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Full Length Research Paper

CANDIDIA AND HIV CO-INFECTIONS AMONG WOMEN ATTENDING HIV CLINIC AT GENERAL HOSPITAL EZZANGBO, NIGERIA

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ABSTRACT

Candidiasis has been identified as a ubiquitous fungal infection commonly affecting people living with HIV/AIDS. This research ascertained the prevalence and risk factors for Oral and vaginal candidiasis among 180 HIV out-patients at Ebonyi State General Hospital, Ezzangbo. Oral and vaginal swabs were aseptically collected from the participants in duplicate. One of the swabs was streaked on Sabouraud's Dextrose Agar (SDA) and isolates were identified using macroscopic characteristics while the second swab was used for microscopic examination. Structured questionnaires were administered to participants to obtain risk factors associated with the infections. The antifungal susceptibility testing of the *Candida* isolates was performed using disc diffusion method. Data obtained was statistically analysed using Statistical Package for Social Scientist (SPSS). Results obtained from the study indicated 120(66.7%) were positive for Candidiasis; 31.7% was positive for only vaginal Candidiasis, 22.2% were positive for only oral Candidiasis while 12.8% had both. *Candida albicans* (CA) was dominant with 71% while none albicans *Candida* (NAC) was 29%. Isolates were most sensitive to Itraconazole and Griseofluvin and less sensitive to Ketoconazole, Nystatin and Fluconazole. The results of this study underlined essentials of good hygiene practices and importance of regularly assessing HIV patients for candidiasis.

Keywords: Candidiasis, HIV/AIDs, Risk factors, Ebonyi, Nigeria

INTRODUCTION

Candidiasis, also known as thrush or moniliasis, is one of the most typical HIV-associated opportunistic infections caused primarily by *Candida albicans* (Monika *et al.*, 2016). When cluster of differentiation 4 (CD4) levels are extremely low (below 200), candidiasis outbreaks can be quite dangerous. It has been reported that the prevalence of *Candida* infection during HIV infection is inversely connected to the patient's CD4 levels, which in turn rely on the usage of anti-retroviral therapy (Smith *et al*., 2018). One of the worst pandemics continues to be the human immunodeficiency virus (HIV) infection. Globally, 21.7 million individuals get antiretroviral medication, 1.8 million people contracted the virus for the first time, and 940,000 people died from HIV-related illnesses in 2017 (Adam, 2018; CDC, 2018; UNAIDS, 2019).

Nigeria has one of the highest rates of new HIV infections in Sub-Saharan Africa and the second largest globally (UNAIDS, 2019). Currently, 33% of Nigerians aged 15 to 49 (or 1.9 million people, or 1.4% of the population) do not know their HIV status. In Nigeria, there are about 130,000 new instances of HIV infection, 53,000 deaths from AIDS, about 55% of adults and 35% of children are receiving antiretroviral therapy (ART), and 80% of HIV-positive patients receiving ART have viral suppression. The highest prevalence rate, 5.6%, is found in Akwa Ibom State, while the lowest prevalence rates, 0.3%, are found in Jigawa and Katsina States. Particularly in Ebonyi State the study area, the frequency of 0.8% has been reported (NACA, 2020).

To lower the mortality and morbidity rates of infections caused by *Candida* species, particularly in patients with HIV infection, early detection of candidiasis is essential. It has been suggested that the first person to notice oral lesions may be a general practitioner or dentist, who may encourage the patient to get tested for HIV and perhaps benefit from early management (Naga *et al*., 2019). The examination for oral and vaginal candidiasis in HIV-positive women using Antiretroviral treatment (ART) will aid in identifying the primary *Candida* species responsible for the illness through proper characterisation. Identification of the risk factors for oral and vaginal candidiasis in HIV-positive females as well as the sensitivity profile of the *Candida* species to the existing antifungal medications are very crucial. It is unknown how frequently oral and vaginal candidiasis affects HIV-positive out-patient women receiving Antiretroviral treatment (ART) at Ebonyi State General Hospital, Ezzamgbo. Therefore, this study is necessary to bridge the knowledge gap of Candidiasis-HIV coinfection in this area.

