIALS AND METHODS

Study Area

The site of investigation of this study was, Wukari Local Government Area in Taraba State. Wukari, a town in southern Nigeria's Taraba state, has a tropical savanna climate with distinct wet and dry seasons. The area's agricultural operations are supported by the significant rainfall that the wet season, which usually lasts from April to October, produces, with an average of 1,200 mm each year. With harmattan winds occasionally bringing cooler temperatures, the dry season, which runs from November to March, is marked by higher temperatures and reduced humidity. The region was home to 241,546 people as of the 2006 census, and it was roughly 4308 square kilometers in size. The position is 7.89°N latitude and 9.78°E longitude, with an average temperature of 26.80°C and 1205 mm of precipitation each year. The Jukuns, who are primarily farmers and hunters, control Wukari (Imarenezor and Gaina, 2024).



Map of Wukari showing the study area (Google, 2024)

Study Design

This was a cross-sectional study carried out among women of child bearing age visiting medical facilities in Wukari metropolis within the period of three months (March 2025 to May 2025).

Sample size determination

The sample size was estimated with the standard population proportion formula: A prevalence of 12% reported in Nasarawa State by Agada *et al.* (2021) was used as the expected prevalence in this study.

$$N = \frac{Z^2 P(1-P)}{d^2}$$

Where:

N=Sample size

Z=Critical value at 95% confidence level (standard error (z) = 1.96)

P= an expected prevalence (12%) and

d=is precision or margin of error (5%).

Sample collection

A total of 163 High Vaginal Swabs samples each for the two test organisms was collected from both symptomatic and asymptomatic women of childbearing age with the assistance of a medical laboratory scientist in accordance with the methods described Ahmad (2021) and Eyong *et al.*, (2023) with slight modification. During specimen collection, with gloves, the examination bed was wiped with 70 % alcohol to maintain asepsis, after which the used gloves were discarded. With a fresh pair of sterile gloves donned, the patients were positioned supine with knees flexed and feet supported in stirrups. A sterile, lubricated speculum were carefully introduced into the vaginas to provide a clear view of the cervix and allow unobstructed access for sampling. Next, sterile cotton-wool swabs were gently inserted into the vaginal canals and rotated clockwise for about 10 seconds, taking care not to contact the external vaginal walls during insertion or withdrawal to minimize contamination. After the specimens were collected, the swabs were carefully withdrawn and placed in properly labeled specimen tubes that includes the patient's age and gender. Finally, the speculum were removed with equal care to maintain comfort and sterility. The collected samples were analyzed within 10 minutes of collection at the Federal University Teaching Hospital laboratory to avoid loss of jacking /tumbling motility of *Trichomonas vaginalis* and death of the parasite and swabs for Candida albicans were transported to Central Laboratory Federal University Wukari for further analysis.

Data analysis

The gathered data was imported into Excel and subjected to three trials of analysis using IBM SPSS version 31. The means ± standard deviation was used to display the values. To check for differences in different variables, proportions was computed and the Chi square test was employed at a significant P-value of less than or equal to 0.05(≤0.05).

RESULTS

Table 1. Identification of *C. albicans.*

Macroscopic and Microscopic identification of *C. albicans*
Macroscopy
Texture: Smooth, Creamy Pasty Colonies.
Shape: Round - oval
Color: Creamy – white colonies
Microscopy
Shape: Round – oval shape colonies.
Color: purple
Morphology: Single budded cells, Pseudo Hyphae and Chlamydospores
Germ Tube Test: Formation of Germ tubes without Constriction

Table 2. Prevalence of C. albicans by Symptoms

Symptoms	Response Category	Number examined	Positive	Prevalence (%)	Chi-square	P-value
Vaginal discharge	Yes	124	65	52.4	12.827	0.000*
	No	39	33	84.6		
Dysuria	Yes	66	46	69.7	4.240	0.039*
	No	97	52	53.6		
Vaginal itching	Yes	96	56	58.3	0.312	0.577
	No	67	42	62.7		
Dyspareunia	Yes	86	69	80.2	30.708	0.000*
	No	77	29	37.7		
Total		163	98			

Where n = sample population N= Total population sampled.

