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Original article

Epidemiology and risk factors of oral candidiasis among people living with HIV/AIDS in Ilorin, Kwara State, Nigeria

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ABSTRACT

Background: Oral candidiasis has proven to be endemic amongst people infected with HIV/AIDS. The initial symptoms of human immunodeficiency virus (HIV) infections are accompanied by other diseases which indicate a suppressed immune system. In this study, an epidemiological survey was conducted on HIV positive patients who visited Kwara state general hospital, Kwara state specialist hospital, Civil service hospital and Cottage hospital, Ilorin. **Methods:** Oral swabs were collected and cultured for the isolation and characterization of *Candida* and speciation of isolates were done using Chromagar *Candida*. The socio-demographic and clinical data of the HIV patients were obtained using a structured researcher-administered questionnaire and were correlated with presence or absence of oral candidiasis. **Results:** Out of a total of the 300 HIV positive patients, 40 (13.4%) yielded growth of *Candida* species with distribution of *Candida albicans* 20(6.7%), *Candida tropicalis* 6(2.0%), *Candida krusei* 6(2.0%), *Candida glabrata* 2(0.7%) and a mixed growth of *Candida albicans* and *Candida tropicalis* 6(2.0%). Data were analyzed using SPSS version 21 and significance level were set at p=<0.005. **Conclusion:** The study revealed that *Candida albicans, Candida tropicalis, Candida krusei* and *Candida glabrata* were the species causing oral candidiasis among people living with HIV/AIDS. An overall oral candidiasis prevalence of 13.4% was observed among the studied population.

Introduction

The transmission of human immunodeficiency virus (HIV) is yet to subside despite the tremendous efforts being put into its eradication globally [1]. The spread of this disease affects countries of all incomes especially the poor developing countries and it continues to pose as a global threat since it was discovered in 1981[2]. There were about 35.5million people living with HIV until 2012 when 2.3 million people were newly infected and 1.6 million deaths occurred as a result [3].

Human Immunodeficiency virus is usually categorized into two types which are HIV-1 and HIV-2. Its main targets are the immune cells (CD4+ cells). The viral particle often gets integrated with the host cell DNA. the virus becomes immortalized after complete integration using the reverse transcriptase enzyme [4]. A gradual reduction of

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CD4+ lymphocytes, among other cells till its complete exhaustion which leads to opportunistic infections and specific neoplastic process is a major characteristic of the virus [5]. Clinical samples from mouth lesions are the major source of diagnostic information in HIV/AIDS patients. The appropriate and early diagnosis is essential for the wellbeing of the patients. The lesions signifies the immune suppression [6]. Oral candidiasis (OC), also known as "thrush" comprises of infections of the tongue and other oral mucosal sites which is characterized by fungal overgrowth and invasion of superficial tissues [7]. *Candida albicans* is the major causative agent of OC as it accounts for about 95% of cases. *Candida albicans* is usually a commensal floral of the oral cavities of healthy individuals but becomes an opportunistic fungi due to their resistance to most antifungal drugs [9]. The first phase of the infection is usually without visible symptoms due to immunosuppression it can take years before the first symptoms show up. This effect is due to the direct catastrophic effect of HIV on T-helper lymphocytes, which the virus has a strong tropism for and where it completes its replication cycle. The first symptoms are the manifestations of opportunistic infections.which can be local or systemic. Candida species are naturally abundant with peculiar arrangement of nuclear arrangement of nuclear materials presence or absence of mitochondria and endoplasmic reticulum. *Candida* is a genus of yeast and a major pathogen of fungal infections globally [10]. *Candida* species are highly resistant to azoles, a former treatment for candidiasis which makes it important to research the isolation of *Candida* in immunocompromised patients [11]. There's been a persistent increase in the cases of *Candida* infections recently. However, the early detection and the exact identification the *Candida* species are requirements for the proper treatment [12]. Numerous virulence factors contributes to the pathogenicity of *Candida*, however, the adherence factor to host tissues and medical devices including its ability to secrete proteases, phospholipases and haemolysins [13]. *Candida* infection has a diverse spectrum, spanning from asymptomatic colonization to oropharyngeal candidiasis (OPC), esophagitis, onychomycosis, vulvovaginitis, cutaneous candidiasis, and systemic candidiasis or invasive candidiasis including candidemia [14]. Symptoms of candidiasis in HIV patients includes clinical lesions [15]. Low CD4 counts and high plasma HIV RNA levels, viral load significantly correlate with oral *Candida* carriage as well as with oral candidiasis in HIV patients [16]. Pseudomembranous Candidiasis (PC), Erythematous Candidiasis (EC), Denture Stomatitis (DS) and Chronic Hyperplastic Candidiasis (CHC) are the most common OC types found in HIV/AIDS patients [17]. The infection is commonly acquired endogenously except in a few cases where strains can be transmitted from person to person [18].

