PREVALENCE OF *Candida* SPECIES AMONG HIV-INFECTED ADULT FEMALES AT MBODO HEALTH CENTER ALUU, RIVERS STATE, NIGERIA.

Abstract

The acquired immune deficiency syndrome (AIDS), which is brought on by HIV, is a major public health concern. The human immunodeficiency virus (HIV) is still a worldwide epidemic. Only 2.1% of HIV cases worldwide are recorded in Nigeria. Usually, under the control of the immune system, *Candida* infections may be dangerous for immunocompromised people, particularly those living with HIV/AIDS. At the Mbodo Health Centre in Aluu, Rivers State, Nigeria, this study aimed to assess the prevalence of *Candida* infections and their relationship to HIV-positive patients. Fifty volunteers in all were chosen at random. Self-collected oral and vaginal swabs were used to gather data. To identify *Candida* species, biochemical testing, culturing, and microscopy were used. 80% of the 50 individuals had positive candidiasis tests. Oral and vaginal mono/co-candidiasis were found to be common, with *Candida albicans* being the most common species. Based on demographic parameters, statistical analysis did not show a significant difference in the prevalence of oral candidiasis. The incidence of vaginal candidiasis was much greater in those with secondary education and aged 31-40. The age group of 31 to 40 years old had a considerably greater co-occurrence rate of oral and vaginal candidiasis.Adult female HIV-positive patients at Mbodo Health Centre have a significant prevalence of candidiasis. The research sheds light on the distribution of *Candida* species and how demographic variables relate to them. These results highlight the significance of treating candidiasis as a serious health issue in people living with HIV. To improve overall health outcomes for HIV-positive people and reduce related risk factors, further research and treatments may be required.

Keywords: HIV, Females, *Candida albicans*, *Candida tropicalis*, *Candida parapsilopsis*

Introduction

The spread of HIV continues to be one of the world's most widespread pandemics. The most significant public health issue of the 20th century is acquired immune deficiency syndrome (AIDS), which is brought on by HIV. Only 2.1% of all HIV-infected individuals among adults aged 15–49 years reside in Nigeria [1], approximately 2 million people living with HIV in Nigeria [1]. Previous national HIV prevalence estimated 1.4% from the 2018 NAIIS [2] while estimation and projection package (EPP) of the Joint United Nations Program on AIDS (UNAIDS) estimated 1.8 million for people living with HIV (PLHIV)in 2022 [1].

Human *Candida* infection is often under immune system control. This suggests that the host is vulnerable to a variety of diseases, including fungal infections, in immunocompromised conditions like HIV/AIDS. For example, it has been shown that patients with reduced neutrophil activities and those with immune-compromised illnesses such as HIV/AIDS have a higher frequency of candidiasis. Conversely, HIV-negative people may develop candidiasis if their immune systems are momentarily weakened by other causes such as malnourishment, chemotherapy, and extensive antibiotic usage [3].

The most common etiologic agent, however, is *Candida albicans*, which is followed by *Candida tropicalis*, *Candida parapsilopsis*, and *Candida glabrata* [4]. As a member of the typical endogenous flora, *Candida albicans* is thought to have an endogenous source for its infections. In Mbodo Health Centre in Aluu Rivers State, the purpose of this research

was to ascertain the frequency of Candida infections and their correlation with the immune status of HIV-positive patients.

Materials and Methods

Study Area

Adult female patients with HIV who were enrolled in the HIV clinic at the MbodoAluu Health Centre in the MbodoAluuObio-Akpor Local Government Area of Nigeria participated in this research. Located in the MbodoAluu village in the Ikwerre Local Government Area of Rivers State, it is a primary healthcare centre. They provide small procedures, general outpatient treatment, lab testing, and antenatal care. Coordinates: 6.9209135 4.8580767

Research Design

At Mbodo Health Centre in Aluu Rivers State, this cross-sectional institutional-based research was conducted among adult female patients who tested positive for HIV. Randomly chosen for the trial were consenting adult females with proven HIV status who visited the HIV clinic at Mbodo Health Centre Aluu Rivers State and who had not had antifungal medication in the two weeks before. The research excluded HIV-positive adult men, girls under the age of 18, and those who had received antifungal medication during the two weeks before the trial.