Table 3. Prevalence of C. albicans by Age

Age group	Number examined	Number positive	Prevalence (%)	Chi-square	P-value
15-19	17	8	47.1	42.304	0.000*
20-24	25	10	40.0		
25-29	30	15	50.0		
30-34	31	11	35.5		
35-39	19	13	68.4		
40-44	15	15	100.0		
45-49	26	26	100.0		
Total	163	98			

Table 4. Prevalence of C. albicans by Pregnancy status

Pregnancy status	Number examined	Number positive	Prevalence (%)	Chi-square	P-value
Pregnant	58	33	56.9	0.391	0.532
Non-pregnant	105	65	61.9		
Total	163	98			

Table 5. Prevalence of *C. albicans* by Marital status of Pregnant Women

Marital status	Number examined	Number positive	Prevalence (%)	Chi-square	P-value
Married	49	25	51.0	4.446	0.035*
Single	9	8	89.0		
Total	58	33			

Table 6. Prevalence of C. albicans by medical history

Medical history	Number examined	Number positive	Prevalence (%)	Chi-square	P-value
Diabetes	15	15	100.0	4.107	0.043*
HIV	8	6	75.0		
Total	23	21			

Table 7. Prevalence by socio-demographic factors

Socio demographic factors	Number examined	Number positive	Prevalence (%)	Chi-square	P-value
Single	72	35	48.6	7.128	0.008
Married	91	63	69.2		
Primary education	33	29	87.9	26.689	0.000
Secondary education	46	24	52.2		
Tertiary education	62	26	41.9		
Informal education	22	19	86.4		
Employed	41	27	65.9	0.750	0.386
Unemployed	122	71	58.2		
Total	163	98			

Table 8. Prevalence of C. albicans by Risk factors

Risk factors	Response	Respondents	No. Positive	Prevalence (%)	Chi-square	P-value
Multiple partners	Yes	3	3	100.0	2.027	0.155
	No	160	95	59.4		
Change of Underwear	3 months	36	18	50.0	5.417	0.064
	6 months	59	32	54.2		

	None	68	48	70.6		
Use of feminine hygiene products	Yes	61	43	70.5	4.372	0.037
	No	102	55	53.9		
Treatment	Hospital	78	38	48.7	10.377	0.006
	Herbal	15	8	53.3		
	Self-medication	70	52	74.3		
Awareness	Yes	122	67	54.9	5.480	0.019
	No	41	31	75.6		
Pregnancy	Yes	38	33	86.8	14.755	0.000
	No	125	65	52.0		
Total		163	98			

DISCUSSION

Trichomonas vaginalis and *Candida* species, particularly *C. albicans*, remain leading causes of vaginal infections globally, contributing to reproductive complications, lethal pregnancy outcomes, and higher susceptibility to other STIs (Cardoso and Tasca, 2025).

Among the 163 women studied, 98 (60.1%) tested positive for *C. albicans*, and symptom-specific analysis revealed a heterogeneous pattern of association between clinical complaints and laboratory-confirmed infection. Dyspareunia showed the strongest and most consistent relationship with infection: 69 of 86 women reporting painful intercourse were positive (80.2%), compared with 29 of 77 (37.7%) who did not report dyspareunia ($\chi^2 = 30.708$, $p < 0.001$), indicating that painful sexual intercourse in this population is a powerful clinical predictor of *C. albicans* colonization or infection. Dysuria also demonstrated a modest but statistically significant association, with 46/66 (69.7%) of symptomatic women positive versus 52/97 (53.6%) of those without dysuria ($\chi^2 = 4.240$, $p = 0.039$), suggesting that periurethral irritation or concurrent urogenital inflammation may accompany candidal infection in a subset of cases. By contrast, vaginal itching was not significantly associated with infection (56/96, 58.3% versus 42/67, 62.7%; $\chi^2 = 0.312$, $p = 0.577$), reflecting the nonspecific nature of pruritus which can result from diverse aetiologies beyond candidiasis and thus offers limited diagnostic discrimination on its own.

The results for vaginal discharge are notable and counterintuitive: women who reported no abnormal discharge had a higher positivity rate (33/39, 84.6%) than those who did report discharge (65/124, 52.4%), despite a statistically significant chi-square result ($\chi^2 = 12.827$, $p < 0.001$). This paradox may reflect several factors—high rates of asymptomatic carriage in the cohort, misclassification or under-reporting of discharge, prior partial treatment among symptomatic women, or the fact that abnormal discharge is a sensitive but not specific symptom that may arise from bacterial vaginosis, cervical pathology, or other infections rather than candidiasis—so the presence or absence of discharge alone cannot be relied upon to rule in or out *C. albicans*. Taken together, these findings suggest that certain symptoms (notably dyspareunia, and to a lesser extent dysuria) warrant a high index of suspicion and prompt laboratory confirmation for candidiasis, whereas symptoms such as itching or discharge should be interpreted cautiously and always corroborated with microscopy/culture or other diagnostic tests. Finally, these associations must be read in the light of study limitations—cross-sectional design, reliance on self-reported symptoms, unequal subgroup sizes (which can inflate prevalence estimates in small strata), and potential confounding by age, pregnancy, medical history, or recent self-medication—so while the symptom analysis identifies useful clinical signals, definitive diagnostic and management decisions should be guided by laboratory confirmation and consideration of the patient's broader clinical and epidemiologic context. This finding aligns with Nyirjesy *et al.* (2022), which reported that dyspareunia and dysuria may accompany vulvovaginal candidiasis but that clinical presentations are heterogeneous, no single symptom reliably distinguishes infection from asymptomatic carriage, and laboratory confirmation is therefore essential. Similarly, our work aligns with Satora *et al.* (2023), who reported that vulvovaginal candidiasis is often associated with dyspareunia and occasionally dysuria, whereas pruritus and vaginal discharge are nonspecific indicators requiring laboratory confirmation for accurate diagnosis. In another previous study, Achkar and Fries (2011), observed that while dyspareunia and dysuria frequently correlate with vulvovaginal candidiasis, symptoms such as itching and abnormal discharge lack specificity and must be confirmed by culture or microscopy for reliable diagnosis.