Materials and Methods

Study Area: The study was carried out in Ebonyi State General Hospital, Ezzangbo which is one of the authorised facilities in the State for HIV/AIDS diagnosis. Preliminary surveillance revealed that, there are extensive and necessary documents and data regarding HIV patients in this facility. The hospital is located in the State's North province at roughly 6.3989^0N, 7.9615^0E Ebonyi State is located in South-East geopolitical zone of Nigeria located roughly at latitude 6°15’00’’N and longitudes 8° 05’ 00’’E. It has a landmass of about 5,932 square kilometres (EBMOI, 2014) and shares boundaries with Abia, Enugu, Cross River and Benue States. Igbo ethnic group make up the majority of the population estimated at 2,176,947 (NPC, 2006). With a 2.8% growth rate and a predicted population of roughly 3,242,500 for the

year 2022. Nigerians from other States also reside in different parts of the State.

Inclusion Criteria: Adult females with HIV who are getting treatment at Ebonyi State General Hospital Ezzangbo, who are able and willing to give informed consent are eligible to participate since the study sampling techniques required both an oral and vaginal swab. A total of 180 HIV-positive female adult patients at the clinic was each given a special participant identification number (PIN). Patients were addressed in regard to the research techniques and provided eligibility assessment to ensure they meet the criteria.

Exclusion Criteria: The following people were left out of the study: HIV-positive females under medication who have had antifungal treatment in the past two weeks, and HIV-positive females under 18 years.

Study Period: The duration of this study was from January to April 2022. A record of the patients who attended the weekly Anti-retroviral therapy (ART) clinic was kept throughout the study term. The patients' compliance with the therapy regimen was observed, and the findings were included in the socio-demographic data.

Study Population: A total of 180 HIV-positive adult female patients attending Ebonyi State General Hospital, Ezzangbo HIV clinic were the study population for this cross-sectional institutional-based research.

Sample size determination: The sample size of 180 for this research was calculated using the method described by Charan and Biswas (2013) method for calculation of different sample size in medical research using $N=Z^2PQ/d^2$ where: N=required sample size, Z=Standard normal variance at 5% ($P<0.05$) error or 95% confidence interval is 1.96P=Portion of the population of adult females HIV positive patients on ART clinic having Candidiasis from earlier study, Q=Portion of the population of adult females HIV positive patients on ART clinic without Candidiasis (1-P) and D=Absolute error Margin is 0.05

Ethical Approval: The Ebonyi State General Hospital Ezzangbo's ethics committee granted the ethical permission with approval details EBGHE/15/01/22 the study was conducted in accordance with the Nigeria Department of Health and Human Services' policies on human testing. Study was carried out in accordance with Good Clinical Laboratory Practice (GCLP) and Good Clinical Practice (GCP).

Collection of Survey Data: Prior to collecting samples, individuals were asked to complete a well-structured questionnaire to provide demographic and clinical data. There was a unique participant identification number (PIN) for each study participant. The biodata of the patients, such as name, age, educational level and marital status, was included in the first section of the questionnaire. The second section includes the history of candidiasis (such as poor breath, a white tongue, dry mouth, trouble swallowing, peculiar taste, vaginal discharge, vaginal itching, etc.), risk factors (if any), personal cleanliness, and medical care seeking behavior. Age, marital status, and ART use was used to stratify the research population. Data was gathered on the epidemiology and demographic trends of oral and vaginal candidiasis in HIV infection via responses to the structured questionnaire. All information gathered from participants were kept private and confidential then, using standardised formats the survey and clinic data was collated for analysis.

Collection, Transportation, and Storage of the Clinical Swab Specimens: With the aid of trained nurses each

research participant provided high vaginal swabs (HVS) and mouth swabs. Samples were aseptically collected in duplicate using swab sticks. Each participant's specimens were collected, and the specimen container was tagged with their Identification Number. All samples were brought as quickly as possible and without delay to the laboratory, where they were processed the same day, they were collected. The samples were stored in the refrigerator at 37ºC in cases where a delay was anticipated.

Laboratory Analyses of the Clinical Swab Specimens

Direct microscopy: Each patient had one of their duplicate swab sticks (mouth and vaginal swabs) stirred in 1ml of normal saline. Each sample was suspended in a drop on a distinct grease-free glass slide, gently covered with a cover slip to keep air bubbles out and examined under a microscope with 10x and 40x lenses. On a clean, grease-free slide, a drop of the suspension was applied before a drop of potassium hydroxide (KOH) was added. Using 10x and 40x objectives, the mixture was examined for Candida species after being combined and covered with a cover slip.

