Ochekpe et al. *Afr. J. Clin. Exper. Microbiol.* 2026; 27 (3): 371 - 377 https://www.afrjcem.org

African Journal of Clinical and Experimental Microbiology. ISSN 1595-689X Jul 2026; Vol.27 No.3
AJCEM/2462. https://www.ajol.info/index.php/ajcem

Short Communication **Open Access**

Prevalence of vaginal *Candida albicans* among women attending Federal Medical Centre, Makurdi, Nigeria

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Abstract:

Background: *Candida albicans* accounts for the most common type of opportunistic fungal infection affecting human heath globally, with more than a billion cases annually. The prevalence is reportedly high in resource-limited settings. The aim of this study is to determine the prevalence of vaginal *C. albicans* among women attending Federal Medical Centre, Makurdi, Nigeria.
Methodology: Vaginal swab samples were collected from a total of 698 women attending both the Outpatient Department (OPD) and the HIV clinic at Federal Medical Centre, Makurdi. *Candida albicans* was isolated on Sabouraud Dextrose Agar, and confirmed by the germ tube test and growth on CHROMAgar plate.
Results: The isolation rate of *C. albicans* among the 698 selected women was 49.0% (n=342). The highest prevalence was among women aged 41–50 years (90.7%, n=78/86) and widowed (58.0%, n=29/50). Significant associations were observed between *C. albicans* prevalence and variables such as location (χ^2=15.497, p<0.0001), age (χ^2=207.35, p<0.0001), marital status (χ^2=7.833, p=0.0199), occupation (χ^2=14.668, p=0.0054), and HIV status (χ^2=6.578, p=0.0373)
Conclusion: Public health education programmes should be implemented to raise awareness about *Candida albicans* infections.

Keywords: *Candida albicans*, vagina, HIV status, occupation, age, gender, location

Received Oct 8, 2025; Revised Mar 22, 2026; Accepted Mar 23, 2026

Prévalence des vaginales *Candida albicans* chez les femmes consultant le Centre médical fédéral de Makurdi, au Nigéria

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Résumé:

Contexte: *Candida albicans* représente le type d'infection fongique opportuniste le plus fréquent à l'échelle mondiale, avec plus d'un milliard de cas par an. Sa prévalence est particulièrement élevée dans les pays à ressources limitées. Cette étude vise à déterminer la prévalence des candidoses vaginales à *C. albicans* chez les femmes consultant au Centre Médical Fédéral de Makurdi, au Nigéria.
Méthodologie: Des prélèvements vaginaux ont été effectués chez 698 femmes consultant au service de consultations externes et à la clinique VIH du Centre médical fédéral de Makurdi. *Candida albicans* a été isolé sur gélose Sabouraud dextrose et confirmé par le test de germination et la culture sur milieu CHROMAgar.
Résultats: Le taux d'isolement de *C. albicans* parmi les 698 femmes sélectionnées était de 49,0% (n=342). La prévalence la plus élevée a été observée chez les femmes âgées de 41 à 50 ans (90,7%, n=78/86) et chez les veuves (58,0%, n=29/50). Des associations significatives ont été observées entre la prévalence de *C. albicans* et des variables telles que la localisation (x^2=15,497, p<0,0001), l'âge (x^2=207,35, p<0,0001), la situation matrimoniale

(x^2=7,833, p=0,0199), la profession (x^2=14,668, p=0,0054) et le statut VIH (x^2=6,578, p=0,0373). **Conclusion:** Des programmes d'éducation à la santé publique devraient être mis en œuvre afin de sensibiliser la population aux infections à *Candida albicans*.

Mots-clés: *Candida albicans*, vagin, statut VIH, profession, âge, sexe, lieu de résidence.

Introduction:

Candidiasis is an infection caused by the overgrowth of pathogenic yeast from the *Candida* genus (1). Its prevalence accounts for the most common type of opportunistic fungal infection affecting human heath globally, with more than a billion cases annually (2,3). Typically, yeast can live harmlessly on the host's mucosal tissues, such as in the oral cavity, gastrointestinal mucosa and vaginal mucosa, unless balance is disrupted (4,5). The immunosuppressed, elderly population and palliative patients are highly susceptible to *Candida* infections (6). Oral candidiasis results in local oral pain and discomfort, enhanced oral dryness, loss of taste and aversion to food and may lead to secondary complications (7).