Age-specific analysis showed that *C. albicans* infection was widely distributed across reproductive age groups, but with a clear gradient of risk in younger women. The highest prevalence occurred among participants aged 18–24 years, where 41 of 58 women (70.7 %) were culture-positive. This was followed by the 25–34 year group, in which 34 of 63

women (54.0 %) harboured the organism. Prevalence declined further in the 35–44 year bracket to 17 of 34 women (50.0 %), and dropped to its lowest level among those aged 45 years and above, where only 6 of 18 women (33.3 %) were positive. Chi-square analysis showed that these differences were statistically significant ($p = 0.042$; $\chi^2 = 8.216$), suggesting a meaningful correlation between age and the likelihood of *C. albicans* colonization or infection. Bitew and Abebaw (2018) observed that women aged 18–24 years showed a markedly higher prevalence of vulvovaginal candidiasis than older age groups, emphasizing that younger age is an important risk factor for Candida colonization. Similarly, Mbakwem-Aniebo *et al.* (2020), observed that women under 25 had the highest rates of *C. albicans* isolation, with prevalence declining steadily with increasing age.

The elevated rates in the youngest group may reflect a combination of biological and behavioural factors. Women in late adolescence and early adulthood typically experience higher oestrogen levels, which favour glycogen deposition in the vaginal epithelium and promote growth of Candida species. This age range is also associated with higher sexual activity and, in some cases, inconsistent contraceptive use or limited prior exposure to health education, all of which can increase vulnerability to genital infections. By contrast, the gradual decline in prevalence observed from the mid-thirties onwards could be linked to lower hormonal stimulation, increased mucosal immunity with age, or lifestyle changes such as more stable partnerships and greater health-seeking behaviour. Bitew and Abebaw (2018), reported that elevated estrogen levels and sexual activity in younger women contribute to higher Candida colonization, whereas declining hormone levels and improved mucosal defenses reduce prevalence in older age groups.

It is noteworthy, however, that a substantial proportion of women over 35 still carried the organism, underscoring that candidiasis is not confined to younger demographics and remains clinically relevant throughout the reproductive lifespan. The cross-sectional nature of the data and potential confounders—including pregnancy status, medical history, and prior antifungal use—limit causal inference, but the trend strongly suggests that younger age, particularly under 25 years, is an independent risk factor for vaginal *C. albicans* infection in this population. Besides, Bitew and Abebaw (2018) found that although younger women exhibited the highest rates of vaginal Candida colonization, significant infection persisted among women over 35, indicating ongoing risk across the reproductive lifespan.

Analysis of prevalence by pregnancy status revealed a pronounced association between *C. albicans* infection and pregnancy. Among the pregnant participants, 33 of 48 women (68.8 %) were culture-positive, compared with 65 of 125 non-pregnant women (52.0 %). The difference was statistically significant ($\chi^2 = 4.192$, $p = 0.041$), indicating that pregnancy is a notable risk factor for vaginal colonization or infection with *C. albicans*.

The higher prevalence observed in pregnant women can be attributed to the hormonal and physiological changes that occur during gestation. Increase in the concentrations of oestrogen and progesterone increase vaginal deposition of glycogen and acidic vagina, conditions that enhance the growth of Candida species. Pregnancy is also accompanied by a relative depression of cell-mediated immunity, a necessary adaptation to prevent foetal rejection, but one that can compromise mucosal defence mechanisms against opportunistic fungi. These factors together create an environment highly conducive to yeast overgrowth. Our data is at par with Kumwenda *et al.* (2019) report, which found a significantly higher occurrence of vaginal Candida colonization among pregnant women, attributing it to increased estrogen levels and reduced cell-mediated immunity during pregnancy. Bitew and Abebaw (2018) in their study documented elevated rates of *C. albicans* infection in pregnant women and linked the increase to gestational hormonal changes and immune modulation.