Culture of the Clinical Swab Specimens: Each patient's second duplicate oral and vaginal swabs were streaked on Sabouraud dextrose agar (SDA), which also included 50.0mg of chloramphenicol to prevent bacterial growth. The culture plates were incubated at 37^0C for 24 hours and checked for growth.

Identification of Candida isolates: The macroscopic characteristics of the fungal isolates from the oral and vaginal swabs, such as elevation, surface, colour, edge, and opacity, were used to identify the isolates. Microscopic analysis was performed with the methods described by Ochei and Kolhatkar (2006) for Wet mount, Permanent direct mount, Gram staining, and Germ tube test.

Symptomatic and Asymptomatic Candidiasis: In this study symptomatic candidiasis was the presence of one or more symptoms and indications that are consistent with oral and vaginal candidiasis together with the identification of *Candida* species in the oral and vaginal swab cultures of the study participants. While asymptomatic candidiasis was the finding of *Candida* species in the oral/vaginal swab cultures of the research participants in the absence of one or more symptoms and signs typical of oral/vaginal candidiasis

Antifungal Resistance testing of the Candida Isolates: Bauer *et al.* (1966) and Cheesbrough (2006)'s described modified Kirby-Bauer disc diffusion technique was used to assess the antifungal sensitivity pattern of the *Candida* isolates. The zones sizes of each antibiotic were analysed using the Interpretative Chart, and the isolates were reported as Resistant or Sensitive.

Data analysis: Microsoft Excel was used to enter the data gathered from the test procedures and the questionnaire. The statistical application SPSS-20.0 (Statistical Package for Social Scientist version 20.0) was used to conduct the statistical analysis. Tukey-kramer Multiple Comparisons and Chi-square, the prevalence rates of oral and vaginal candidiasis among adult females with HIV was compared to see if there were any significant difference. In order to establish the connection between the occurrence of candidiasis and related risk variables, data was also subjected to Spearman correlation and regression analysis to identify significant risk variables for candidiasis. The P-Value was set at 0.05.

RESULTS

The prevalence of oral candidiasis in relation to the sociodemographic details

of the research participants are displayed in Table 1. According to the age distribution of oral candidiasis, individuals between the ages of 34 and 41 had the highest incidence (8.3%), while participants between the ages of 18 and 25 had the least cases (2.2%). Regarding all of the demographic characteristics taken into consideration, there is no statistically significant difference (P>0.05) in the prevalence of oral candidiasis among the research participants.

Table 1: Frequency of oral candidiasis in relation to the demographics of participants

Demographics of participants	**Category**	**Examined**	**Positive for only oral candidiasis**	**Negative for only oral candidiasis**	***P-value**	χ^2
		No. (%)	No. (%)	No. (%)		
Age range (y)	18-25	18 (10.0)	4 (2.2)	14 (7.8)	0.086	8.167
	26-33	24 (13.3)	10 (5.6)	14 (7.8)		
	34-41	62 (34.4)	15 (8.3)	47 (26.1)		
	42-49	46 (25.6)	6 (3.3)	40 (22.2)		
	≥50	30 (16.7)	5 (2.8)	25 (13.9)		
Education	Informal	15 (8.3)	4 (2.2)	11 (6.1)	0.382	3.060
	Primary	30 (16.7)	9 (5.0)	21 (11.7)		
	Secondary	86 (47.8)	20 (11.1)	66 (36.7)		
	Tertiary	49 (27.2)	7 (3.9)	42 (23.3)		
Marital status	Single	8 (4.4)	2 (1.1)	6 (3.3)	0.000	43.14
	Married	62 (34.4)	7 (3.9)	55 (30.6)		0
	Divorced	15 (8.3)	10 (5.6)	5 (2.8)		
	Separated	10 (5.6)	8 (4.4)	2 (1.1)		
	Widow	85 (47.2)	13 (7.2)	72 (40.0)		
Residence	Urban	65 (36.1)	10 (5.6)	55 (30.6)	0.097	2.752
	Rural	115 (63.9)	30 (16.7)	85 (47.2)		
State of Origin	Ebonyi	98 (54.4)	15 (8.3)	83 (46.1)	0.006	14.26
	Enugu	40 (22.2)	8 (4.4)	32 (17.8)		4
	Anambra	30 (16.7)	10 (5.6)	20 (11.1)		
	Abia	8 (4.4)	5 (2.8)	3 (1.7)		
	Imo	4 (2.2)	2 (1.1)	2 (1.1)		
Total		**180 (100.0)**	**40 (22.2)**	**140 (77.8)**		

*P–value >0.05 is not significant. P- value < 0.05 is significant.