The distribution of *Candida* species in women can vary depending on geographical location, population demographics and other factors (8). *Candida* species are commonly found in the genital tract of women. Historically, *Candida albicans* has been the most prevalent *Candida* species in vaginal infections (9) and is a natural inhabitant of the human body, including the genital tract (10). It is typically responsible for uncomplicated vulvovaginal candidiasis (VVC) (2,10,11). It is important to note that the distribution of *Candida* species can change over time due to factors such as antimicrobial use, changes in sexual practices and the emergence of antifungal resistance (8).

Accurate identification of the causative *Candida* species is crucial for effective treatment, as different species may exhibit varying susceptibilities to antifungal medications (12). Additionally, the presence of non-albicans *Candida* species, which may be less responsive to standard treatments, underscores the importance of proper diagnosis and tailored therapy in the management of vaginal candidiasis (13, 14). The study was aimed at determining the prevalence of *Candida* species from women attending Federal Medical Centre, Makurdi, Nigeria

Materials and method:

Study area:

The study was carried out in Makurdi. Makurdi is the capital of Benue State. Makurdi lies between latitude 7° 43' 50" N and longitude 8° 32' 10" E. The town is divided into two major blocks by River Benue, hence, the North and South bank. Makurdi is inhabited predominantly by the Tiv and Jukun people. Makurdi being the State capital, has become a cosmopolitan city with people of different tribes as Idoma, Igede, Agatu, Etulo, Igbo, Hausa and Igala (15). Makurdi have an estimated population of 500,797 with a landmass of 16km radius (16).

Study participants:

The study participants include both symptomatic and asymptomatic women attending outpatient department (OPD) and HIV clinic of the Federal Medical Centre, Makurdi. A total of 698 women were enrolled in the study. Participants included both symptomatic and asymptomatic women.

Symptomatic participants were those presenting with clinical features suggestive of vulvovaginal candidiasis such as vaginal itching, discharge, irritation, and discomfort while asym ptomatic participants showed no obvious signs of infection due *Candida albicans* among different clinical categories.

Sample size determination:

Sample size was determined using this formula (17); $S= X^2 NP (1-P)/d^2 (N-1) + X^2P (1-P)$, where S= Sample size being sought, X^2 = table value for Chi-square at 1 degree of freedom at the desired alpha level (0.05=3.84), N = Population size, P = the population proportion (usually 0.05 as this provides the maximum sample size) and d = degree of accuracy desired, expressed as a proportion (usually 0.05).

Inclusion and exclusion criteria:

The study included women within the reproductive age group, who were symptomatic or asymptomatic for vaginal infections, and who gave consent to participate in the study. The following individuals were excluded from the study; women below the age of childbearing and women who did not provide consent.

Sampling technique:

A combination of purposive and random sampling techniques was employed. Purposive sampling was initially used to select eligible participants attending the OPD and HIV clinic based on the study criteria. Thereafter, random sampling was applied to ensure that participants were selected without bias, thereby improving the representativeness of the study population.

Data and sample collection:

Vaginal samples were collected from 698 women attending OPD and HIV clinic at Federal Medical Centre, Makurdi. The samples collected were appropriately labeled and were transported to the laboratory for inoculation and identification. In addition, data were collected directly from participants using a structured questionnaire.

The data included socio-demographic data (age, marital status, educational level, occupation), clinical data (presence or absence of symptom such as itching, discharge, irritation) and potential risk factors (antibiotic use, contraceptive use, hygiene practices, underlying disease conditions such as HIV).

Microbiological analysis and identification of *Candida:*

The samples were inoculated onto Sabouraud Dextrose agar and incubated at 37^0C for 24h. The colonies obtained were purified by sub-culturing onto ChromAgar *Candida* medium and incubated at 37^0C for 24 hours. The colonies obtained were sub-cultured repeatedly to obtain pure isolates**.** The presumptive isolates were identified using Gram stain and germ tube test as described by (18).

Statistical analysis:

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 29.0. Pearson's Chi-square test was used to determine associations between variables at 95% confidence level. A *p* value less than or equal to 0.05 was considered to be indicative of a statistically significant relationship.

Results:

The isolation rate of *Candida albicans* in the study population was 49.0% (n=342/698), while 51.0% (n=356/698) were negative. The HIV clinic had a higher prevalence rate (61.0%, n=122/200) than the outpatient department (44.2%, n=220/498). Isolation rate of *C. albicans* with respect to location is as presented in Fig 1. The difference in isolation rate of *C. albicans* with respect to location was statistically significant (χ^2=15.497, p<0.0001).