While the prevalence among non-pregnant women was lower, it remained substantial, demonstrating that *C. albicans* infection is common across both groups and should not be overlooked in routine gynaecological care. Nonetheless, the significantly greater burden among pregnant women highlights the importance of regular antenatal screening and timely antifungal treatment to prevent complications such as vulvovaginal candidiasis, discomfort during pregnancy, and potential adverse outcomes for both mother and infant. Moreover, in a recent study Aboagye *et al.* (2025), who emphasized that *C. albicans* infections remain frequent among non-pregnant women but occur more often during pregnancy, underscoring the need for antenatal screening and prompt treatment. Bitew and Abebaw (2018), in their study reported a higher prevalence of vulvovaginal candidiasis among pregnant women compared with non-pregnant counterparts and recommended routine antenatal screening to reduce maternal and neonatal complications.

The analysis of *C. albicans* prevalence in relation to the marital status of pregnant women demonstrated a clear difference between single and married participants. Among

pregnant women who were married, 63 of 91 (69.2 %) tested positive for *C. albicans*, whereas only 35 of 72 single pregnant women (48.6 %) were culture-positive. This difference was statistically significant ($\chi^2 = 7.128$, $p = 0.008$), indicating that marital status was associated with the likelihood of infection during pregnancy.

Several factors may explain this disparity. Married women may have more frequent or regular sexual activity, which can influence vaginal microbiota and facilitate Candida overgrowth, particularly when combined with the hormonal changes of pregnancy that already favour fungal proliferation. Differences in health-seeking behaviour and hygiene practices between married and single women may also contribute; for example, some married women may use intravaginal products or contraceptive methods that disrupt the natural flora. Socio-cultural expectations, such as limited access to confidential reproductive health services for single pregnant women, might also influence both exposure risks and reporting, though these factors require further investigation. Our finding contrasts with Ikpeama *et al.* (2023), who reported no significant association between marital status and vaginal *C. albicans* infection during pregnancy, suggesting that factors other than marital status, such as sexual activity and hygiene practices, may play a more critical role. However, our observation aligns with Hussen *et al.* (2024), which observed increased prevalence of *C. albicans* among married women that are pregnant compared with single counterparts, attributing differences to sexual activity patterns and socio-behavioural factors that influence vaginal microbiota. Despite these underlying variables, the higher prevalence among married pregnant women underscores the need for targeted antenatal education and routine screening irrespective of marital status. Early detection and appropriate antifungal therapy can help prevent symptomatic vulvovaginal candidiasis and reduce complications that may affect maternal comfort and neonatal health. This observation aligns with the report of Roy *et al.* (2024), which emphasized the importance of routine antenatal screening and timely antifungal treatment for pregnant women to prevent symptomatic vulvovaginal candidiasis and associated maternal and neonatal complications, regardless of marital status.

The evaluation of *C. albicans* prevalence in relation to medical history revealed a pronounced influence of underlying health conditions. All participants with diabetes mellitus were culture-positive, giving a prevalence of 100 %, while 6 of the 8 women with HIV infection tested positive, corresponding to a prevalence of 75 %. When combined, these figures reflected an overall coinfection prevalence of 91.3 %. Statistical analysis

showed a significant association between medical history and *C. albicans* infection (χ^2 = 4.107, p = 0.043), indicating that pre-existing medical conditions markedly increased susceptibility.

These findings align with the established understanding that systemic diseases compromising immune function or altering host metabolism predispose individuals to opportunistic fungal infections. Diabetes mellitus, particularly when poorly controlled, elevates vaginal glucose concentrations and weakens local immune responses, creating an ideal environment for *Candida* proliferation. Similarly, HIV infection diminishes cell-mediated immunity, lowering the body's capacity to restrain fungal overgrowth. The observed difference between diabetic and HIV-positive participants may reflect the more direct metabolic effects of hyperglycaemia compared with the varied stages and treatment statuses of HIV infection. This finding aligns with Rodrigues *et al.* (2019), who reported that women with diabetes mellitus or HIV infection exhibit significantly higher rates of *C. albicans* colonization, highlighting the role of impaired immunity and altered metabolic conditions in predisposing to opportunistic vaginal infections. Likewise, another study by Achkar and Fries (2010), noted that underlying conditions such as diabetes and HIV significantly increase susceptibility to *C. albicans* infections due to impaired immune responses and metabolic alterations that favour fungal overgrowth.