Table 2 shows the prevalence of vaginal candidiasis among the research participants in relation to their sociodemographic variables. 57(31.7%) had vaginal candidiasis. Individuals between the ages of 42 and 49 and those with a secondary education were found to have greater rates of vaginal candidiasis than other participants.

Table 2: Frequency of vaginal candidiasis in relation to the demographics of participants

Demographics of participants	**Category**	**Examined**	**Positive for only vaginal candidiasis**	**Negative for only vaginal candidiasis**	***P-value**	**χ^2**
		No. (%)	No. (%)	No. (%)		
Age range (y)	18-25	18 (10.0)	10 (5.6)	8 (4.4)	0.003	16.199
	26-33	24 (13.3)	9 (5.0)	15 (8.3)		
	34-41	62 (34.4)	15 (8.3)	47 (26.1)		
	42-49	46 (25.6)	20 (11.1)	26 (14.4)		
	≥50	30 (16.7)	3 (1.7)	27 (15.0)		
Education	Informal	15 (8.3)	7 (3.9)	8 (4.4)	0.429	2.769
	Primary	30 (16.7)	10 (5.6)	20 (11.1)		
	Secondary	86 (47.8)	23 (12.8)	63 (35.0)		
	Tertiary	49 (27.2)	17 (9.4)	32 (17.8)		
Marital status	Single	8 (4.4)	5 (2.8)	3 (1.7)	0.055	9.239
	Married	62 (34.4)	20 (11.1)	42 (23.3)		
	Divorced	15 (8.3)	7 (3.9)	8 (4.4)		
	Separated	10 (5.6)	5 (2.8)	5 (2.8)		
	Widow	85 (47.2)	20 (11.1)	65 (36.1)		
Residence	Urban	65 (36.1)	17 (9.4)	48 (26.7)	0.232	1.429
	Rural	115 (63.9)	40 (22.2)	75 (41.7)		
State of Origin	Ebonyi	98 (54.4)	29 (16.1)	69 (38.3)	0.044	9.774
	Enugu	40 (22.2)	20 (11.1)	20 (11.1)		
	Anambra	30 (16.7)	5 (2.8)	25 (13.9)		
	Abia	8 (4.4)	2 (1.1)	6 (3.3)		
	Imo	4 (2.2)	1 (0.6)	3 (1.7)		
Total		**180 (100.0)**	**57 (31.7)**	**123 (68.3)**		

*P–value >0.05 is not significant. P- value < 0.05 is significant.

Table 3 shows the frequency of co-occurrence of oral and vaginal candidiasis in connection to the sociodemographic traits of the research subjects. 23 (12.8%) of the 180 participants in the research who were investigated had both oral and vaginal candidiasis. The percentage with those of secondary education (5.6%) and those between the ages of 34 and 41 (4.4%) who also had oral and vaginal candidiasis was found to be higher than other categories of the study participants.

Table 3: Frequency of Oral and Vaginal candidiasis in relation to the demographics of participants

Demographics of participants	**Category**	**Examined**	**Positive for both oral and vaginal candidiasis**	**Negative for both oral and vaginal candidiasis**	***P-value**	**χ^2**
		No. (%)	No. (%)	No. (%)		
Age range (y)	18-25	18 (10.0)	3 (1.7)	15 (8.3)	0.638	2.538
	26-33	24 (13.3)	5 (2.8)	19 (10.6)		
	34-41	62 (34.4)	8 (4.4)	54 (30.0)		
	42-49	46 (25.6)	4 (2.2)	42 (23.3)		
	≥50	30 (16.7)	3 (1.7)	27 (15.0)		
Education	Informal	15 (8.3)	3 (1.7)	12 (6.7)	0.37	3.144
	Primary	30 (16.7)	6 (3.3)	24 (13.3)		
	Secondary	86 (47.8)	10 (5.6)	76 (42.2)		
	Tertiary	49 (27.2)	4 (2.2)	45 (25.0)		
Marital status	Single	8 (4.4)	0 (0.0)	8 (4.4)	0.028	10.83
	Married	62 (34.4)	5 (2.8)	57 (31.7)		4
	Divorced	15 (8.3)	5 (2.8)	10 (5.6)		
	Separated	10 (5.6)	3 (1.7)	7 (3.9)		
	Widow	85 (47.2)	10 (5.6)	75 (41.7)		
Residence	Urban	65 (36.1)	9 (5.0)	56 (31.1)	0.747	0.104
	Rural	115 (63.9)	14 (7.8)	101 (56.1)		
State of Origin	Ebonyi	98 (54.4)	8 (4.4)	90 (50.0)	0.098	7.829
	Enugu	40 (22.2)	10 (5.6)	30 (16.7)		
	Anambra	30 (16.7)	4 (2.2)	26 (14.4)		
	Abia	8 (4.4)	1 (0.6)	7 (3.9)		
	Imo	4 (2.2)	0 (0.0)	4 (2.2)		
Total		**180 (100.0)**	**23 (12.8)**	**157 (87.2)**		

