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Full Length Research Paper

HIV/vaginal candida coinfection: Risk factors in women

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To assess the association between candida and HIV infections in women from different socio-economic backgrounds, vaginal swabs were collected from 510 women (aged 9 - 83 years) attending secondary healthcare units in southern part of Benue State, Nigeria. *Candida albicans* was identified by microscopy. Candida infection rate was higher among HIV-infected women (88.8%, n = 116) than among HIV negative subjects (58.6%, n = 394) (X^2 = 36.077, p < 0.05; odds ratio = 5.59, 95% confidence interval (CI) = 3.03 - 10.297). Candida (yeast) infection was significantly associated with HIV infection in pregnant subjects (r = 0.504, p < 0.05), married (r = .290, p < 0.05), and unmarried women (r = 0.259, p < 0.05); in married women (and also unmarried women) vaginal yeast infection was significantly correlated/associated with HIV infection (p < 0.05). In other words, the higher the number of married women who were HIV+, the higher the number with candidal yeast infection; in women ≤ 39 years old (r = 0.399, p < 0.05), civil servants (r = 0.328, p < 0.05), self/unemployed (r = 0.281, p < 0.05), and among university and secondary school students (r = 0.263, p < 0.05). All diabetic women (100%, n=106) had yeast infection, although only 3.8% of them were HIV-infected. Intervention programmes against yeast infections in HIV-infected women should be targeted at the vulnerable groups of women.

Key words: HIV, candida infection, HIV/Candida co-infection, pregnancy, diabetes, Idoma women.

INTRODUCTION

Candida species especially *Candida albicans* are extremely ubiquitous yeasts that occur as part of the resident flora of the healthy human large intestine, vagina, or skin. They constitute the commonest fungal pathogens that affect humans causing either mucosal or systemic infections especially in immunocompromised persons. The vagina infection is characterized by vulvar pruritus, dysuria, dyspareunia, irritation, and soreness of the vulva; and is sometimes accompanied by erythematous and curdlike vaginal non foul smelling discharge. A change in the vaginal environment can cause the yeast to grow excessively, resulting in thrush (vaginal candidiasis). Risk factors associated with candida infections are pregnancy, use of oral contraceptives (Ref), menstruation (Ref) (Sagay et al., 2005; Talaro, 2005), abuse of antibiotics (Spinillo et al., 1995), wearing tight underwear (Elegbe and Elegbe, 1983), inadequate vaginal therapy (Sobel, 1985), maternal complications in STIs, and urinogenital tract infections (Enweani et al., 1987).

Prevalence of candida infections is frequently correlated with immunological status of host (Spinillo et al., 1994; Duerr et al., 2003), the infection being the commonest fungal infection associated with HIV-infection in women (Ogunshe et al., 2008; Sobel et al., 1998; Fidel and Sobel, 1996, Ocheni et al., 2000). For instance, most mucosal infections and vaginal discharge among HIV seropositive women are usually attributed to candida (Imam et al., 1990; Spinillo et al., 1994). HIV seropositive patients seem to be at a higher risk of the infection than controls (Spinillo et al., 1994). Duerr and his coworkers in 2003 reported a higher incidence and greater persistence of the infection in HIV-seropositive women. Similarly, Dahl et al. (1997) reported that *C. albicans* occurs as one of the common complications of HIV infection affecting HIV seropositive women. In Lagos, Nigeria, however, the studies of Anorlu et al. (2004) implicated *C. albicans* as a common cause of vaginal discharge among HIV-seropositive women; while in northern Nigeria, Sagay et al. (2005) found that candida infection is one of the predictors of HIV infection. The

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Table 1. Frequency of HIV and yeast infections in women attending a secondary healthcare unit.

Yeast infection	Frequency of yeast infection		Total (%)
	HIV+ (%)	HIV- (%)	
Yes	103 (88.8)	231 (58.6)	334 (65.5)
No	13 (11.2)	163 (41.4)	176 (34.5)
	100.0%	100.0	
Total	116 (22.7)	394 (77.3)	510 (100.0)

Correlation coefficient (r) = 0.266 ($p < 0.05$). Chi-square = 36.077 ($p < .05$); rate of coinfection = 30.8% (n = 334) among women who had candida infection.

prevalence of vaginal candida infections appears to be on the increase (Ogunbiyi et al., 2004), and in Nigeria about 28 million women are affected (Vanguard Newspapers, September 2008). Such increases may suggest multiple interacting risk factors for the infection (Ohmit et al., 2003). 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 (Sobel et al., 1998). Given the association between the yeast infection and HIV and the increase in the prevalence of HIV in Nigeria (Ogunbiyi et al., 2004; Anorlu et al., 2004). This study was carried out to determine some host-related risk factors that influence the association of HIV and vaginal yeast infection. The information obtained in this study may form part of the baseline information that could enhance better control of the two infections.