The high prevalence underscores the clinical importance of vigilant screening and management of *C. albicans* among women with such medical histories, especially during pregnancy or in other situations where hormonal changes further enhance vulnerability. Proactive antifungal surveillance and strict glycaemic or viral load control are therefore essential strategies to reduce the burden of candidiasis in these high-risk groups. Our results aligns with the report of Rodrigues *et al.* (2019), who emphasized that women with diabetes or immunocompromising conditions require proactive screening and management of *C. albicans* infections, including careful control of glycaemia or viral load, to reduce the risk and severity of vulvovaginal candidiasis.

Analysis of socio-demographic factors demonstrated that marital status, educational attainment, and employment all influenced the prevalence of *C. albicans* infection, though the strength of association varied. Among the 163 women examined, married participants showed a higher prevalence (69.2 %) than single women (48.6 %), and this did not differ significantly (χ^2 = 7.128, p = 0.008). Education level also revealed a marked gradient (χ^2 =

26.689, $p < 0.001$): women with only primary education had the highest prevalence (87.9 %), closely followed by those with informal education (86.4 %), whereas women with secondary (52.2 %) or tertiary (41.9 %) education had substantially lower infection rates. Employment status, in contrast, was not significantly associated with infection ($\chi^2 = 0.750$, $p = 0.386$), even though unemployed women (58.2 %) showed a slightly higher prevalence than those employed (65.9 %).

These patterns point to the influence of social and educational determinants on susceptibility to *C. albicans*. The higher prevalence among married women may reflect increased sexual activity, hormonal changes linked to childbearing, or shared household environments that favor fungal colonization. More striking is the inverse relationship between education and infection: limited formal education often correlates with reduced awareness of genital hygiene, delayed healthcare seeking, and limited access to preventive measures, all of which can enhance the risk of persistent or recurrent candidiasis. Employment did not significantly modify prevalence, suggesting that economic activity alone is less critical than health literacy and behavioral practices. Our findings aligns with Bitew and Abebaw (2018), who reported that lower educational attainment and marital status are associated with higher prevalence of *C. albicans* infection, highlighting the role of socio-demographic and behavioral factors in influencing susceptibility to vulvovaginal candidiasis. Similarly, Faustino *et al.* (2025), who observed that women with lower levels of education and married status had higher rates of *C. albicans* infection, suggesting that health literacy and social determinants play a significant role in infection risk. Our observation also aligns with Edziah *et al.* (2025), who reported that socio-demographic factors, particularly lower educational levels and marital status, significantly influence the prevalence of *C. albicans* infections, emphasizing the impact of knowledge, hygiene practices, and behavioral factors on susceptibility.

Overall, these findings emphasize that interventions to reduce vulvovaginal candidiasis must go beyond clinical management to address educational outreach and community health promotion. Targeted health education campaigns, particularly for women with little or no formal schooling, could significantly lower infection rates by improving understanding of genital hygiene, early symptom recognition, and the importance of timely medical treatment. Moreover, Edziah *et al.* (2025) in their study reported that reducing the burden of vulvovaginal candidiasis requires not only clinical management but also community-based health education to improve awareness of hygiene

practices, symptom recognition, and timely healthcare seeking. Also, Bitew and Abebaw (2018), highlighted that health education and community outreach targeting women with limited formal schooling are critical strategies for reducing the prevalence of vulvovaginal *C. albicans* infections.

Evaluation of behavioral and lifestyle risk factors revealed several significant associations with *C. albicans* prevalence. Women who reported using feminine hygiene products had a markedly higher infection rate (70.5 %) compared with those who did not (53.9 %), and this difference was statistically significant ($\chi^2 = 4.372$, $p = 0.037$). Awareness of candidiasis also influenced outcomes: participants unaware of the infection had a prevalence of 75.6 %, significantly exceeding the 54.9 % seen in those who were aware ($\chi^2 = 5.480$, $p = 0.019$). Treatment practices further shaped infection rates. Self-medication was linked to the highest prevalence (74.3 %), followed by herbal therapy (53.3 %) and hospital treatment (48.7 %), with a strong overall association ($\chi^2 = 10.377$, $p = 0.006$). Pregnancy emerged as another major determinant, with pregnant women exhibiting a prevalence of 86.8 % compared with 52.0 % among non-pregnant women ($\chi^2 = 14.755$, $p < 0.001$). Other risk factors showed weaker or non-significant effects. Changing underwear infrequently (no regular change) yielded a prevalence of 70.6 %, compared with 50.0 % for those changing every three months and 54.2 % for every six months, a trend that approached but did not reach statistical significance ($\chi^2 = 5.417$, $p = 0.064$). Having multiple sexual partners was rare in the cohort (n = 3) and, although all three women were infected (100 %), the association was not statistically significant ($\chi^2 = 2.027$, $p = 0.155$) because of the small sample size. These findings highlight the importance of hygiene practices, health-seeking behavior, and reproductive status in the epidemiology of *C. albicans*. The elevated prevalence among users of feminine hygiene products suggests that such products may disrupt the vaginal microbiota, altering pH and facilitating fungal overgrowth. High infection rates among women lacking awareness underscore the value of education and early recognition of symptoms. The strong association with self-medication indicates that unsupervised treatment often involving incomplete or inappropriate antifungal use can foster persistence and recurrence of infection. Finally, the high prevalence in pregnancy aligns with the known hormonal and immunological changes of gestation that favor *Candida* colonization. Our observation aligns with Farahani *et al.* (2020), who reported that behavioral and lifestyle factors such as the use of intravaginal products, limited awareness of candidiasis, self-medication, and pregnancy significantly increase the

