



Preliminary Survey on the Prevalence of Vaginal Candidiasis among Women Contraceptive Users Attending a Tertiary Health Facility in Kano Metropolis, Northern Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author MUA conceived the idea, designed the study and wrote the protocol. Authors MUA, NHN and SMY conducted the sampling, culturing and microscopy. Authors UAU and NHN did the statistical analysis and wrote the first draft of the manuscript. Authors MIH and AIS did the literature searches.

Article Information

DOI: 10.9734/ISRR/2018/40926

Editor(s):

(1) Kailash Gupta, Division of AIDS, NIAID, NIH, USA.

Reviewers:

(1) Wagner Loyola, Brazil.

(2) E. O. Oluwole, College of Medicine of the University of Lagos, Nigeria.

Complete Peer review History: <http://www.sciencedomain.org/review-history/24502>

Original Research Article

Received 14th February 2018

Accepted 23rd April 2018

Published 7th May 2018

ABSTRACT

The prevalence of *Candida albicans* infection in women attending Muhammadu Abdullahi Wase specialist Hospital was investigated in relation to use of contraceptives. A total of 100 high vaginal swabs were collected and examined for *Candida albicans* infections using wet preparation, germ tube test and Gram-staining. A structured questionnaire was administered to the study subjects to derive information on contraception practice. The study revealed an overall infection prevalence of 13.0%, without significant association with the use of contraceptives ($P>0.05$), frequency of contraception ($P>0.05$), age-groups (years) of the subjects ($P>0.05$), and type of marriage; polygamy (13.04%) and monogamy (12.99%) ($P>0.05$). However, infection prevalence was found

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only among age-groups 21-25 (20.0%), 26-30 (8.7%) and 31-35 (20.0%). Prevalence of *Candida albicans* infection concerning a type of contraceptive use is: injection (11.63%), pills (16.67%), implants (36.36%) and IUDs (0.0%), while non-users had 7.14% with the statistically significant association ($P < 0.05$). The findings revealed little influence of contraception on the prevalence of vulvovaginal candidiasis due to *C. albicans* infection with the IUDs even playing safer than other methods of contraception used by the study population.

Keywords: *Candida albicans*; prevalence; contraceptives; polygamy; monogamy.

1. INTRODUCTION

Candida albicans is the most common human fungal pathogen and is naturally found in healthy human digestive and reproductive tracts as commensals [1,2]. *Candida* has recently garnered much attention due to its potential to cause life-threatening systemic infections. Additionally, *Candida albicans* has become a common issue in hospitals, especially in intensive care units where close quarters allow for pathogens to spread rapidly [3]. Fungal infections have always been difficult to treat, especially in patients with weakened or compromised immune systems [4]. In pregnancy, vaginal candidiasis is common due to altered pH and sugar content in vaginal secretions [5]. Increased estrogen level during pregnancy produces more glycogen in the vagina and it also has a direct effect on yeast cells, causing it to grow faster and stick more efficiently with the walls of the vagina. The incidence of candidiasis is almost doubled in pregnant women particularly in the third trimester compared to the non-pregnant women. It has been estimated that up to 40% of pregnant women worldwide may have vaginal colonization by *Candida* species [6]. Vulvovaginal candidiasis is a significant cause of morbidity, especially in the pregnant population. It can cause abortion, candida chorioamnionitis and subsequent preterm delivery [7]. Candidiasis can also be transmitted through sexual intercourse or from mother to infants, during delivery or breastfeeding. It could be by contact with excretions of mouth, skin, and faces from patients or carrier; dissemination candidiasis may originate from mucosal lesions, unsterile narcotic injections, catheters [8]. Several factors can be associated with increased rate of vaginal colonization by *C. albicans*. These include pregnancy, use of high estrogen content and oral contraceptives [9,10], uncontrolled diabetes mellitus [10,11], prolonged use of broad-spectrum antibiotics [12] which kill the beneficial bacteria, lactobacilli, allowing yeast overgrowth, poor dietary habits and poor personal hygiene. Risk factors associated with *Candida albicans*

infections are pregnancy, use of contraceptives, menstruation [1,2], abuse of antibiotics [13], wearing tight underwear [14], inadequate vaginal therapy [15], maternal complications in STIs, and urinogenital tract infections [16]. Several *Candida* species are commensals and colonise the skin and mucosal surface of humans. Critically ill or otherwise immunocompromised patients are more prone to develop both superficial and life-threatening *Candida* infections [17]. *Candida albicans* is the predominant cause of invasive fungal infections [18] and represent a serious public health challenge with increasing medical and economic importance due to the high mortality rates and increased costs of care and duration of hospitalization [19,20]. Poor social economic status, inadequate knowledge, lack of diagnostic facilities and shortage of effective treatment all contribute to the high incidence of sexually transmitted and reproductive tract infections [21,22]. Candidiasis is the most common opportunistic fungal infection [3] with the prevalence appearing to be on the increase [23], and in Nigeria about 28 million women are affected [24]. Such increase may suggest multiple interacting risk factors for the infection [25], hence the need to determine the role of contraception on the prevalence of the disease.