MATERIALS AND METHODS

Study area

The study site is semi-urban, and the inhabitants are mainly farmers, although some are civil servants, teachers and traders. Oturkpo, where the study was carried out, is a Local Government Area headquarters in Benue State, Middle-Belt, Nigeria.

Study population

The study population consisted mainly of Idoma speaking women (n = 510; aged 9 -83 years) of Benue State, Nigeria, who attended secondary healthcare institution (Oturkpo General Hospital, Oturkpo) for ante-natal care, and for genitourinary problems.

Sample collection

Vaginal swabs were collected by experienced hospital personnel between July and October 2008. The HIV status of each patient was determined by the HIV-1 and 2 dipstick comb assay, and the socio-demographic details such as: age, sex, marital status, level of education, and occupation were obtained through questionnaires distributed on sample collection. The diabetic status and pregnancy status of each patient was taken note of, including whether she was on oral contraceptives, or on antibiotic therapy.

Identification of yeasts

A thin smear of vaginal exudates on a sterile swab was made on a microscope slide. The smear was air-dried and gram-stained. Yeast cells appeared ovoid and Gram-positive with some of the cells having buds and attached to pseudohyphae. Yeast cells are much larger than staphylococcal cells.

Ethical clearance

Notes from the medical director of the hospital used permitted collection samples and information from patients.

Statistical analyses

SPSS version 15 was used for descriptive and inferential statistical analyse; associations between variables were determined using Pearson Correlation coefficients, and the relative importance of the independent variables were determined using regression analytical technique. Significance for the inferential analytical techniques were set at 0.05 level.

RESULTS

The rate of yeast colonization in HIV seropositive (HIV+) women was determined (By this, we mean vaginal yeast infection rate in women who were HIV positive). The overall prevalence of candida, HIV, and HIV/Candida infections were 22.7% (n = 510), 65.5% (n = 510) and 20.2% (n = 510) respectively.

As shown in Table 1, 88.8% of HIV-infected (HIV+) women had yeast infection, whereas 58.6% of HIV seronegative (HIV-) women had the infection. The correlation coefficient (r) for yeast and HIV infections was 0.266 ($p < 0.05$), and the odds ratio was 5.59 (95% Confidence Interval = 3.03 - 10.297). Table 2 presents the level of HIV and candida association in women belonging to different socio-economic groups. For example, 30 (20.5%) out of 146 pregnant women were infected with the yeast; and all (100%) the pregnant women who were HIV-infected had yeast infection, whereas only 15.3% of HIV seronegative pregnant women had yeast infection. HIV infection was significantly correlated with yeast infection in pregnant women ($r = 0.504$; $p < 0.05$) but not in non - pregnant women. Likewise, HIV infection was

Table 2. Association between yeast infection and HIV infection in different categories of women.

	Categories	HIV+ (%)	HIV- (%)	Candida = Yes (%)	N	Correlation coefficient
Pregnancy	Pregnant*	9 (100)	21 (15.3)	30 (20.5)	146	0.504
	Not pregnant	94 (87.9)	81.7 (210)	304 (83.5)	364	0.075
Diabetes	Diabetics	4 (100)	102 (100)	106 (100)	106	-
	Non-diabetics*	99 (88.4)	129 (44.3)	228 (56.6)	403	0.398
Contraceptive use	Users	51 (92.7)	60 (92.3)	111 (92.5)	120	0.008
	Non-users*	52 (85.2)	171 (52.0)	223 (57.2)	390	0.244
Antibiotic therapy	Yes	23 (92.0)	88 (77.9)	111 (81.9)	138	0.137
	No*	79(87.8)	143 (50.9)	222 (59.8)	371	0.323
Marital status	Married*	76(90.5)	168(57.1)	244 (64.6)	378	0.290
	Single*	27(36.0)	48(64.0)	75 (64.1)	117	0.259
	Widow	0	15(100)	15 (100)	15	-
Age	9 - 39 years*	50 (90.9)	39.0 (98)	148 (48.4)	306	0.399
	40 - 59 years	51 (87.9)	78 (90.7)	129 (89.6)	144	- 0.044
	60 - 69 years	2 (66.7)	34 (94.4)	36 (92.3)	39	- 0.278
	70 - 85 years	0	21 (100)	21 (100)	21	-
Educational level	Uneducated	3 (75.0)	19 (86.4)	22(84.6)	26	- 0.114
	Primary	7 (100.0)	20 (71.4)	27 (77.1)	35	0.272
	Secondary*	31 (91.2)	69 (66.3)	100 (72.5)	138	0.240
	Tertiary*	62 (87.3)	123 (51.3)	185 (59.5)	311	0.308
Occupation	Elderly/Aged	1 (100)	24 (100)	25 (100)	25	-
	Banker	0	2 (33.3)	2 (28.6)	5	- 0.258
	Civil servant*	35 (87.5)	63 (49.6)	98 (58.7)	69	0.328
	Student*	18 (90.0)	51 (57.3)	69 (63.3)	109	0.263
	Self/unemployed*	49 (90.7)	91 (61.5)	140 (69.3)	202	0.281