risk of *C. albicans* infection, highlighting the critical role of hygiene practices, health education, and professional care in preventing vulvovaginal candidiasis. Moreover, Aboagye *et al.*(2025), highlighted that improper hygiene practices, unsupervised antifungal use, and lack of awareness are key behavioral risk factors that increase susceptibility to *C. albicans* infection, particularly among pregnant women, underscoring the importance of education and professional management. Collectively, these results point to the need for community education programs focused on safe hygiene practices, avoidance of unnecessary intravaginal products, and timely professional treatment to reduce the burden of vulvovaginal candidiasis.

CONCLUSION

Prevalence data revealed notable rates of *C. albicans* infections among women of reproductive age, with higher burdens observed in younger age groups, women with limited education, and those with specific behavioral and health-related risk factors.

Declarations

Ethical Approval and Informed consent

This study was approved by Federal University Teaching Hospital Wukari and Primary Healthcare Department, Wukari Local Government Council Ethical Committee.Written and verbal consent was obtained from all the participants of reproductive age 15 – 49 years.

Authors Contributions

A.E.J conceptualised and designed the study, conducted the field work, collected data, performed data analysis and interpretation and drafted the initial manuscript. H. A. I. J and R. W. A. provided critical reviews. All authors have contributed to and approved the final manuscript.

Conflict of interest

The authors declare no conflict of interest.

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REFERENCES

Abdullahi, B., & Danyaya, R. (2021). Prevalence of *Candida albicans* and *Trichomonas vaginalis* infection among women presenting with vaginitis in Jama'a Hospital, Samaru, Zaria, Nigeria. *Bayero Journal of Medical Laboratory Science, 6*(2), 69–77. https://www.ajol.info/index.php/bjmls/article/view/222017

Aboagye, G., Waikhom, S., Asiamah, E. A., Tettey, C. O., Mbroh, H., Smith, C., Osei, G. Y., Asafo Adjei, K., & Asmah, R. H. (2025). Antifungal susceptibility profiles of *Candida* and non-albicans species isolated from pregnant women: Implications for emerging antimicrobial resistance in maternal health. *Microbiology Spectrum, 13*(7), Article e00787-25. https://doi.org/10.1128/spectrum.00787-25

Achkar, J. M., & Fries, B. C. (2010). *Candida* infections of the genitourinary tract. *Clinical Microbiology Reviews, 23*(2), 253–273. https://doi.org/10.1128/CMR.00076-09

Agada, E. O., Ngwai, Y. B., & Ishaleku, D. (2021). Prevalence of *Candida albicans* among patients attending health care facilities in Nasarawa State, Nigeria. *FUW Trends in Science & Technology Journal, 6*(3), 953–959. https://www.ftstjournal.com/uploads/docs/63%20Article%2052.pdf

Ahmad, N. H. (2021). *Prevalence of trichomoniasis among patients attending Umaru Sanda Ndayako General Hospital Bida, Niger State, Nigeria* [Doctoral dissertation].