Sample and Sampling Techniques

For the research, 50 adult female patients with HIV who gave their permission and were receiving care at Mbodo Health Centre in Aluu, Rivers State, Nigeria, were chosen. The formula provided by Charan and Biswas [5] was used to determine the sample size (N) for this investigation.

$N = Z^2PQ/d^2$

Where,N = required sample size

Z = Standard normal variance at 5% ($p<0.05$) error or 95% confidence interval is 1.96

P = Portion of the population of adult female HIV-positive patients with candidiasis from previous study

Q = Portion of the population of adult female HIV-positive patients without candidiasis (1-P) and

D = Absolute error margin is 0.05

For the calculation, a 95% confidence interval, a P value of 0.076, i.e., a prevalence rate of 7.6% candidiasis among African HIV adult females from a previous study by Mushi et al. [6] and a margin of error (d) set at 0.05 will be used to determine the minimum sample size required. To minimize errors arising from the likelihood of non-compliance, 10% of the sample size will be added giving a final sample size of 50.

Methods of Data Collection/Instrumentation

Every research participant was asked to provide two sets of self-collected high vaginal swabs (HVS) and early morning mouth swabs. Along with instructions on how to collect samples aseptically, they were given sterile swab sticks to collect samples in triplicate. Every participant provided a specimen, which was then collected and labelled with their identification number on the specimen container. Every sample was processed on the same day of collection and brought as quickly and painlessly as possible to the laboratory. They were stored in the refrigerator between 2 and 8 degrees Celsius when a delay was anticipated.

Microscopy

One millilitres of normal saline were used to agitate the HVS and Throat swabs, which were then placed in separate test tubes. Each sample's suspension was transferred in a single drop to a distinct grease-free microscope slide. The cover slip was carefully positioned to prevent air bubbles and examined at 10x and 40x magnifications [7]. On spotless, oil-free slides, sputum samples were inserted, and a drop of potassium hydroxide (KOH) was applied. After mixing, the mixture was placed under a glass cover. With 10x and 40x goals, fungi were looked for in this.

Cultivation

On modified Sabouraud-chloramphenicol agar plates, the second set of swab sticks (HVS and Throat swabs) were streaked and plated out. The plates were then incubated at 37°C for a maximum of 72 hours [7]. Bacterial growth was reduced by the 0.5% chloramphenicol antibiotic. The positive plates were seen to have complete borders and cream-coloured colonies with a pasty smell, which is characteristic of *Candida* species.

Biochemical tests

These experiments were conducted using Daeket al.'s methodology [8]. Using the Gramme stain, morphology, germ tube formation, maize meal agar with tween-80 (to demonstrate chlamydospores, blastospores, and pseudohyphae), and the sugar fermentation test (glucose, sucrose, lactose, maltose, and xylose) closing as a confirmatory test, *Candida spp*. was distinguished from other yeasts and identified to species level. To rule out normal flora, only suspected yeast colonies with budding yeast cells, pseudohyphae, pus cell spectrum, and high development of Candida—more than 30 colonies on SDA—were evaluated for Gram staining. After two hours, the formation of a germ tube at 37°C in horse serum suggested a successful outcome. 2% of different sugars (maltose, sucrose, lactose, xylose, and glucose) were added to a broth medium containing indicators in sterile narrow-neck MaCartney bottles with Durham tubes to conduct sugar assimilation/fermentation processes. Overnight, the tubes were incubated at 37°C.