*P–value >0.05 is not significant. P- value < 0.05 is significant.

Table 4lists the risk variables that the research participants experienced when oral and vaginal candidiasis occurred. All research participants were on HAART, and 176 (97.8%) of respondents reported taking their medicine on a consistent basis, while 4 (2.2%) reported doing so often. 40 (22.2%) of the 97.8% of patients who take their HAART treatments had oral candidiasis alone, 57 (31.7%) have vaginal candidiasis alone, and 23 (12.8%) have both oral and vaginal candidiasis.

The prevalence of both symptomatic and asymptomatic candidiasis among the research participants in (Figure 1) indicated that 19.2% had asymptomatic oral candidiasis while 14.2% had symptomatic oral candidiasis. However, 30.8% of women had asymptomatic vaginal candidiasis, 6.7% of women had both oral and vaginal candidiasis concurrently and 12.5% were asymptomatic oral and vaginal candidiasis carriers.

Also, antifungal sensitivity patterns of the *candida* isolates are shown in Figure 2. Of the 90 isolates, 64 *Candida albicans* and 26 non-albicans Candida were chosen, for antifungal susceptibility test, and 100% of the

examined isolates showed sensitivity to Itraconazole and Griseofulvin.

Table 4: Risk factors for oral and vaginal candidiasis among the study participants

Characteristics of participants	**Responses**	**Examined**	**Positive for only oral candidiasis**	**Positive for only vaginal candidiasis**	**Positive for both oral and vaginal candidiasis**	**Negative for both oral and vaginal candidiasis**	***P-value**
		No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
Adherence to HAART medication	Always	176 (97.8)	40(22.2)	57(31.7)	23(12.8)	56(31.1)	0.004
	Often	4 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	4 (2.2)	
Knowledge of candida as agent of oral and vaginal thrush	Yes	10 (5.6)	2 (1.1)	1 (0.6)	5 (2.8)	2 (1.1)	0.357
	No	170 (94.4)	38(21.1)	56(31.1)	18(10.0)	58(32.2)	
History of oral infection	Yes	20 (11.1)	8 (4.4)	7 (3.9)	3 (1.7)	2 (1.1)	0.019
	No	160 (88.9)	32(17.8)	50(27.8)	20(11.1)	58(32.2)	
History of vaginal infection	Yes	70 (38.9)	16 (8.9)	20(11.1)	10 (5.6)	24(13.3)	0.829
	No	110 (61.1)	24(13.3)	37(20.6)	13 (7.2)	36(20.0)	
Frequency of brushing	Once daily	120 (66.7)	30(16.7)	44(24.4)	20(11.1)	26(14.4)	0.000
	Twice daily	60 (33.3)	10 (5.6)	13 (7.2)	3 (1.7)	34(18.9)	
Sharing of toothbrush	Yes	6 (3.3)	1 (0.6)	0 (0.0)	5 (2.8)	0 (0.0)	0.078
	No	174 (96.7)	39(21.7)	57(31.7)	18(10.0)	60(33.3)	
Sharing of underwear	Yes	6 (3.3)	0 (0.0)	4 (2.2)	2 (1.1)	0 (0.0)	0.000
	No	174 (96.7)	40(22.2)	53(29.4)	21(11.7)	60(33.3)	
Sharing of sanitary facilities	Yes	130 (72.2)	32(17.8)	50(27.8)	19(10.6)	29(16.1)	0.078
	No	50 (27.8)	8 (4.4)	7 (3.9)	4 (2.2)	31(17.2)	
Frequency in changing underwear	Everyday	114 (63.3)	20(11.1)	40(22.2)	15 (8.3)	39(21.7)	0.042
	Every two days	16 (8.9)	5 (2.8)	6 (3.3)	4 (2.2)	1 (0.6)	
	Neither of the two	50 (27.8)	15 (8.3)	11 (6.1)	4 (2.2)	20(11.1)	
Nature of cleaning up after toileting	Back to front	35 (19.4)	5 (2.8)	7 (3.9)	3 (1.7)	20(11.1)	0.001
	Front to back	145 (80.6)	35(19.4)	50(27.8)	20(11.1)	40(22.2)	
Number of sexual partners	None	70 (38.9)	15 (8.3)	30(16.7)	11 (6.1)	14 (7.8)	0.000
	1	85 (47.2)	20(11.1)	20(11.1)	3 (1.7)	42(23.3)	
	1 - 2.	25 (13.9)	5 (2.8)	7 (3.9)	9 (5.0)	4 (2.2)	
Recent change of sexual partner	Yes	16 (8.9)	6 (3.3)	7 (3.9)	3 (1.7)	0 (0.0)	0.003
	No	164 (91.1)	34(18.9)	50(27.8)	20(11.1)	60(33.3)	
Uses contraceptives	Yes	25 (13.9)	5 (2.8)	10 (5.6)	8 (4.4)	2 (1.1)	0.004
	No	155 (86.1)	35(19.4)	47(26.1)	15 (8.3)	58(32.2)	