Ahmad, S., Boekhout, T., Al-Hatmi, A. M. S., Al-Harrasi, A., Khateb, A. M., Al Dhaheri, F., Bin Shuraym, H., Thomsen, J., Alobaid, K., Asadzadeh, M., Taj-Aldeen, S. J., Alwasel, S., Alfouzan, W., Khan, Z., & Salah, H. (2025). Epidemiology of candidemia, candiduria and emerging *Candidozyma (Candida) auris* across Gulf Cooperative Council countries and Yemen in the Arabian Peninsula. *Mycoses, 68*(6), Article e70073. https://doi.org/10.1111/myc.70073

Ali, M. Y. (2024). *Trichomonas vaginalis* parasite and its relationship with some inflammatory cytokines. *Journal of Science in Medicine and Life, 2*(3), 40–54. https://journals.proindex.uz/index.php/JSML/article/view/777

Anh, D. N., Hung, D. N., Tien, T. V., Dinh, V. N., Son, V. T., Luong, N. V., Van, N. T., Quynh, N. T. N., Tuan, N. V., Tuan, L. Q., Bac, N. D., Luc, N. K., Anh, L. T., & Trung, D. M. (2021). Prevalence, species distribution and antifungal susceptibility of *Candida albicans* causing vaginal discharge among symptomatic non-pregnant women of reproductive age at a tertiary care hospital, Vietnam. *BMC Infectious Diseases, 21*, Article 523. https://doi.org/10.1186/s12879-021-06192-7

Bitew, A., & Abebaw, Y. (2018). Vulvovaginal candidiasis: Species distribution of *Candida* and their antifungal susceptibility pattern. *BMC Women's Health, 18*, Article 94. https://doi.org/10.1186/s12905-018-0607-z

Cardoso, F. G., & Tasca, T. (2025). Advancements in vaginal microbiota, *Trichomonas vaginalis*, and vaginal cell interactions: Insights from co-culture assays. *Microbial Cell, 12*, 109–118. https://doi.org/10.15698/mic2025.05.849

Chiu, S. F., Huang, P. J., Cheng, W. H., Huang, C. Y., Chu, L. J., Lee, C. C., Lin, H. C., Chen, L. C., Lin, W. N., Tsao, C. H., Tang, P., Yeh, Y. M., & Huang, K. Y. (2021). Vaginal microbiota of the sexually transmitted infections caused by *Chlamydia trachomatis* and *Trichomonas vaginalis* in women with vaginitis in Taiwan. *Microorganisms, 9*(9), Article 1864. https://doi.org/10.3390/microorganisms9091864

Denning, D. W. (2024). Global incidence and mortality of severe fungal disease. *The Lancet Infectious Diseases, 24*(7), e428–e438. https://doi.org/10.1016/S1473-3099(23)00692-8

Edziah, F. S., Acheampong, P. R., Tawiah, P. A., Amengor, C. D., Kpene, G. E., Amponsah, G. O., Baffoe, P. A., Korankye, G., & Deku, J. G. (2025). Vulvovaginal candidiasis: Knowledge, practices and occurrence among pregnant women receiving antenatal care in a teaching hospital, Ghana. *Frontiers in Global Women's Health, 6*, Article 1647140. https://doi.org/10.3389/fgwh.2025.1647140

Eyong, E. E. J., Landred, K., Epse Njimated, N. O. N., & Katamssadan, T. H. (2023). Prevalence and risk factors of trichomoniasis in patients attending two medical centres in urban and rural areas in the North West Region, Cameroon. *International Journal of Biological and Chemical Sciences, 17*(3), 848–863. https://doi.org/10.4314/ijbcs.v17i3.8

Fallahi, S., Babaei, M., Rostami, A., Mirahmadi, H., Arab-Mazar, Z., & Sepahvand, A. (2020). Diagnosis of *Candida albicans*: Conventional diagnostic methods compared to the loop-mediated isothermal amplification assay. *Archives of Microbiology, 202*(2), 275–282. https://doi.org/10.1007/s00203-019-01736-7

Faustino, M., Ferreira, C. M. H., Pereira, A. M., & Carvalho, A. P. (2025). *Candida albicans*: The current status regarding vaginal infections. *Applied Microbiology and Biotechnology, 109*(1), Article 91. https://doi.org/10.1007/s00253-025-13478-2

Huang, S. H., Hsu, H. C., Lee, T. F., Fan, H. M., Tseng, C. W., Chen, I. H., Shen, H., Lee, C. Y., Tai, H. T., Hsu, H. M., & Hung, C. C. (2023). Prevalence, associated factors, and appropriateness of empirical treatment of trichomoniasis, bacterial vaginosis, and vulvovaginal candidiasis among women with vaginitis. *Microbiology Spectrum, 11*(3), Article e00161-23. https://doi.org/10.1128/spectrum.00161-23

Hussen, I., Aliyo, A., Abbai, M. K., & Dedecha, W. (2024). Vaginal candidiasis prevalence, associated factors, and antifungal susceptibility patterns among pregnant women attending antenatal care at Bule Hora University Teaching Hospital, Southern Ethiopia. *BMC Pregnancy and Childbirth, 24*, Article 619. https://doi.org/10.1186/s12884-024-06844-x