Statistical Analysis

Microsoft Excel was used to input the data from the questionnaire and the test procedures. The statistical software SPSS-18.0 (Statistical Package for Social Scientists, version 18.0) was used to conduct the statistical analysis. To look for statistically significant variations in the prevalence rates of oral and vaginal candidiasis in adult female HIV-positive patients, chi-square and the Tukey-Kramer Multiple Comparisons Test were used. To ascertain the association between the incidence of candidiasis and related risk variables, data was also submitted to Spearman correlation analysis using the Graph pad In-stat Software Package. Simple logistic regression analysis was used to identify significant risk variables for candidiasis. Tables and charts were used to display the statistical results.

Results

Table 1 displays the research participants' demographic information, such as age range, marital status, and level of education. The participants were divided into four age groups: 20.0–30.0%, 31.0–40.0%, 41.0–50.0%, and above 50 (10.0%). Of the participants, 34.0% are single, 12.0% are divorced, 4.0% are widowed, and 50.0% are married.

Table 1: *Socio-Demographic Characteristics of Study Participants*

Characters	Category	Frequency (N)	Percentage (%)
Age Range	20-30years	15	33.0
	31-40years	21	42.0
	41-50years	9	18.0
	Above 50years	5	10.0
Marital Status	Single	17	34.0
	Married	25	50.0
	Divorced	6	12.0
	Widowed	2	4.0
Educational Status	None	9	18.0
	Primary	14	28.0
	Secondary	23	46.0
	Tertiary	4	8.0
	Total	50	100

The study's findings indicate that candidiasis affected the majority ofthe individuals. Forty (80.0%) out of the fifty people who were checked had positive candidiasis tests, whereas the remaining ten (20.0%) had negative results.

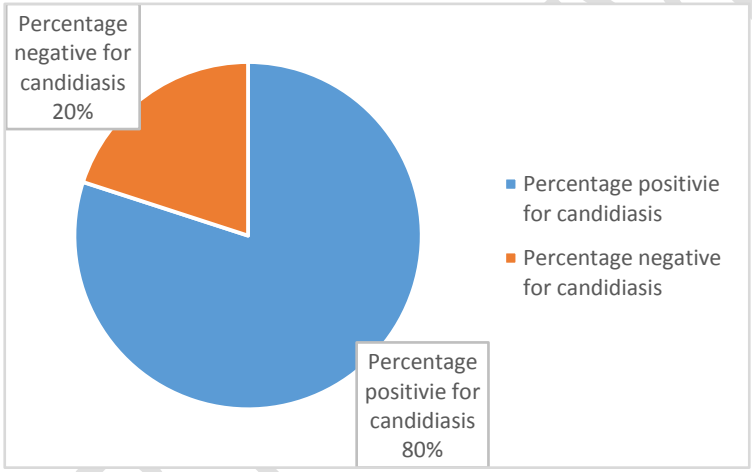

Figure 1: *A pie graphic illustrating how prevalent candidiasis is overall among study participants*

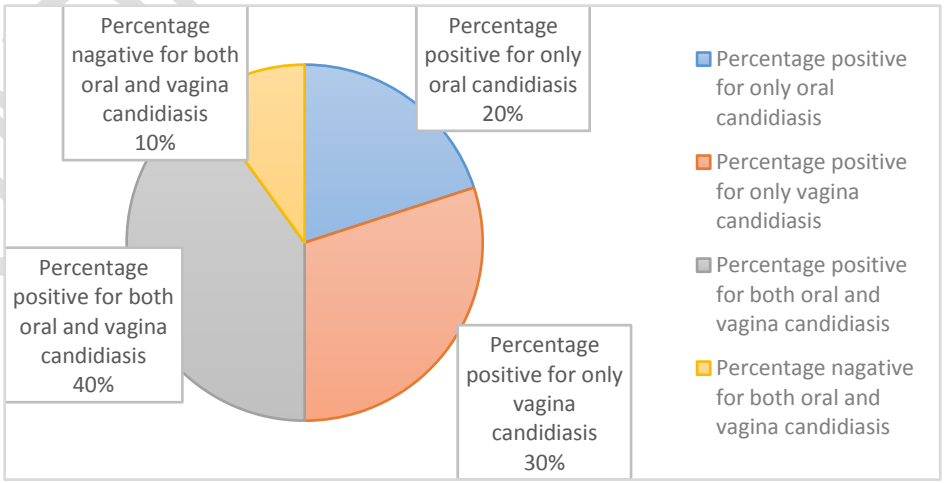

Figure 2. *A pie chart showing the prevalence of oral and vaginal mono/co-candidiasis among the study participant*

