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Comparative Analysis of *Candida albicans* Prevalence among Pregnant and Non-pregnant Women across Age Groups Attending the Gynaecology Clinic in Lafia

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Abstract

Candida albicans is a common fungal pathogen frequently associated with infections in women, especially during pregnancy due to hormonal and immunological changes. This study aimed to determine the prevalence of *Candida albicans* among pregnant and non-pregnant women attending the gynaecology clinic at Dalhatu Araf Specialist Hospital (DASH), Lafia. A total of 100 women (50 pregnant and 50 non-pregnant) were examined. High vaginal swabs (HVS) were collected and cultured on Sabouraud Dextrose Agar (SDA) and CHROMagar. Isolates were examined microscopically using Gram staining, presumptively identified by germ tube test, and confirmed by sugar fermentation and incubation at 45°C. Data were analyzed using the chi-square (χ^2) test. The overall prevalence of *Candida albicans* was 64.0%. Pregnant women showed a higher prevalence (72.0%) than non-pregnant women (56.0%), although the difference was not statistically significant (χ^2 = 1.00, p = 0.317). Age-related analysis revealed the highest prevalence among pregnant women in the 26–35 age group (80.0%), while the 18–25 age group had high and comparable rates in both groups (69.2% in pregnant, 70.8% in non-pregnant). However, the association between age and colonization was also not statistically significant (χ^2 = 1.52, p = 0.468). *Candida albicans* colonization was more prevalent in pregnant women, especially those aged 26–35, although the differences across groups were not statistically significant. Routine screening and preventive strategies remain essential, especially for women at increased risk.

Keywords: *Candida albicans*, prevalence, pregnancy, non-pregnant women, vaginal swab, fungal infection

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Introduction

Candidiasis is a globally occurring infection found in both developed and developing nations. It manifests as thrush, invasive candidiasis, or vaginal candidiasis. *Candida albicans* is a fungus which causes a secondary infection known as candidiasis in mostly individuals with some underlying immune-compromised conditions [1]. This organism is the most incriminated in candidiasis of the urogenital tract. Other Candida species include *Candida tropicalis*, *C. stellatoides*, *C. parapsilopsis*, and C. *crusei*. They are also called non-*Candida albicans* (NCA) [2]. *Candida* spp is the most common cause of vaginitis that affects millions of women yearly [3]. Few women complain of vaginal discharge, discomfort, or odour without any objective finding [4]. Such women may be motivated by a neurotic fear of uncleanness, guilt concerning sexual activities, or anxiety about venereal disease, whether or not sexual exposure has taken place. Several vaginal infections present with few or no symptoms and yet produce serious effects and can be transmissible to other people. *Candida* infections in the vaginal area are frequently referred to as "Vulvovaginal candidiasis" (VVC) or "*Candida vaginitis*" [5].

Vulvovaginal candidiasis (VVC) is an opportunistic mucosal infection and the second most common vaginal infection affecting women of reproductive age [6]. It affects more than 75% of women at least once in their lifetime, with approximately 50% of them also suffering a single recurrence [7]. The clinical symptoms and manifestations of VVC include cottage cheese-like vaginal discharge, swelling, pruritus, pain, irritation, burning sensation, dyspareunia, and dysuria [8].

Diabetes mellitus, pregnancy, and the use of tight nylon underwear have been found to enhance the overgrowth of *Candida albicans* in a manner that the body's defense mechanisms cannot control [9, 10]. Immune imbalances and changes in the dynamic environment inside the woman's vagina especially increased temperature and pH promote the pathogenesis of the yeast. Vaginal candidiasispredisposes women to other sexually transmitted infections such as HIV/AIDS [9]. Candidiasis can also lead to infertility, pelvic inflammatory disease, and preterm labour. This can be very fatal, especially in pregnant women.

Candidiasis remains a common yet under-recognized cause of morbidity among women, presenting with symptoms that can significantly disrupt daily life. If left untreated, infections may progress to serious

complications such as pelvic inflammatory disease, infertility, and preterm labor. Despite its high prevalence, critical gaps persist in understanding the risk factors, optimal diagnostic strategies, effective treatment, and preventive measures, especially across different demographic groups. Conducting a prevalence study among pregnant and non-pregnant women is therefore essential to enhance understanding of the burden and distribution of *Candida* infections. Findings will support the development of targeted, evidence-based guidelines for prevention, diagnosis, and management, ultimately improving clinical outcomes, reducing healthcare costs, and enhancing the quality of life for affected women. Moreover, such research contributes to broader efforts addressing the growing public health challenge posed by fungal infections globally.