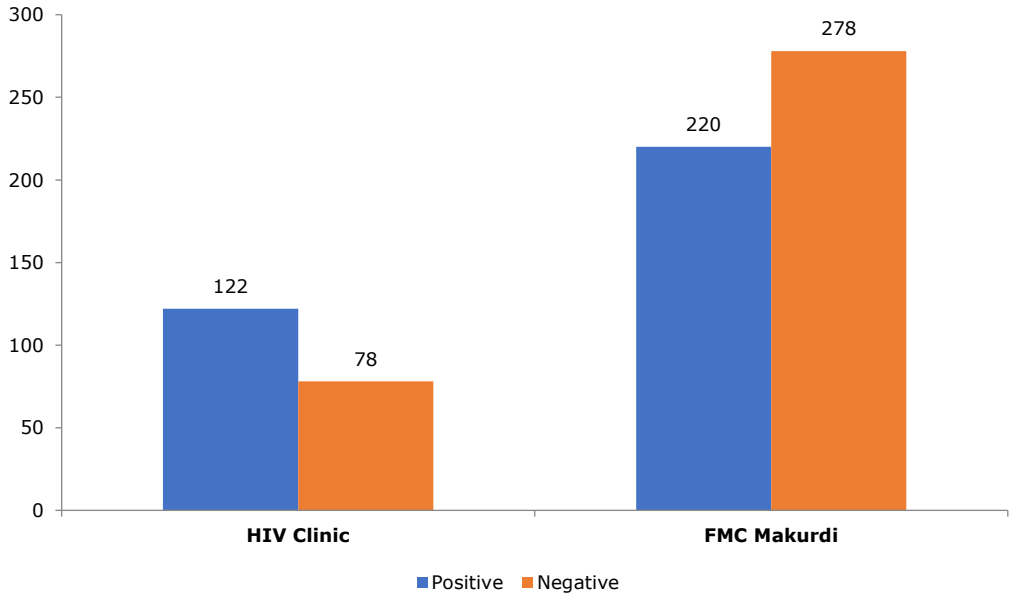

Fig 1: Frequency of *Candida albicans* with respect to location

Table 1: Bivariate analysis of prevalence of *Candida albicans* and socio-demographic and risk factors among women attending outpatient department and HIV clinic of Federal Medical Centre, Makurdi, Nigeria

Variables	No positive (%)	No negative (%)	Total	x^2	*p* value
Age group (years)					
≤20	27 (72.9)	10 (27.1)	37	207.35	<0.0001*
21-30	43 (20.7)	165 (79.3)	208		
31-40	106 (70.7)	44 (29.3)	150		
41-50	78 (90.7)	8 (9.3)	86		
51-60	76 (57.1)	57 (42.9)	133		
>60	12 (14.3)	72 (85.7)	84		
Marital status					
Single	90 (41.5)	127 (58.5)	217	7.833	0.0199*
Married	223 (51.7)	208 (48.3)	431		
Widowed	29 (58.0)	21 (42.0)	50		
Educational status					
Primary	21 (41.2)	30 (58.8)	51	2.854	0.4148
Secondary	114 (50.4)	112 (49.6)	226		
Tertiary	202 (48.8)	212 (51.2)	414		
None	5 (71.4)	2 (28.6)	7		
Occupation					
Civil service	138 (54.5)	115 (45.5)	253	14.668	0.0054*
Trading	137 (50.7)	133 (49.3)	270		
Farming	3 (75.0)	1 (25.0)	4		
Students	35 (34.3)	67 (65.7)	102		
Housewife	29 (42.0)	40 (58.0)	69		
Underwear type					
Pant	176 (49.7)	178 (50.3)	354	0.4359	0.8041
Short	85 (49.7)	86 (50.3)	171		
Tight	81 (46.8)	92 (53.2)	173		
HIV status					
Positive < 5 years	46 (52.9)	41 (47.1)	87	6.578	0.0373*
Positive ≥ 5 years	67 (58.8)	47 (41.2)	114		
Negative	229 (46.1)	268 (53.9)	497		
Symptoms					
Itching	49 (57.6)	36 (42.4)	85	3.798	0.2841
Discharge	5 (35.7)	9 (64.3)	14		
Itching + Discharge	123 (47.5)	136 (52.5)	259		
No symptoms	165 (48.5)	175 (51.5)	340		
Drug use history					
Prescribed drugs	154 (48.1)	166 (51.9)	320	2.875	0.4113
Over-the-counter drug	45 (56.3)	35 (43.7)	80		
Contraceptive drugs	19 (41.3)	27 (58.7)	46		
No drugs	124 (49.2)	128 (50.8)	252		
Total	**342 (49.0)**	**356 (51.0)**	**698**		