The prevalence of oral and vaginal mono/co-candidiasis among the study participants is presented using a pie chart (Figure 2). Ten (20.0%) out of the 50 participants examined had only oral candidiasis, 15 (30.0%) had only vaginal candidiasis, 20 (40.0%) of them had both oral and vaginal candidiasis, while 5 (10.0%) tested negative.

Table 2 shows the relationship between the research participants' sociodemographic traits and the frequency of oral candidiasis incidence. The age distribution of oral candidiasis showed that 30.0% of participants were between the ages of 31 and 40, followed by 14.0% of individuals between the ages of 20 and 30, and 0.0% of participants aged 51 and above. Thirty percent of those who tested positive for oral candidiasis were married, while fourteen percent were single. Those with secondary school education had the greatest incidence (38.0%) and those with elementary school education (16.0%), according to their educational standing. Regarding all the demographic characteristics taken into consideration, there is no discernible difference (P>0.05) in the prevalence of oral candidiasis among the research participants.

Table 2: *The frequency of occurrence of oral candidiasis about the socio-demographic characteristics of the study participants*

Socio-demographic Characteristic	**Category**	**Number of participants examined N (%)**	**Number positive for only oral candidiasis N (%)**	**Number negative for only oral candidiasis N (%)**	**P-value**	**Pearson ChiSquare (χ2)**
Age range	20-30years	15(30)	7(14)	8(16)	0.067	9.876
	31-40years	21(42)	15(30)	6(12)	0.078	
	41-50years	9(18)	5(10)	4(8)	0.098	
	Above 50years	5(10)	0(0)	5(10)	0.057	
	Total	50	27(54)	23(46)		
Educational status	None	9(18)	5(10)	4(8)	0.043	7.987
	Primary	14(18)	8(16)	6(12)	0.098	
	Secondary	23(46)	19(38)	4(8)	0.854	
	Tertiary	4(8)	1(2)	3(6)	0.987	
	Total	50	33(66)	17(34)		
Marital status	Single	17(34)	7(14)	10(20)	0.999	5.876
	Married	25(50)	15(30)	10(20)	0.089	
	Divorced	6(12)	4(8)	2(4)	0.046	
	Widowed	2(4)	0(0)	2(4)	0.074	
	Total	50	26(52)	24(48)		

Table 3 displays the frequency of vaginal candidiasis together with the research participants' sociodemographic details. The age group of 31–40 years old had the greatest prevalence of vaginal candidiasis (26.0%), followed by the age group of 20–30 years old (18.0%). Out of the 50 individuals that were investigated, 22 (44.0%) developed vaginal candidiasis. Those with secondary education and those between the ages of 31 and 40 had a considerably (P<0.05) greater incidence of vaginal candidiasis.

Table 3: *The frequency of vaginal candidiasis about the socio-demographic characteristics among the study participants.*