*Predictors with significant association between Yeast infection and HIV infection at 0.05 level.

significantly correlated with yeast infection in married women and single women; among those that were ≤ 39 years old; those in secondary and tertiary levels of education, and among civil servants and unemployed. On the contrary, both infections were not correlated among the diabetics, nor among those that use oral contraceptives, or in those on prolonged antibiotic therapy ($p > 0.05$).

The risk factors for candida infection are shown in Table 3. These include: age, educational status, diabetes, use of oral contraceptive, and prolonged use of antibiotics. These risk factors were also significantly related to candida infection in HIV seronegative women (except marital status) but not in HIV-infected women. In non-HIV women, marital status was a risk factor for candida infection; all widows were HIV seronegative and all of them had yeast infection. The estimated regression coefficients presented in Table 4 depict the relative importance of the predictor variables to HIV/yeast coinfection.

Diabetes and pregnancy had the highest coefficients and therefore were the most important risk factors as regards HIV/yeast coinfection. The regression coefficients of these predictor variables were however negative and implies that fewer diabetics (3.8%, n = 106) than non-diabetics (24.6%, n = 403) were coinfected. Likewise, a smaller proportion of pregnant women (6.2%, n = 146) than non-pregnant women (25.8%, n = 364) were coinfected. Nonetheless, the incidence of candida infection was higher among diabetics (100%, n = 106) than non-diabetics (56.6%, n = 403) thereby giving a positive coefficient; and among non-pregnant women (83.5%, n = 364) than pregnant ones (20.5%, n = 146) resulting in negative coefficients.

Table 3. Correlation coefficients of hypothesized risk factors for candida infection and HIV/Candida coinfections.

	Candidiasis	HIV/Yeast coinfection	HIV+ women	HIV- women
X-1	1	0.365(**)	1	1
X-2	- 0.070	.026	.086	- 0.102(*)
X-3	- 0.397(**)	.016	.091	- 0.473(**)
X-4	0.006	- 0.097(*)	- 0.086	0.050
X-5	0.162(**)	- 0.022	.026	0.203(**)
X-6	- 0.599(**)	- 0.221(**)	.103	- 0.642(**)
X-7	.371(**)	- 0.210(**)	0.067	0.496(**)
X-8	.315(**)	.308(**)	0.118	0.304(**)
X-9	.193(**)	- 0.051	0.055	0.248(**)
X-10	.365(**)	1	a	a

a = correlation cannot be computed because one of the variables is constant.
Key:X-1: Candidiasis. X-2: Marital status. X-3: Age re-categorized. X-4: Occupation of patients. X-5: Educational status. X-6: Pregnancy. X-7: Diabetes. X-8: Contraceptive use. X-9: Antibiotic use. X-10: HIV/yeast coinfection.

Table 4. Estimated regression coefficients of the predictor variables on infection status.

Predictor variables	Infection status (Dependent variables)		
	HIV	Candidiasis	HIV/Candida coinfection
Marital status	0.068 (1.620)	0.034 (.825)	0.052 (1.270)
Age re-categorized	- 0.116 (- 3.307)**	- 0.010 (- 0.289)	- 0.087 (- 2.544)*
Occupation of patients	- 0.061 (- 3.063) **	- 0.021 (- 0.1.050)	- 0.058 (2.971)**
Educational status	- 0.060 (- 2.212)*	.017 (.623)	- 0.050 (-1.858)
Pregnancy	- 0.292 (- 5.363)**	- 0.487 (- 9.099)**	- 0.227 (- 4.265)**
Diabetes	- 0.437 (- 7.195)**	0.246 (4.114)**	- 0.348 (5.858)**
Contraceptive use	0.108 (2.123)*	0.180 (3.592)**	0.142 (2.842)**
Antibiotic use	- 0.057 (- 1.435)	0.052 (1.334)	- 0.036 (0 - 0.939)
Constant	3.439**	1.342**	3.040**
F-statistic (ANOVA)	18.727**	45.663**	15.032**
R^2	0.231	.423	0.194

*coefficient is significant at 0.05 level; ** coefficient is significant at 0.01 level; Figures in parenthesis represent the t-statistics.