Candida species can be contracted by both clinical and environmental sources. Rapid changes in the rates of infection, potential risk factors and emerging new species in the aetiologic frequencies demand continued and close surveillance in our hospitals and environs. Recent studies, performed years ago have broadened the epidemiologic understanding of nosocomial candidiasis from a single endogenous infection to one that may be exogenously acquired from persons to persons. Clinically there are a number of different types of oral candidiasis. Therefore the choice of therapy is guided by the type of candidiasis. The diagnosis of oral candidiasis is essentially clinical and is based on the recognition of the lesions by the professional, which can be confirmed by the microscopic identification of *Candida* [18]. The techniques available for the isolation of *Candida* species from the oral cavity include direct examination or cytological smear, culture of microorganisms and biopsy which is indicated for cases of hyperplasic candidiasis because this type could present dysplasias [19]. Adequate dental hygiene has been proven to substantially mitigate the risk of oral candidiasis among immunocompetent individuals [20].

In Nigeria, there is paucity of epidemiological data pertaining to OC when compared to the extensive research conducted in the developed world. The recorded global increase in resistance of *Candida* species to antifungal agents and the emergence of species capable of causing disease entities previously the domain of *Candida albicans* warrants identification to species level in virtually every situation. This study will help to establish baseline epidemiological data on *Candida* colonization and infection in the oral cavity of HIV patients in the study area. Such data will be helpful in making useful decisions regarding the management of these patients

The aim of this study is to estimate the epidemiology and social-demographic of oral

Candida infection among people living with HIV/AIDS in Ilorin.

Materials and methods

The study area

The study was conducted in Kwara State Specialist Hospital, Sobi, Civil Service Hospital, Challenge and Cottage Hospital, Adewole in Ilorin and the department of medical laboratory science teaching laboratory, (Medical Microbiology), Kwara State University, Malete.

Study design

This is a cross-sectional study and epidemiological survey among people living with HIV/AIDS in Ilorin, Kwara State. The confirmed HIV/AIDS patients who consented to participate in this study were all included and a total of Three hundred subjects were recruited in this research. The participation of the subjects was voluntary and informed consent was obtained from each of them.

Ethical consideration

Ethical Clearance and Informed Consent

Ethical clearance was soughed and obtained from the Institutional Ethics Committee of the Kwara State Ministry of Health prior to commencement of patient recruitment. Informed written consent was obtained from each patient after adequate explanation of the study and its objectives. They were made to understand that participation was voluntary and won't attract any financial obligation to them. More so, non- consent would not result in any compromise to the standard of medical care received. Each recruit was identified using a unique serial number rather than names to ensure confidentiality.

Study population

Study population consisted of all confirmed individuals living with HIV/AIDS receiving treatment within the study area in Ilorin, Kwara state.

Data collection

Questionnaires were used to collect necessary data from the 300 recruited subjects for the study. The data obtained included socio-demographic characteristics, duration of HIV infection, use of anti-retroviral therapy, and viral load estimation. Data obtained from the research were analyzed and tested statistically. The research instrument included data from questionnaire, laboratory investigation, microscopy, culture results and CD4+ counts and viral load results.

Specimen collection

A total of 300 individuals participated in this research. According to the laboratory procedure of WHO (2009), a sterile swab stick (single use) was inserted into the mouth and gently rotated against the tongue wall to pick oral swab sample (aseptically) the swab was labeled with patient's coded details.

Specimen analysis

Samples were processed according to standard mycological techniques (Milne, 1996). Each specimen was also smeared on a sterile glass slide and examined for the presence of yeast cells microscopically and smears with yeast cells were directly stained using (Lacto phenol cotton blue stain) to improve the visualization of the yeast cells. Cultural isolation of the fungus was done using Potato dextrose agar which is a selective media for the propagation of many fungi and the plates were incubated at 37 ^{0}C for 24–72 hours. Growth rate, colony characteristics and microscopy were used to identify *Candida* by their morphological features. *Candida* isolates were sub cultured into slopes of Chromagar specific for *Candida* species. Slope cultures are preferable in the cultivation of fungi in order to prevent easy contamination by droplets which is often the case with petri dish cultures [20]

Chromagar *Candida* spp media

Chromagar *Candida* is a special media for isolation and differentiation of major clinical species of *Candida*. It displays high specificity and sensitivity for 3 of the major *Candida* species (*Candida albicans, Candida glabrata*, *Candida tropicalis* and *Candida krusei*). *Candida* isolates were identified to species level by their colonial morphological characteristics on Chromagar *Candida*. The inoculated slopes were incubated aerobically at 37^{o}C at 36- 48hrs.

Results

Three hundred (300) oral swabs were collected among patients with HIV/AIDS population in Ilorin. In this study, the prevalence of oral candidiasis was found to be 13.4% in Ilorin.