*P–value >0.05 is not significant. P- value < 0.05 is significant.

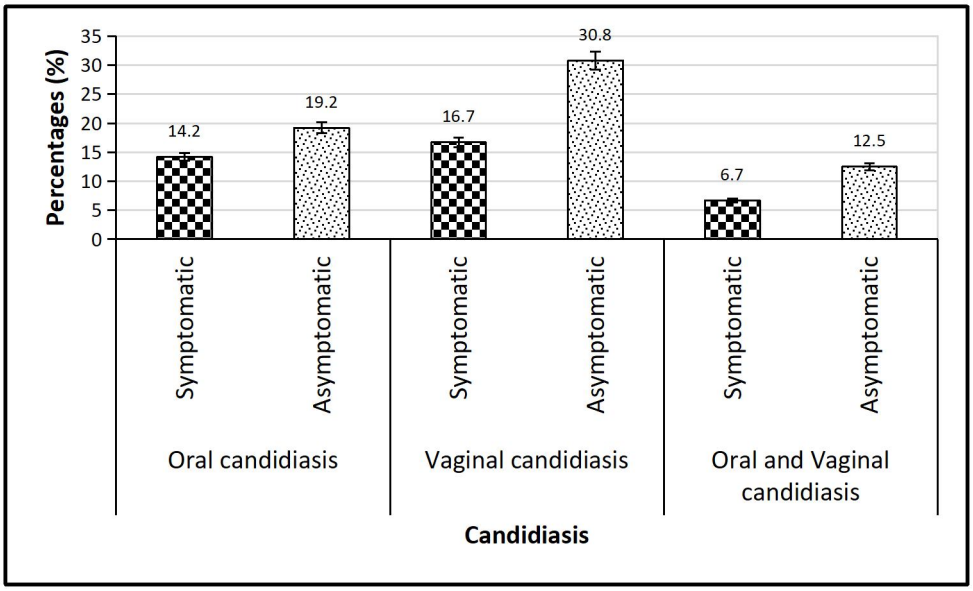


Figure 1: Prevalence of symptomatic and asymptomatic candidiasis among participants