This study aimed to determine the prevalence of candidiasis among pregnant and non-pregnant women attending the gynecology clinic at Dalhatu Araf Specialist Hospital (DASH) Lafia, Nasarawa State.

Materials and Methods

Study design

This study adopted a cross-sectional design aimed at determining the prevalence of *Candida albicans* colonization among pregnant and non-pregnant women. Here, high vaginal swabs (HVS) were collected from women attending the Gynaecology Clinic at Dalhatu Araf Specialist Hospital (DASH) Lafia, Nasarawa State. The study involved the simultaneous examination of samples from 100 participants (50 pregnant and 50 non-pregnant women) without any follow-up. Laboratory investigations, such as culture, microscopic examination, and biochemical testing, were performed to identify the presence of *Candida albicans*. The relationship between infection rates and factors such as pregnancy status and age group was analyzed using statistical tests. This design provided a clear picture of the burden of candidiasis within the target population during the study period

Study area

This research was carried out at the Gynaecology Unit of Dalhatu Araf Specialist Hospital Lafia, Nasarawa state (DASH). The hospital is a referral health facility that manages patients from different localities in Nasarawa state and neighbouring states. The hospital has a central location in the middle belt region of Nigeria. The state lies between latitude 7° 45` and $9^{\circ}$ 25`N of the equator and between longitude 7° and 9°37` E of the Greenwich meridian. It shares boundary with Kaduna state in the North, Plateau state in the East, Taraba and Benue state in the South while Kogi and Federal Capital Territory flanks in the West most of the population are civil servant, traders, animal and crop farmers (National Population Commission, 2006; Federal Republic of Nigeria, 2009).

Study population

The study population comprised pregnant and non-pregnant women attending the gynaecology unit at Dalhatu Araf Specialist Hospital (DASH). Women with signs and symptoms of any underlying disease, which might interfere with the expected results were excluded from this study.

Ethical considerations

Ethical clearance was obtained from the Ethical Research Committee of Dalhatu Araf Specialist Hospital (DASH), Lafia, Nasarawa State, Nigeria, with approval number DASH/REC/424.

Sample collection

A total of 100 samples of High Vaginal Swabs (HVS) was used for this study. Samples were collected by the nurses in charge. These samples were transported to the Microbiology laboratory and processed within 3 h of collection.

Laboratory analysis

Culture: The collected samples were streaked on Sabouraud Dextrose Agar (SDA) and were incubated at 37ºC for 24 h. Growths on the SDA plates were observed, and the colonial morphology of the isolates studied. The pure colonies obtained from SDA were subcultured on CHROMagar Candida and incubated at 30°C for 48 h. The medium selectively identified the isolates as *Candida albicans* based on their morphology and distinctive green coloration.

Growth at 45°C

Growth at 45ºC is a valuable test for distinguishing *Candida dubliniensis* (which does not grow) from *Candida albicans* (which exhibits growth) [11]. Colonies that appeared green on CHROMagar were further confirmed using a temperature test on SDA, with incubation at 45ºC and daily growth assessment for 10 days.

Gram-staining: Gram-staining was carried out to help identify yeast cells (*Candida* species); following strict guidelines/Steps according to [12].

Germ tube test: A loopful of the pure colonies of the yeast was suspended in a test tube containing 0.5 ml human serum and incubated at 35ºC for 2 h. A drop of the incubated suspension was placed on a clean, grease-free slide, covered with a glass cover slip, and observed under ×10 and x40 objective lens. The formation of small, tube-like extensions or filaments emerging from the cell surface served as confirmation of germ tube production and helps to determine the dimorphic nature and pathogenic potential of *Candidaalbicans*.

Sugar fermentation test

To assess the fermentation ability of Candida isolates, one gram (1 g) each of galactose, glucose, maltose, lactose, and sucrose was dissolved in 1 ml of double-distilled water in separate test tubes. The solutions were inoculated with Candida isolates and supplemented with phenol red as an indicator. The test tubes were then incubated at 30°C for 48 h, after which color changes were observed to determine sugar fermentation activity.