Oral contraceptive use was also another risk factor that had significant impact on both candida infection and HIV/Candida coinfection: 92.5% (n = 120) of women on oral contraceptive had yeast infection, compared to 57.2% (n = 390) that do not use oral contraceptives. In the same way, 42.5% (n = 120) of women on oral contraceptive had HIV/Candida coinfection, and only 13.3% (n = 390) of non-users of contraceptives had the coinfection.

DISCUSSION

This study attempted to assess the extent of relationship between HIV and Candida infections in women of different socio-economic groups. Overall, the rates of HIV, candida infection, and HIV/Yeast coinfection were high and support the report of Anorlu et al. (2004) that the prevalence of HIV in Nigeria is on the increase, more so, when an earlier study in another part of Africa (Kapiga et

al., 1994), recorded lower results.

The findings of this study indicate that vaginal candidiasis is common in HIV infected women, and as reported in previous studies (Imam et al., 1990; Spinillo et al., 1994; Dahl et al., 1997; Duerr et al., 2003; Anorlu et al., 2004), is significantly associated with HIV infection; the rate of the yeast infection occurring significantly higher in HIV infected women than in non-HIV ones. In fact, the significant difference in the occurrence rates is highlighted by the fact that the risk of yeast infection was almost six times as high in HIV infected women as in non-HIV women, implying that for every non-HIV women that had vaginal candida infection, there were about six HIV infected women that had the fungal infection. HIV infection reduces the immunity of the affected individual and increases the vulnerability of the patient to opportunistic infections such as candida infections. The association of candida infections with HIV infection in women of varying physiological and socio-demographic groups was examined. The strong association between the two infections in pregnant women is noteworthy, and is consistent with the report of Sagay et al. (2004). This finding portends pregnancy as a significant predictor of candida infection in HIV infected women. Hormone levels change dramatically during pregnancy and this change creates high levels of sugar in vaginal secretions. If the extra sugars are not broken down quickly, candida will use them to grow. Moreover, the stress brought about by pregnancy coupled with HIV infection is likely to weaken the immune system of the pregnant woman thereby increasing her vulnerability to opportunistic candida infections. Although, vaginal candidiasis has been implicated as a common infection during pregnancy (Cheesebrough, 2000), it is more so in HIV infected pregnant women.

Other groups of women presenting significant relationship between HIV and vaginal candida infections were married women, unmarried women, and young women below 40 years old including those in secondary and tertiary levels of education. As earlier reported by Patel et al. (2004), the rates of vaginal infections in these groups of women, were significantly higher in HIV infected ones than in non-HIV ones. Contrary to expectations, HIV infected women who were diabetic or currently on contraceptive pill or on antibiotic therapy appeared not to be at increased risk of yeast infection. These results lead us to believe that vaginal yeast infection may not be a risk factor for HIV infection among the diabetics, or among women on contraceptive pills or on antibiotic therapy: the rates of yeast infection in these groups of women were similar in both HIV infected women and in non-HIV ones. We also observed that risk variables associated with vaginal candida infections in HIV-seronegative women were not correlated significantly with the fungal infection in HIV infected women. This result indicates that in HIV infected women the risk factors for vaginal candida infection show no inter-group differences, that is, the yeast infection rates are similar irrespective of sub-groups differences. For example, the rate of candida infection is same among contraceptive pill users as among non-users of contraceptive pills, or same among married as among unmarried women. One possible explanation is that all HIV infected persons have destabilised immune system and therefore are equally vulnerable to all risks. It is also worthy of note that, as suggested by Dahl et al. (1997), the epidemiology of candida infection in HIV is complex. The results of the regression model indicate that pregnancy and diabetes were the predictor variables that had the strongest impact on the HIV/candida coinfection status. We recommend that, for effective control of candida infection among HIV-infected women, intervention programs should be targeted towards women in these vulnerable groups. In addition, stringent measures that could reduce the risk factors of the infections may need to be undertaken.

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