Table 1 shows the social-demographic characteristics of the participants. In this study Age group 31-40 years had the highest number of participants with frequency of (32.7%), followed by age groups; 41-50years (26.7%), 51-60 years (10.0%) and the ages group with the lowest number of participants were 10-20 years (4.7%) and 61-70 years (4.7%). Females had the highest number of

participants with frequency of (98.0%) and male with frequency of (64.7%). Married HIV positive participants had the highest frequency of (68.0%), followed by HIV positive participants who were unmarried, the participants who were divorcees (6.7%), those who were Widowed had (4.0%) and those separated had the lowest frequency (2.0%). Based on educational status, participants with secondary level of education had the highest frequency (46.0%), followed by participants with tertiary level of education and the least was observed among participants with primary level of education. Artisans in this study were with the highest frequency (62.7%) followed by civil servants (22%), those unemployed had (8 %) and students were with the lowest frequency (6.0%). All participants in this study were on HAART.

Table 2 shows that 40 out of 300 participants in this study had oral candidiasis while 260 participants did not have. The prevalence of oral candidiasis among HIV/AIDS patients in Ilorin was 13.4%.

Table 3 shows the species distribution of candidiasis with *Candida albicans* having the highest prevalence 20(6.7%), followed by *Candida tropicalis* 6(2.0%), *Candida krusei* 6(2.0%), a mixed growth of *Candida albicans* and *Candida tropicalis* 6(2.0%) and *Candida glabrata* had the lowest prevalence 2(0.7%).

Table 4 shows the age groups of the participants in relation to the prevalence of *Candida* species isolated. Age group 31-40 years had the highest prevalence rate, (50%), followed by age groups; 41-50 years (20%), 21-30 years (15%), 51-60 years (7.5%), 61-70 years (7.5%) and age group 10-20 years had the lowest prevalence (0%). There was statistical significant association of age groups (0.000) and oral candidiasis among HIV/AIDS patient at p= <0.005.

Table 5 shows that oral candidiasis was more among females 13 (65%) while males had 7(35%).

There was statistically significant relationship between gender (p=0.000) and oral *Candida* infection among people living with HIV/AIDS in Ilorin. p<0.005.

As shown in **table (6),** HIV/AIDS positive patients living in the urban area of Ilorin has the highest prevalence (100%) of oral candidiasis while HIV/AIDS positive patients in rural area of Ilorin had the lowest prevalence (0%) of oral candidiasis. There was statistical significant level of association between location of residence (p=0.000) and oral candidiasis among HIV/AIDS patient at p=<0.005.

Table 7 showes that the married HIV/AIDS positive patients had the highest prevalence (70%) of oral *Candida* infection, followed by single (15%) and divorced (15%) HIV/AIDS positive patients while the widowed (0%) and the separated (0%) HIV/AIDS positive patients had the lowest prevalence of oral *Candida* infection. There was statistically significant relationship between marital status (p=0.000) and oral candida infection among HIV/AIDS positive patients at p=<0.005.

Table 8 shows that tertiary level of education had the highest prevalence (50%) of oral candida infection among people living with HIV/AIDS in Ilorin followed by secondary level (40%) while primary level of Education had the lowest prevalence (10%) oral *Candida* infection among people living with HIV/AIDS in Ilorin.

There was statistically significant association of level in educational status (p=0.000) and Oral Candidiasis among people living with HIV/AIDS in Ilorin at p<0.005.

Table 9 showed that the HIV/AIDS positive patients that are Artisans had the highest prevalence (75%) of oral *Candida* infection, followed by civil servants (25%) while the military (0%), Students (0%) and Unemployed (0%) HIV/AIDS positive patients had the lowest prevalence of oral *Candida* infection. There was statistically significant relationship between occupational status (p=0.000) and oral *Candida* infection among HIV/AIDS positive patients at p=<0.005.

Table 10 shows that all the HIV/AIDS positive participants on HAART in this study had oral *Candida* infection in Ilorin.

There was statistically significant association of level in HAART usage (p=0.000) and oral *Candida* infection among people living with HIV/AIDS in Ilorin at p<0.005.

Table 11 shows that the viral load range of 10-1000copies/ml had the highest prevalence of oral *Candida* infection (65%) followed by <10copies/ml (25%) while >1000copies/ml had the lowest prevalence of oral *Candida* infection among people living with HIV/AIDS in Ilorin (10%).

There was statistically significant association of level in viral load (p=0.000) with oral

candidiasis among people living with HIV/AIDS in Ilorin at $p<0.005$.

Table 1. Social-demographic characteristics of the participants.