Statistical analysis

Data were analyzed using Statistical Package for Statistical Product and Service Solutions (IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp). All tests were two-tailed with a P-value <0.05 considered statistically significant. Descriptive

statistics were expressed as frequencies and percentages while χ^2 tests were used to compare difference in proportion of isolates between pregnant and non-pregnant women and across age bands.

Results and Discussion

Table 1 presents the prevalence of *Candida albicans* isolated from pregnant and non-pregnant women. Out of the 50 samples obtained from pregnant women, 36 were positive, yielding a prevalence rate of 72.0%. Among the 50 non-pregnant women, 28 tested positive – corresponding to a prevalence rate of 56.0%. The overall prevalence across the study population was 64.0%. Statistical analysis using the Chi-square test showed no significant association between pregnancy status and *Candida albicans* colonization ($\chi^2 = 1.00$, p = 0.317).

Table 1: Prevalence of *Candida albicans* in pregnant and non-pregnant women

Participant Group	Number Examined	Number of positive case	Prevalence (%)
Pregnant Women	50	36	72.0
Non-pregnant Women	50	28	56.0
Total	100	64	64.0

$\chi^2 = 1.00$, $P = 0.317$

Table 2 illustrates the age-related prevalence of *Candida albicans* among pregnant and non-pregnant women. In the 18–25 age group, 39 pregnant and 24 non-pregnant women were examined. Among them, *C. albicans* was isolated from 27 (69.2%) of the pregnant women and 17 (70.8%) of the non-pregnant women, yielding a combined prevalence of 69.8%. In the 26–35 age group, 10 pregnant and 21 non-pregnant women participated, with *C. albicans* detected in 8 (80.0%) of the pregnant and 10 (47.6%) of the non-pregnant women, resulting in a combined prevalence of 58.1%. For the 36–45 age group, the sample included 1 pregnant and 5 non-pregnant women. The single pregnant participant tested positive (100.0%), while 1 (20.0%) of the 5 non-pregnant women was positive, giving a combined prevalence of 33.3%. Overall, out of 100 participants, 64 (64.0%) were positive for *Candida albicans*. However, Chi-square analysis showed no statistically significant association between age group and *Candida albicans* colonization ($\chi^2 = 1.52$, p = 0.468).

Table 2: Prevalence of *Candida albicans* among pregnant and non-pregnant women by age group

Age Group	Pregnant Participants		Non-pregnant Participants		Total Participants	Total positive cases (%)
	No. of participants	Positive cases(%)	No. of participants	Positive cases(%)		
18–25	39	27 (69.2%)	24	17 (70.8%)	63	44 (69.8)
26–35	10	8 (80.0%)	21	10 (47.6%)	31	18 (58.1)
36–45	1	1 (100.0%)	5	1 (20.0%)	6	2 (33.3)
Total	**50**	**36 (72.0%)**	**50**	**28 (56.0%)**	**100**	**64 (64.0)**

$\chi^2 = 1.52$, $P = 0.468$

This study evaluated the prevalence of *Candida albicans* among pregnant and non-pregnant women to determine the potential influence of pregnancy on fungal colonization. As shown in Table 1, *Candida albicans* was isolated in 36 out of the 50 pregnant women examined, resulting in a prevalence rate of 72.0%. According to existing literature, vaginal colonization by *Candida* species during pregnancy is estimated to range between 10 and 50% [5]. The prevalence observed in this study is notably high and aligns closely with the 63.83% reported by Menza *et al.* [13] in Kenya. However, it is significantly higher than the prevalence rates reported by Nwachukwu *et al.* [10] (36.67%), Aghedo *et al.* [14] (30.5%), and Ohale *et al.* [15] (29.4%).

In contrast, among the 50 non-pregnant women, *Candida albicans* was isolated in 28 cases, corresponding to a prevalence of 56.0%. This figure is higher than that reported by Anh *et al.* [16] (51.3%), Aghedo *et al.* [14] (18%), Nwachukwu *et al.* [10] (16.66%), and Ohale *et al.* [15] (13.68%). The overall prevalence across both groups was 64%, indicating a considerable burden of infection within the studied population. This finding is similar, though higher, than the 53.34% reported by Nwachukwu *et al.* [10].