x^2 = Chi square; * = statistically significant at $p<0.05$

The prevalence of *C. albicans* across the socio-demographic and risk factors is shown in Table 1. The highest prevalence was in the age group 41-50 years with 90.7% (n=78/86) while the age group >60 years had the lowest prevalence of 14.3% (n=12/84). This difference in prevalence was statistically significant (χ^2=207.4, p<0.0001). The prevalence of *C. albicans* with respect to marital status showed that women who are widowed had the highest prevalence (58.0%, n=29/50) while the single women had the lowest prevalence (41.5%, n=90/217). The difference in prevalence was statistically significant (χ^2=7.833, p=0.0199).

The isolation rate of *C. albicans* with respect to educational status showed that women with no education had the highest isolation rate (71.4%, n=5/7) while those with primary education had the least prevalence (41.2%, n=21/51). The difference in isolation rate is, however, not statistically significant (χ^2=2.834, p=0.415). The prevalence of *C. albicans* with respect to occupation showed that women who are farmers had the highest rate of isolation (75.0%, n=3/4), followed by civil servants (54.5%, n=138/253), and traders (50.7%, n=137/270). In contrast, students had the lowest isolation rate of 34.3% (n=35/102). The

difference in isolation rates across the occupational groups was statistically significant (χ^2= 14.668, *p*=0.0054).

The prevalence of *C. albicans* with respect to nature of underwear showed that the highest isolation rate was among women who wear pants (49.7%, n=176/354) and shorts (49.7%, n=85/171) while the least isolation was among women who wear tights (46.8%, n=81/173). The difference in isolation rate with respect to underwear was not statistically significant (χ^2=0.4359, *p*=0.804). The isolation rate of *C. albicans* in relation to HIV status showed that those with HIV infection for ≥5 years had the highest isolation rate of 58.5% (n=67/114), followed by individuals with HIV infection for <5 years with 52.9% (n=46/87). HIV-negative individuals had the lowest isolation rate of 46.1% (n=229/497). The difference in isolation rates with respect to HIV status was statistically significant (χ^2=6.578, *p*= 0.0373).

The prevalence of *C. albicans* in relation to reported symptoms showed that highest isolation rate was observed among individuals experiencing itching (57.6%, n=49/85), while those with discharge had the lowest rate (35.7%, n=5/14). However, the difference in isolation rate across symptom types was not statistically significant (χ^2=3.798, *p*=0.284).

The prevalence of *C. albicans* in relation to drug use showed that patients who used over-the-counter drugs had the highest isolation rate (56.3%, n=45/80), while those who used contraceptive pills had the lowest isolation rate at 41.3% (n=19/46). The difference in isolation rate was, however, not statistically significant (χ^2=2.875, *p*=0.4113).

Discussion:

The study was aimed at determining the prevalence of vaginal *C. albicans* among women attending the Federal Medical Centre, Makurdi, Benue State. The findings revealed *C. albicans* isolation rate of 49.0%, indicating a significant public health challenge in the study area. The prevalence observed in this study is comparable to a previous study conducted in Owerri, Imo State, Nigeria, which reported rate as high as 57% among women (19). Oral candidiasis prevalence of approximately 20.5% has been reported among patients with haematological malignancies (20), while vulvovaginal candidiasis prevalence of up to 50.2% has been documented in Egypt (21). However, some studies focused primarily on antifungal resistance and molecular characteristics rather than prevalence (22, 23). The variations in rates could be attributed to differences in population characteristics, healthcare practices, or local antibiotic and contraceptive usage patterns. The public health implication of the high prevalence of *C. albicans* observed in this study suggests the need for heightened awareness and preventive measures in the region.