Socio-demographic Characteristic	**Category**	**Number of participants examined N (%)**	**Number positive for only vagina candidiasis N (%)**	**Number negative for only vagina candidiasis N (%)**	**P-value**	**Pearson ChiSquare (χ2)**
Age range	20-30years	15(30)	9(18)	6(12)	0.999	8.798
	31-40years	21(42)	13(26)	8(16)	0.999	
	41-50years	9(18)	0((0)	9(18)	0.999	
	Above 50years	5(10)	0(0)	5(10)	0.036	
	Total	50	22(44)	28(56)		
Educational status	None	9(18)	6(12)	3(6)	0.007	6.354
	Primary	14(28)	5(10)	9(18)	0.164	
	Secondary	23(46)	10(20)	13(26)	0.076	
	Tertiary	4(8)	2(4)	2(4)	0.871	
	Total	50	23(46)	27(54)		
Marital status	Single	17(34)	9(18)	8(16)	0.098	1.354
	Married	25(50)	11(22)	14(28)	0.067	
	Divorced	6(12)	3(6)	3(6)	0.489	
	Widowed	2(4)	2(4)	0(0)	1.000	
	Total	50	25(50)	25(50)		

Additionally, Table 4 displays the incidence of co-occurrence of oral and vaginal candidiasis together with the sociodemographic details of the research participants. Forty (80.0%) of the fifty research subjects who were investigated had both vaginal and oral candidiasis. Among those aged 31 to 40, the proportion of cases with co-occurring oral and vaginal candidiasis was found to be substantially greater (P<0.05).

Table 4: *The frequency of co-occurrence of oral and vaginal candidiasis about the socio-demographic characteristics among the study participants*

Table 5:*Mean distribution of phenotypically characterized Candida species among HIV patients*

Socio-demographic Characteristic	Category	Number of participants examined N (%)	Number positive for both oral and vagina candidiasis N (%)	Number negative for both oral and vagina candidiasis N (%)	P-value	Pearson ChiSquare (χ2)
Age range	20-30years	15(30)	13(26)	2(4)	0.999	2,987
	31-40years	21(42)	20(40)	1(2)	0.876	
	41-50years	9(18)	5(10)	4(4)	0.987	
	Above 50years	5(10)	0(0)	5(10)	0.075	
	Total	50	38(76)	12(24)		
Educational status	None	9(18)	7(14)	2(4)	0.894	16.987
	Primary	14(28)	12(24)	2(4)	0.365	
	Secondary	23(46)	20(40)	3(6)	0.864	
	Tertiary	4(8)	0(0)	3(6)	0.045	
	Total	50	40(80)	10(20)		
Marital status	Single	17(34)	15(30)	2(4)	0.044	14.098
	Married	25(50)	20(40)	5(10)	0.543	
	Divorced	6(12)	4(8)	2(4)	0.985	
	Widowed	2(4)	1(2)	1(2)	0.843	
	Total	50	40(80)	10(20)		

patients

Candida Isolates	**Mean Distribution**
C. albicans	179.00 ± 11.36
C. tropicalis	72.33 ± 27.10
C. stellatoidea	7.00 ± 1.00

Table 6:*Percentage distribution of Candida species by site among HIV patients*

Isolate	Percentage Distribution
High vagina swab	13.0
Sputum	56.3
Throat	30.7

Discussions

Candida albicans was the most common species among HIV patients, followed by *Candida tropicalis* and *Candida stallatoidea,* according to the mean distribution of

phenotypically characterized*Candida* species. Table 5 shows that the mean distribution of the three isolates was 179.00 ± 11.36, 7.00 ± 1.00, and 72.33 ± 27.10 for *Candida albicans, Candida stellatoidea,* and *Candida tropicalis,* respectively. One-way ANOVA statistical analysis showed that all isolates' mean distributions were statistically significant ($P < 0.05$). Out of all the *Candida* isolates, *C. albicans* was the most common species, according to similar research done by Thanyasrisuyet al. [9].

In different research, 50% of the samples taken from HIV patients included *C. albicans,* which further suggests that *C. albicans* is the primary species of *Candida* that is often linked to candidiasis in HIV patients. *Candida tropicalis* (20.0%), *Candida parapsilosis* (19.3%), *Candidaguillerimondi* (4.8%), and *Candida krusei* (1.6%) are the other isolates. [10]. The *pathogen Candida albicans* is opportunistic. Its proliferation and colonization of the oropharynx are made possible by immunosuppression and the careless use of antibiotics, which may result in disorders in both adults and children that range from superficial to systemic infections [11]. There have also been reports of *C. tropicalis* isolation in HIV patients [9, 12]. Unfortunately, there arenot many studies on the isolation of *C. stellatoidea* from HIV participants, which suggests that the isolate isn't the main reason HIV patients have candidiasis.