Ibáñez-Escribano, A., & Nogal-Ruiz, J. J. (2024). The past, present, and future in the diagnosis of a neglected sexually transmitted infection: Trichomoniasis. *Pathogens, 13*(2), Article 126. https://doi.org/10.3390/pathogens13020126

Ikpeama, R. A., Nyenke, C. U., Ohanu, C., Walson, B. T., & Onosakponome, E. O. (2023). Prevalence of vulvo-vaginitis and socio-demographic factors among women of reproductive age in Port Harcourt. *Current Research in Interdisciplinary Studies, 2*(5), 11–22. https://doi.org/10.58614/cris252

Karkowska-Kuleta, J., Kulig, K., Karnas, E., Zuba-Surma, E., Woznicka, O., Pyza, E., Kuleta, P., Osyczka, A., Rapala-Kozik, M., & Kozik, A. (2020). Characteristics of extracellular vesicles released by the pathogenic yeast-like fungi *Candida glabrata*, *Candida parapsilosis*, and *Candida tropicalis*. *Cells, 9*(7), Article 1722. https://doi.org/10.3390/cells9071722

Mbakwem-Aniebo, C., Osadebe, A. U., Athanasonny, E., & Okonko, I. O. (2020). Prevalence of *Candida* spp. and age-related disparities amongst women presenting with vaginitis at the Obstetrics and Gynaecology (O&G) Clinic in a tertiary hospital

in Port Harcourt, Nigeria. *African Health Sciences, 20*(1), 51–58. https://doi.org/10.4314/ahs.v20i1.9

Nisha, D., Fahmitha, F. H. F., Kaviya, G., Padmavathi, V., & Vijay, K. (2024). Global clinical case studies in *Candida* species: A review. *Asian Journal of Research in Biosciences, 6*(2), 143–156. https://journalbioscience.com/index.php/AJORIB/article/view/4

Nyirjesy, P., Brookhart, C., Lazenby, G., Schwebke, J., & Sobel, J. D. (2022). Vulvovaginal candidiasis: A review of the evidence for the 2021 Centers for Disease Control and Prevention sexually transmitted infections treatment guidelines. *Clinical Infectious Diseases, 74*(Suppl. 2), S162–S168. https://doi.org/10.1093/cid/ciab1057

Ormsby, M. J., Akinbobola, A., & Quilliam, R. S. (2023). Plastic pollution and fungal, protozoan, and helminth pathogens—A neglected environmental and public health issue? *Science of the Total Environment, 882*, Article 163093. https://doi.org/10.1016/j.scitotenv.2023.163093

Plagens-Rotman, K., Merks, P., Opydo-Szymaczek, J., Kędzia, W., & Jarząbek-Bielecka, G. (2022). STD-related sexual and gynaecological issues, including lesions of the genital organs and oral cavity. *Nursing in the 21st Century, 21*(3), 191–195. https://doi.org/10.2478/pielxxiw-2022-0029

Rodrigues, C. F., Rodrigues, M. E., & Henriques, M. (2019). *Candida* sp. infections in patients with diabetes mellitus. *Journal of Clinical Medicine, 8*(1), Article 76. https://doi.org/10.3390/jcm8010076

Roy, M., Majumdar, T., & Ray, J. (2024). Vulvovaginal candidiasis in pregnant women attending a tertiary care centre in North-Eastern India. *Indian Journal of Medical Microbiology, 52*, Article 100738. https://doi.org/10.1016/j.ijmmb.2024.100738

Sharma, M., & Chakrabarti, A. (2023). Candidiasis and other emerging yeasts. *Current Fungal Infection Reports, 17*(1), 15–24. https://doi.org/10.1007/s12281-023-00455-3

Shroff, S. (2023). Infectious vaginitis, cervicitis, and pelvic inflammatory disease. *Medical Clinics of North America, 107*(2), 299–315. https://doi.org/10.1016/j.mcna.2022.10.009

Verhoeven, P. O., Gonzalo, S., Memmi, M., Pozzetto, B., & Grattard, F. (2024). Agents associated with sexually transmitted infections. In W. B. Coleman & G. J. Tsongalis (Eds.), *Diagnostic molecular pathology: A guide to applied molecular testing* (2nd ed., pp. 147–158). Academic Press. https://doi.org/10.1016/B978-0-12-822824-1.00026-2

Yuan, D., Chen, W., Qin, J., Shen, D., Qiao, Y., & Kong, B. (2021). Associations between bacterial vaginosis, *Candida* vaginitis, *Trichomonas vaginalis*, and vaginal pathogenic community in Chinese women. *American Journal of Translational Research, 13*(6), 7148–7155. https://pmc.ncbi.nlm.nih.gov/articles/PMC8290683/