2. MATERIALS AND METHODS

2.1 Study Population

The study was carried out at Muhammad Abdullahi Wase Specialist Hospital, Kano, and the entire women who constituted the study subjects were mostly Hausa by tribe and Muslim by faith that have a belief in polygamous type of marriage attending the family planning clinic and the laboratory of the hospital. The subjects enrolled in the study were between 16 and 45 years of age and of different family background. Out of this population, purposive sampling was used to select 100 subjects who consented to participate in the study and who fit the criteria of the study population, such as the use of any type of contraceptive during recruitment, or

discontinue usage for some time due to some reasons. The sample size was determined based on the speculation on the number of women practicing contraception because of difficulty in acceptance of the contraception practice mainly for religious and traditional beliefs as well as difficulty in convincing and having consented volunteers after painstaking explanation of the study as it involved examination of reproductive tract. Those subjects not using contraceptives were used as control.

2.2 Ethical Clearance

For adherence to ethical consideration, consent for strict and confidential use of information was sought, and was formally granted. After this, the participants were given a pre-test counseling for STIs by a trained counselor. As the research involved ethical issues, consent and approval was requested and received from Kano State Hospital Management Board, Director Medical and Ethical Committee of the hospital and the study subjects.

2.3 Questionnaire Administration

A structured questionnaire was designed for the purpose of this research and administered to consented individuals of child-bearing age (16 to 45 years). The questionnaire contained the necessary information on demography and risk factors relevant to the research objectives such as marital status, parity, contraception and type of contraceptives used.

2.4 Collection of Samples

Prior to sample collection, 70% alcohol was swabbed in the area to remove any bacterial contaminant. A total of 100 high vaginal swab (HVS) samples were collected from the study subjects. Sterile cotton wool swabs were used in collecting the high vaginal swab (HVS) samples. The vaginal smear was obtained from a posterior fornix of the vagina using sterile swab sticks labeled accordingly. The collected HVS samples were screened the presence of yeast using 3 different procedures for accuracy of the result.

2.5 Wet Preparation

Sabouraud Dextrose Agar (SDA) supplemented with 0.05mg/mL chloramphenicol, to avoid contamination, was put in a petri dish after preparation, and was preserved inside the fridge, when the sample was taken the media is put

inside the drying oven for it to dry and then allow it to cool, then the media was inoculated with the sample taken on the swap stick after that the place inoculated was strike all-over the media using wire loop and it was kept upside down inside the incubator at 37°C for 3 days for culturing. After culturing the media the sample was taken using wire loop and put on a glass inside in a drop of normal saline and covered with a coverslip and viewed under light microscope for identification of the yeast cells using ×10 objective. By the end of incubation period, colonies of *C. albicans* appear as creamy, pasty and smooth, and have a yeasty odour [26].

2.6 Gram Staining

A drop of sterile physiological saline was put on a glass slide and a colony from the culture was picked from the media plate using a wire loop and put inside the drop of normal saline on the glass slide, was allowed to air dry, put it in a rake, and methyl violet poured on it for 60 seconds, and water poured until the reagent had gone from the slide, the slide was drained, Lugol's iodine poured for 60 seconds, water poured and drained, acetone poured, water poured and drained, safranin poured for 2 minutes and water poured and drained, then it was kept on the rack to air dry. It was viewed under the light microscope after putting a drop of immersion oil on the slide using ×10 objective for presence of any yeast.

2.7 Germ Tube Test

One milliliter (1ml) of human blood serum was taken using a pipette and placed inside the test tube, and using a sterile wire loop a cultured *C. albicans* colony on the SDA was transferred in to the test tube and incubated at 37°C for 3 hours. A drop of yeast-serum suspension was placed on microscopic glass slide, covered with cover slip and viewed under the microscope for identification of *Candida albicans*. Presence of germ tube without constrictions at the yeast origin confirmed *C. albicans* infection [26].