According to reports of World Health Organization, the majority of *C. albicans* cases occur in Asia, Africa and Latin America where abuse of antibiotics and oral contraceptives are highly prevalent (24). Patients that attended the HIV clinic had a higher prevalence of *C. albicans* compared to patients at the OPD. This disparity is likely attributable to immunosuppressive effects of HIV/AIDS, which predispose individuals to opportunistic infections such as candidiasis. These results emphasize the importance of targeted interventions, particularly among immunocompromised populations, to lessen the spread and impact of *C. albicans*. Regular screening, judicious use of antibiotics, and public health campaigns emphasizing preventive measures could play a crucial role in reducing the burden of candidiasis in the study area.

Patients in the age group 41-50 years had the highest prevalence of 90% (n=78/86), followed by age group <20 years (72.9%, n=27 /37), 31-40 years (70.7%, n=106/150) and least prevalence in >60 years (14.3%, n=12/ 84). This pattern of indicates that infection is not strictly confined to younger reproductive-age women but may extend into late reproductive and perimenopausal age groups. This finding is partially consistent with the observations reported in Edo state that higher burden of infection among sexually active age groups, although their peak prevalence was observed in younger women. The similarity lies in the fact that sexually active and hormonally dynamic age groups remain the most affected, even though the exact peak age differs. The higher prevalence in the 41-50 age group in this study may reflect prolonged exposure to risk factor, including repeated antimicrobial use, chronic underlying conditions, hormonal fluctuations associated with the perimenopausal transition (22). Similarly, the findings align with previous reports which indicate that middle-age women maintain substantial susceptibility to *Candida* infections, particularly in the predisposing factors such as diabetes, antibiotic misuse, and immunological changes. This supports the observation that susceptibility may extend beyond peak reproductive years, especially in populations experiencing high antimicrobial pressure or comorbidities (19).

Furthermore, the observed pattern is consistent with studies demonstrating that age-

related physiological changes, including oestrogen levels, alterations in vaginal microbiota, and reduced immune efficiency, significantly influence infection dynamics. These factors may explain the elevated prevalence observed in the 41-50 years age group, as this stage is often characterized by hormonal instability, which disrupts normal vaginal flora and promotes *Candida* overgrowth (25). The relatively high prevalence among individuals <20 years may be attributed to poor hygiene practices, immature immune responses, and early sexual exposure, while the low prevalence in those >60 years could be due to reduced sexual activity and lower estrogen-dependent glycogen availability, which claims *Candida* proliferation.

The findings of this study revealed several important demographic factors associated with the prevalence of *C. albicans*. Concerning marital status, the widow and married groups had significantly higher *C. albicans* isolation rate of 58.0% and 51.7% respectively, compared to single women with 41.5% (p=0.0199). This observation is consistent with previous reports, although variations in prevalence have been documented across different populations. For instance, a study conducted in Owerri reported a prevalence of 53.34%, while another study in Kano documented a prevalence of 45.7%, indicating a relatively high burden of infection among women of reproductive age (19,26). Similar trends have also been reported in other settings, although the magnitude of prevalence varies depending on geographical location, study population, and methodological differences.

Patients who frequently patronized over the counter medications had the highest rate of isolation rates of *C. albicans*. This is consistent with previous reports indicating that the misuse and overuse of antibiotics, as well as the use of oral contraceptives, are significant predisposing factors for *Candida* infection (19,26,27).

Conclusion:

In conclusion, the findings of the study revealed a high *Candida albicans* isolation rate of 49.0%, indicating a significant public health challenge from vaginal candidiasis. The rate of *C. albicans* infection showed preponderance of HIV clinic over OPD attendees. The study has also highlighted a statistically significant association between prevalence of *C. albicans* and demographic factors such as the age groups, marital status, location and occupation in the study area, with the highest prevalence occurring among women aged 41-50 years and among widowed and married women. However, no statistically significant association was observed between *C. albicans* isolation rate and educational status, type of underwear, symptoms and history of drug use. A synergistic (combination) therapeutic approach should be taken into consideration in the treatment of infection caused by *Candida albicans*.

Acknowledgements:

The authors acknowledge Prof. (Mrs.) Umeh Ebelle Uchenna and Prof. Amali Okwoli for their guidance. The authors also appreciate the support of their colleagues and the enabling environment provided by the University.

Contributions of authors:

OOS, UEU and AO conceived and designed the study; OOS and AP carried out sample collection and laboratory analyses; AAA and AP performed data analysis and interpretation; OOS drafted the manuscript; UEU, AO and OIO critically revised the manuscript for important intellectual content; and AAA served as the corresponding author. All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Source of funding:

No funding was received for the study

Conflict of interest:

Authors declare no conflict of interest.

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