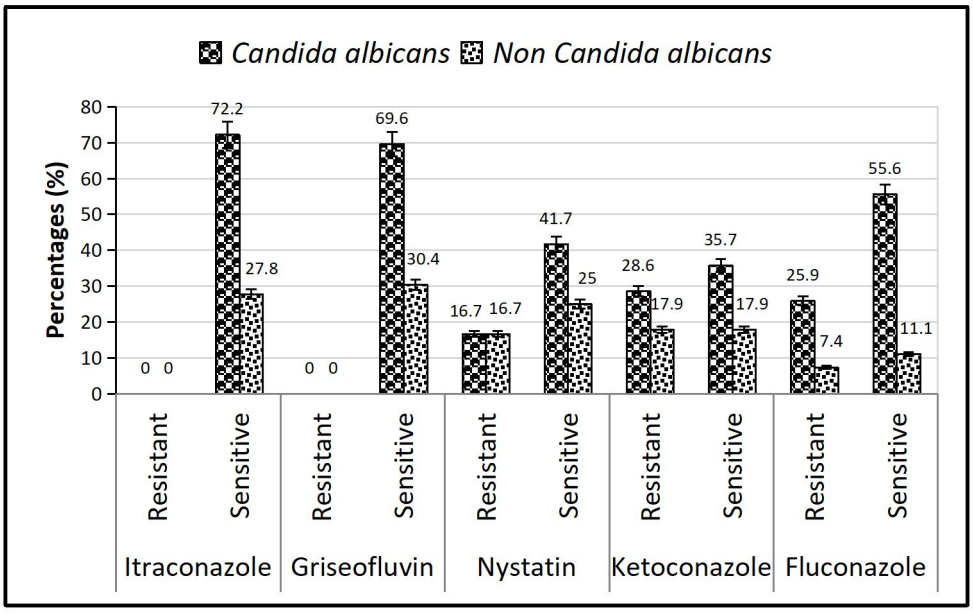


Figure 2: Antifungal susceptibility patterns of *Candida albicans* and non-Candida *albicans* isolates from oral and vaginal swabs of participants.

DISCUSSION

The study underlined the importance of checking HIV-Positive patients for presence of other infections particularly candidiasis, which is often common with HIV patients who are not well balanced with hygiene. It has been reported that co-infections are cause of complications on people living with HIV/AIDS due to weak immune system of HIV patients. The results obtained in this study agreed with other related research in Nigeria and elsewhere on occurrence of candidiasis.

Esebelahie *et al*. (2013) reported a 52.5% overall prevalence rate of candidiasis in research conducted among HIV patients in Benin City, Southern Nigeria but our study's 66.7% overall prevalence rate was higher. Similarly, it was higher than the 30.1% recorded by Njunda *et al*., (2011) in a study conducted in Cameroon, a

neighboring African nation that shares an eastward border with Nigeria. Different research conducted in China and Taiwan by Li *et al*. (2013) and Lin *et al*. (2013) revealed 49.5% and 51.4% respectively. Additionally, it was observed to be comparable to the findings of Paula *et al.* (2015) and Goulart *et al.* (2018) 's findings, who reported 50.4% and 51.3%, respectively from research conducted in Brazil.

The 22.2% rate of oral candidiasis found in this study was higher than the 9.68% rate reported among HIV-positive people in Jos, Nigeria by Lar *et al.,* (2012). It was also higher than the 12.5% recorded by Okonkwo *et al*. (2013) in research conducted in Abakaliki, Nigeria, and 10.8% reported by Enitan *et al*. (2019) from Ogun State South-west Nigeria. The work of Vijeta *et al.* (*20*13), who reported a HIV prevalence rate of 11% among patients in Northern India was also shown to be extremely lower than this one. Other studies conducted outside of Africa observed much higher prevalence rates and enjoys more close comparison to this particular work. These studies include those by Schuman *et al*. (1998) who reported 22% in USA, Tsang and Samaranayake (2000) reported 54.8% in Hong Kong, Campisi *et al*. (2002) reported 61.9% in America, Gugnani *et al. (*2003) reported 65.3% in research conducted in India and Pongsiriwet *et al.* (2004) who reported prevalence rate of70% in Northern Thailand.

In this study, vaginal candidiasis had a single occurrence rate of 31.7%, which is significantly lower than the 88.8% reported by Umeh and Umeakanne (2010) in Benue State, Nigeria. Njunda *et al*. (2011) obtained prevalence rates of 36.3% in Cameroon while Schuman *et al*. (1998) reported similar prevalence rates of 37% in Atlanta, Georgia, USA. These are slightly higher than the finding of this research. Differences in methodology, geographic location, sample size, educational, socioeconomic, and cultural status, level of personal hygiene, adherence to HAART, and prophylaxis for opportunistic infection by the study participants, among other factors, may account for variations in prevalence rates reported from different parts of the world.

In this study, a prevalence of 12.8% for the co-occurrence of oral and vaginal candidiasis was found which is obviously below the 17.5% reported by Enitan *et al.* (2019) in a study conducted on Candidiasis in HIV female adults in Ogun State southwest Nigeria. The majority of earlier studies on candidiasis in HIV-infected individuals either took oral and vaginal candidiasis as a separate occurrence or in conjunction with candidaemia and/or candidiuria. When oral and vaginal candidiasis occur at the same time in one person, it may be a sign of concurrently poor oral and vaginal hygiene while using HAART medicine. This necessitates an overall improvement in their personal hygiene standard.