2.8 Data Analysis

Descriptive statistics was used in the analysis of the data, and this involves the use of tables and percentages. Inferential statistics involving chi-square test was also used to determine the possible relationship among the variables of the study.

3. RESULTS

3.1 Prevalence of *Candida albicans* Infection

The result in Table 1 shows an overall prevalence of 13.0%, with infection prevalence among 21-25, 26-30, and 31-35 age groups each with 9.0%, 2.0% and 2.0% prevalence of *C. albicans* infection of 20.0%, 8.7% and 20.0% respectively. No infection was detected in age-groups ≤ 20 and ≥ 36 years. There was no significant association between age-group and prevalence of *Candida albicans* infection among the subjects ($\chi^2 = 12.00$, $P = 0.29$). Hence, age-group and *Candida albicans* infection are independent among the study subjects. The record of the prevalence of *Candida albicans* infection in relation to the type of marriage is presented in Table 2 which shows that 23% in polygamous marriage as against 77% that are monogamous. The result revealed a prevalence of infection in 13.04% and 12.99% in the subjects practicing polygamous and monogamous marriage respectively. There was no significant association between infection prevalence and type of marriage ($\chi^2 = 2.00$, $P = 0.15$).

3.2 Prevalence of *Candida albicans* Infection in Relation to Contraception Practice

The results in Table 3-5 presented information on the use, type and frequency of contraception among the study subjects. Of the 72 subjects that practice contraception, 15.28% (11/72) are positive for *C. albicans* infection, while only 7.14% (2/28) of non-users are positive for the infection (Table 3) without statistical significance ($\chi^2 = 2.00$, $P = 0.15$). The result on the prevalence of *Candida albicans* infection and type of contraceptives used is reported in Table 4. Out of the 72 subjects that use contraceptives, 43% use injections, 12% use pills, 11% use hormonal implants and 6% use IUDs. The prevalence of infection was in the following trend;

11.63% (injections), 16.67% (pills) and 36.36% (implants). The highest infection was therefore among the subjects using hormonal implants. However, there was a significant difference between contraception type and *C. albicans* infection at $P < 0.05$. The result on the frequency of contraception among contraceptive users is presented in Table 5. Of the 72 positive cases, the frequency is 34.72% (not often), 56.94% (often) and 8.33% (very often) with infection prevalence of 16.0%, 7.32% and 66.67%, respectively, though without any significant difference ($P > 0.05$).

4. DISCUSSION

The findings of this research reveal that *Candida albicans* infection does not depend on age group, marriage type or occupation of the study subjects. However, there was a higher prevalence of infection among the respondents who are working and frequently using contraceptives, particularly implants and those practicing polygamous marriage with past history of sexually-transmitted diseases (STDs). This is in conformity with the reports by CDC [10] and Alli et al. [11] who attributed it to uncontrolled diabetes mellitus and prolonged use of broad-spectrum antibiotics and Mardh et al. [12] which found pregnancy to be significant in explaining *C. albicans* infection. However, the findings of this research that the use of contraceptives does not influence *C. albicans* infection sharply contradicts the assertion reaffirmed by Akah et al. [9] and Alli et al. [10] that the use of high oestrogen oral contraceptives is a significant factor in promoting vaginal candidiasis. On the prevalence of *Candida albicans* infections, the study observed that it does not correlate with type of marriage, use, type and the frequency of contraception. This partly contradicts the finding of Spinillo et al. [13] and Duerr et al. [27] that the Prevalence of *Candida albicans* infections is frequently correlated with the immunological status of host. It was also confirmed that the infection is the

Table 1. Prevalence of *Candida albicans* infection in relation to age-groups

Age group	No. examined	No. infected	%Prevalence
16-20	7	0	0.00
21-25	45	9	20.0
26-30	23	2	8.70
31-35	10	2	20.0
36-40	9	0	0.00
41-45	6	0	0.00
Overall Prevalence	100	13	13.0

$$\chi^2 = 12.00, P = 0.285$$

Table 2. Prevalence of *Candida albicans* infection in relation to Marriage Type

Marriage Type	No. Examined	No. Infected	%Prevalence
Polygamy	23	3	13.04
Monogamy	77	10	12.99

$\chi^2 = 2.00, P=0.157$

Table 3. Prevalence of *Candida albicans* infection in relation to using contraceptives by the respondents

Using Contraceptives	No. Examined	No. Infected	%Prevalence
Using	72	11	15.28
Not Using	28	2	7.14