Sputum and throat swab samples had a greater dispersion of *Candida spp*. by location, with percentage distributions of 56.3% and 30.7%, respectively. With 13.0%, the lowest percentage distribution was seen in high vaginal swabs (HVS). Sixty-eight *Candida* species out of 94 *Candida* species were recovered from oral swabs in similar research conducted by Anwar et al. [13]. Twelve species were acquired from the skin, six species from faeces, three species from blood, three species from sputum, and two species from the oesophagal biopsy.

HIV patients may have localized*Candida* species in their mouths, lungs, or gastrointestinal tracts [14]. It has been shown that oral *Candida* carriage and oral candidiasis in HIV are highly correlated with low CD4 counts and high plasma HIV RNA levels [15]. HIV patients with a greater prevalence of candidiasis were found to be 26–33 years old, followed by 18–25 years old, 34–41 years old, 42–49 years old, 50–57 years old, and 58–65 years old. Despite the lack of a retrospective investigation to ascertain the individuals' usage of antiretroviral medications, a significant incidence of candidiasis among HIV patients aged 26 to 33 points to inadequate treatment of the virus as a cause of further immune system degradation.

Candida species are part of the lower genital tract flora in 20.0-50.0% of healthy asymptomatic women [16]. *Candida albicans*and other *Candida species* had been isolated from several clinical specimens from different part of Nigeria [17] and different parts of the world [16].

Among the HIV-infected females, *Candida albicans*was predominant over other Candidaspecies. Similar observation was reported by Donbraye-Emmanuel et al. [17] and Ali et al. [16] in Ibadan, Nigeria. To identify the species of Candida, several microbiological examinations were carried out, such as microscopy, culturing, and biochemical assays. The findings indicated that *Candida albicans* was the most common species, with *C. tropicalis* and *C. stellatoidea* following closely after. Similar observation was made by Mbakwem-Aniebo et al. [18] in Port Harcourt, Nigeria. Okonko et al. [19] reported 11.0% prevalence for *Candida albicans* (oral thrush) and 28.9% for *Candida albicans* (vaginosis) in HIV-infected individuals in Port Harcourt, Nigeria.

The statistical analysis carried out using SPSS-18.0, revealed information on the correlation between the risk variables and the incidence of candidiasis. To look for

statistically significant variations in the prevalence rates of oral and vaginal candidiasis in adult female HIV-positive patients, chi-square and the Tukey-Kramer Multiple Comparisons Test were used. The link between candidiasis and related risk variables was ascertained by the use of Spearman correlation analysis. The research participants' demographic features, as shown in tables and figures, gave a clear picture of how candidiasis was distributed throughout age groups, marital situations, and educational levels.

Conclusion

This study looked at the frequency of *Candida* infections and how they related to HIV-positive patients at Mbodo Health Centre in Aluu, Rivers State, Nigeria. The research, which included adult female patients with HIV infection, provided important new information on the prevalence and features of candidiasis in this community.Sputum and throat swab samples had a larger proportion of these isolates, whose distribution varied across anatomical regions.With 80% of research participants testing positive for the illness, the results showed that candidiasis was a common infection. Both the oral and vaginal locations showed different distributions of candidiasis, and both infections were also shown to co-occur. The research examined the sociodemographic characteristics of the subjects, such as age, marital status, and level of education, and found certain patterns in the incidence of vaginal and oral candidiasis in these groups.The results of this study emphasize the significance of treating candidiasis as a serious health problem in this community, which has implications for the treatment and care of HIV-positive people. To address the identified risk factors and improve the general health outcomes of HIV-positive individuals, further study and treatments could be necessary.

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