Candida albicans (71% of the *Candida* species isolated in this study) was the most prevalent, while Non-albicans *Candida* (NAC) made up the remaining 29%. This demonstrates that *Candida albicans* (CA) is the primary and commonest cause of candidiasis, outpacing Non-albicans *Candida* (NAC). Other works done in Africa and elsewhere concur with this. For instance, in a study conducted in Tanzania, Hamza *et al.,* (2018) reported 84.5% (CA) and 15.5% (NAC), In Abakaliki, Nigeria, Okonkwo *et al*., (2013) recorded 80% (CA) and 20% (NAC), and in Accra, Ghana, Kwamin *et al*. (2013) reported 68.5% (CA) and 31.5% (NAC). However, in Northern India, Vijeta *et al.* (2013) observed 90.5% (CA) and 9.5% (NAC). Spalanzani *et al*., (2018) reported 66.7% (CA) and 33.3% (NAC) in research done in Brazil, whereas Goulart *et al.* (2018) reported 80% (CA) and 20% (NAC).

Regarding the symptoms of oral and vaginal candidiasis (oral sores, white tongue, difficulty swallowing, bad breath, and mouth dryness) in relation to the presence of candida species, it appears that these symptoms were more pronounced among HIV-positive patients who were infected with Candida *albicans* (CA) as opposed to Non-albicans Candida (NAC). This raises the possibility that CA is a more aggressive and virulent opportunistic pathogenic fungus than the NAC, which would explain why CA-infected research participants had greater signs of oral and vaginal candidiasis. In all types of candidiasis taken into account, the former was shown to be more common than the latter among research participants who had symptomatic and asymptomatic candidiasis. This demonstrates that asymptomatic instances are quite common. Additionally, it has been established that ongoing, asymptomatic Candida species carrying may be a risk factor for a later infection (Goulart *et al.,* 2018).

In this study, we define symptomatic candidiasis as the presence of one or more symptoms and indications that are consistent with oral/vaginal candidiasis together with the identification of Candida species in the oral/vaginal swab culture of the study participants. On the other hand, asymptomatic candidiasis was defined as the finding of *Candida* species in the oral/vaginal swab cultures of the research participants in the absence of one or more symptoms and signs typical of oral/vaginal candidiasis. The community's most important infection reservoirs are asymptomatic people. They may not show any visible signs or symptoms of the illness, but the virus is present in their saliva or vaginal discharge, and they can spread it to others through kissing or sexual contact. The cycle of infection within the community must be stopped by identifying and treating asymptomatic people in light of the aforementioned information. Additionally, having oral sores alone does not always indicate that a person has oral candidiasis, at the first instance, the reason is straightforward: oral infections have been linked to pathogens other than *Candida*, such as some viruses (such as Herpes Simplex Virus-1), parasites (such as *Entamoeba gingivalis*, *Trichomonas tenax*), and many bacteria, such as *Streptococcus mutans*, *Staphylococcus aureus*, and *Klebsiella pneumoniae*. Similar to this, having vaginal itching alone does not always indicate that a person has vaginal candidiasis. The same cause as mentioned above; other organisms such *Chlamydia trichomatis*, *Neisseria gonorrheae*, and *Trichomonas vaginalis* may also be the cause. For this reason, differential diagnosis is essential to identify the infection's true cause when it manifests with identical symptoms. Incorrect reporting and treatment might result from incorrect diagnosis. In addition, self-diagnosis based on personal experience or in another way may result in the erroneous diagnosis and treatment. Antimicrobial resistance is largely caused by the purchase of drugs over the counter without the proper laboratory test results. Clinicians are presently fighting such practice.

CONCLUSION

The findings of this research revealed that a majority of the HIV patients screened were infected with *Candida*. The most prevalent species of *Candida* that affected the sampled population was the *Candida albicans* this suggest that *Candida albicans* are the commonest and more pathogenic strain of the *Candida* species. The antifungal susceptibility profile of the *Candida* isolates revealed that *Candida albicans* isolates were more sensitive to the five drugs tested against them than the non-*albicans Candida* isolates. To avoid infection with *Candida*

species proper hygiene practices should be enhanced.

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