Statistical analysis using the chi-square test revealed no significant association between pregnancy status and *Candida albicans* colonization ($\chi^2 = 1.00$, p = 0.317). Although pregnant women had a higher prevalence compared to non-pregnant women, the difference was not statistically significant. This suggests that while physiological changes during pregnancy—such as increased oestrogen levels, glycogen accumulation, and altered immune responses—may promote fungal colonization, pregnancy alone may not serve as a strong independent risk factor within this population. Nonetheless, the high prevalence among pregnant women remains clinically relevant, as untreated infections can lead to complications such as vulvovaginal discomfort, premature rupture of membranes, and an elevated risk of neonatal candidiasis. These findings underscore the need for routine screening and timely intervention to mitigate potential adverse outcomes during pregnancy.

Despite a lower prevalence in non-pregnant women (56%), the infection rate remains substantial. This implies that other risk factors—such as antibiotic use, poor hygiene, diabetes mellitus, and immunosuppressive conditions—may also predispose non-pregnant women to *Candida albicans* colonization. Therefore, this study emphasizes the importance of monitoring infections in both groups, with a particular focus on pregnant women due to their comparatively higher, though statistically non-significant, prevalence.

Table 2 presents the prevalence of *Candida albicans* among pregnant and non-pregnant women across various age groups. Among women aged 18–25 years, the prevalence was 69.2% in pregnant participants and 70.8% in non-pregnant participants, showing a comparable distribution. This suggests that younger women, regardless of pregnancy status, may be more susceptible to *Candida albicans* colonization, potentially due to hormonal fluctuations and lifestyle factors. The overall 69.8% prevalence in the 18–25 age group which recorded the highest age-specific prevalence among the participants in this study is higher than the 29.17% reported by Nwachukwu *et al*. [10] and 26.6% by Hussen *et al*. [17]. The overall prevalence among pregnant women in this age group reinforces the need for awareness and prevention efforts targeting younger reproductive-age women.

In the 26–35 age group, a more pronounced disparity was noted, with 80.0% prevalence in pregnant women compared to 47.6% in non-pregnant women. This supports the idea that pregnancy amplifies susceptibility to *Candida albicans* colonization in this reproductive age bracket, likely due to hormonal surges and metabolic changes that create a more favourable environment for fungal growth. Although the observed difference was notable, the chi-square test ($\chi^2 = 1.52$, $p = 0.468$) showed no significant association between age group and colonization, limiting the ability to draw definitive conclusions. In a similar research, Aghedo *et al*. [14] also reported the highest prevalence (24%) in the 26–35 age group, which corresponds to the period of highest fertility and sexual activity in Nigerian society [18]. The overall prevalence among pregnant women in this age group (58.1%) is comparable to the 46.1% (ages 25–30) and much higher than 15.8% (ages 31–36) reported by Hussen *et al*. [17], and the 12.50% reported by Nwachukwu *et al*. [10].

The 36–45 age group had the smallest sample size, limiting interpretability. The sole pregnant participant in this group had a 100% prevalence, while only 20.0% of non-pregnant participants tested positive for *Candida albicans*. Despite the limited data, this may suggest that pregnancy-associated vulnerability persists into later reproductive years, though susceptibility may decline with reduced hormonal activity. The overall prevalence among pregnant women in this group (33%) was higher than the 8.33% reported by Nwachukwu *et al*. [10] and the 11.7% reported by Hussen *et al*. [17] for women over 36 years.

However, chi-square analysis did not reveal a significant association between age group and colonization status ($\chi^2 = 1.52$, $p = 0.468$), suggesting that age was not a statistically significant determinant of *Candida albicans* colonization in this study. While trends in age-specific prevalence were observed, these findings underscore the role of additional factors—such as host immunity, microbiota balance, hygiene, and behavioural practices—in influencing colonization risk.

Conclusion

This study demonstrates a high prevalence of *Candida albicans* colonization among both pregnant and non-pregnant women, with pregnant women showing a higher rate (72.0%) compared to non-pregnant women (56.0%). However, the association between pregnancy and colonization was not statistically significant. Age-specific analysis identified the highest prevalence (80.0%) among pregnant women aged 26–35 years, though this too lacked statistical significance. These findings highlight the importance of continued surveillance, preventive education, and routine screening—especially among high-risk populations—to reduce the burden and complications associated with *Candida albicans* infections.

Conflict of interest: The authors declare none.

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