$\chi^2 = 2.00, P=0.157$

Table 4. Prevalence of *Candida albicans* infection in relation to type of contraception

Contraceptives	No. Examined	No. Infected	%Prevalence
Condom (Femidom)	0	0	0.00
Injection	43	5	11.63
Pills	12	2	16.67
Abstinence	0	0	0.00
Withdrawal	0	0	0.00
Ferti. Awareness	0	0	0.00
Implants	11	4	36.36
IUDs	6	0	0.00
None	28	2	7.14

$\chi^2 = 24.00, P=0.02$

Table 5. Prevalence of *Candida albicans* infection in relation to frequency of contraception

Frequency of Use	No. examined	No. infected	%Prevalence
Not Often	25(34.72)	4	16.00
Often	41(56.94)	3	7.32
Very Often	6(8.33)	4	66.67

$\chi^2 = 3.00, P=0.22$

commonest fungal infection associated with HIV-infection in women [15,28,29,30]. However, within the sample of the study, it was found that *Candida albicans* infection is more prevalent among the respondents with history of STDs. This research reveals a 13% prevalence of *Candida albicans* infections which is not in tandem with the submission that the prevalence of *Candida albicans* infections appears to be on the increase [23], and in Nigeria, about 28 million women are affected [24]. Such increases may suggest multiple interacting risk factors for the infection [25]. Similarly, Sobel et al. [15] argued that although vaginal yeast infection is one of the commonest causes of opportunistic mucosal infections in human immunodeficiency virus (HIV) infected women, attention given to the infection is scanty and epidemiological data on its risk factors remain inadequately studied. In a study involving African women wearing tight

clothes, it was reported that there was a higher prevalence of vulvovaginal candidiasis due to *Candida albicans* than in those wearing loose clothing [10]. A similar observation was made in the study by Nwankwo et al. [6], where regular users of tight clothing had 88.2% of *Candida albicans* and occasional and non-wearers had 68.6% of *Candida albicans*. However, this study reveals that the use of IUDs, pills, implants and injection does not promote the risk of infection, and this is supported by previous researchers that poorly supported risk factors include use of sponge, intrauterine devices (IUDs), diaphragms, condoms, orogenital sex, douching and intercourse [10,12,31] and diet with high glucose content [9]. Probable evidence in favour of sexual transmission exists. For instance, penile colonization by *C. albicans* is four times more frequent in male partners of women affected with vulvovaginal candidiasis [10,32]

and infected partners commonly carry identical strains which orogenital transmission has been documented [9,10]. This supports the sexual transmission theory which postulates that sexual partner is the reservoir or a source of recurrent infection in women [33]. However, within the sample examined, it is evident that prevalence of *Candida albicans* infection is higher with the use of contraceptives and the frequency of usage, particularly, the use of implants (36.36%) among the study subjects.

5. CONCLUSION

Candida albicans occurs most commonly when the vagina is exposed to estrogen [34]. But there is no clear evidence as to whether the use of hormonal contraceptives increases the risk of *Candida albicans* infection. As Hedayati and Shafiei [3] suggested, the progestagen-only injectable may reduce a woman's susceptibility to recurrent *Candida albicans*, possibly because of its anovulatory effect and relative hypoestrogenism. This research revealed that *Candida albicans* infection does not depend on age group, marriage type or being working as infections were found among all the three most active age groups, with 9.0%, 2.0%, and 2.0% respectively. It is further found out that neither using contraceptives, the type of contraceptives used nor how often the contraceptives are used is a significant cause of *Candida albicans* infections. Similarly, the history of STDs of the subjects does not explain prevalence of *Candida albicans* infection in women attending Muhammadu Abdullahi Wase Specialist Hospital, Kano. Nevertheless there is higher prevalence of infection among those subjects working, using contraceptives very often, particularly implants, in polygamous marriage and with past history of STDs.

6. RECOMMENDATIONS

Based on the findings of this research we recommend the following strategies:

- i. Health personnel should enlighten patients on the nature and effects of using any type of contraceptives.
- ii. Developing a habit of improved personal hygiene irrespective of contraception practice.
- iii. Use of IUDs and pills in contraception practice as it relates to low infection prevalence of vaginal candidiasis.

- iv. Treating both partners and members of polygamous marriage with onset of infection in any single person.

ACKNOWLEDGEMENT

We acknowledge the contributions of the staff of the laboratory and family planning units of Muhammadu Abdullahi Wase Specialist Hospital, Kano, towards realisation of this research.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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