Factors	Frequency	Percentage
Age		
10-20 years	14	4.7%
21-30 years	64	21.3%
31-40 years	98	32.7%
41-50 years	80	26.7%
51-60 years	30	10.0%
61-70 years	14	4.7%
Total	300	100%
Gender		
Male	106	35.3%
Female	194	64.7%
Location		
Urban	294	98.2%
Rural	6	2.0%
Marital status		
Married	204	68.0%
Single	58	19.3%
Divorced	20	6.7%
Widowed	12	4.0%
Separated	6	2.0%
Education status		
Primary	38	12.7%
Secondary	138	46.0%
Tertiary	124	41.3%
Occupation status		
Civil servant	66	22.0%
Military	4	1.3%
Students	18	6.0%
Artisans	188	62.7%
Unemployed	24	8.0%
HAART usage		
ON HAART	300	100%

Table 2. Prevalence of oral candidiasis in HIV/AIDS patients.

Candida Species	**Number of Participants**	**Percentage**
No growth	260	86.7%
Candida albicans	20	6.7%
Candida krusei	6	2.0%
Candida glabrata	2	0.7%
Candida tropicalis	6	2.0%
Mixed growth	6	2.0%

Table 3. Distribution of various species of *Candida* isolated.

Species of *Candida*	**Number of isolates**	**% of isolates**
Candida albicans	20	50%
Candida krusei	6	15%
Candida glabrata	2	5%
Candida tropicalis	6	15%
Mixed growth	6	15%
(Candida albicans and		
Candida tropicalis)		
Total	40	100%

Table 4. *Candida* isolates in relation to age of participants.

Age	**Mixed Growth**	***Candida albicans***	***Candida krusei***	***Candida glabrata***	***Candida tropicalis***	***P*-value**
10-20Years (n=0)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0.000*
21-30Years (n=6)	0(0%)	6(100%)	0(0%)	0(0%)	0(0%)	
31-40Years (n=20)	4(20%)	8(40%)	2(20%)	0(0%)	2(20%)	
41-50Years (n=10)	2(20%)	4(40%)	2(20%)	0(0%)	2(20%)	
51-60Years (n=2)	0(0%)	0(0%)	2(100%)	0(0%)	0(0%)	
60-79Years (n=2)	0(0%)	2(100%)	0(0%)	0(0%)	0(0%)	
Total N=40	6(15%)	20(50%)	8(20%)	0(0%)	6(15%)	

Age versus *Candida albicans p* = 0.000. *Candida krusei* p = 0.000 *Candida tropicalis* p = 0.000. *Candida glabrata* p=0.000. n = Numbers of Participants N= Grand total, *p* value=Significant.

Table 5. *Candida* isolates in relation to age of participants

Gender	**Mixed Growth**	***Candida albicans***	***Candida krusei***	***Candida glabrata***	***Candida tropicalis***	***P*-value**
Male (n=14)	4(28.57%)	8(57.14%)	0(0%)	0(0%)	2(14.29%)	0.000*
Female (n=26)	2(7.69%)	12(46.15%)	6(23.08%)	2(7.69%)	4(15.38%)	
Total (N=40)	6(15%)	20(50%)	8(20%)	0(0%)	6(15%)	

KEY: n = Numbers of participants, N = Grand total, *p*-value=Significant

Table 6. *Candida* isolates in relationship with the area of residence of participants

Location	**Mixed Growth**	***Candida albicans***	***Candida krusei***	***Candida glabrata***	***Candida tropicalis***	***P*-value**
Urban (n=40)	6(15%)	20(50%)	6(15%)	2(5%)	6(15%)	0.000*
Rural (n=0)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	
Total (N=40)	6(15%)	20(50%)	6(15%)	2(5%)	6(15%)	

KEY: n = Numbers of participants, N = Grand total, *p*-value=Significant.

Table 7. *Candida* isolates based on marital status of the participants.

Marital status	**Mixed Growth**	***Candida albicans***	***Candida krusei***	***Candida glabrata***	***Candida tropicalis***	***P*-value**
Married (n=28)	2(7.14%)	14(50%)	4(14.29%)	(7.14%)	6(21.43%)	0.000*
Single (n=6)	2(33.33%)	4(66.67%)	0(0%)	0(0%)	0(0%)	
Divorced (n=6)	2(33.33%)	2(33.33%)	2(33.33%)	0(0%)	0(0%)	
Widowed (n=0)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	
Separated (n=0)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	
Total (N=40)	6(15%)	20(50%)	6(15%)	2(5%)	6(15%)	

KEY: n = Numbers of participants, N = Grand total, P-value=Significant

Table 8. Candida isolates based on the level of education of the participants.

Education level	**Mixed Growth**	***Candida albicans***	***Candida krusei***	***Candida glabrata***	***Candida tropicalis***	***P*-value**
Primary (n=4)	0(0%)	4(100%)	0(0%)	0(0%)	0(0%)	0.000*
Secondary (n=16)	4(25%)	4(25%)	4(25%)	0(0%)	4(25%)	
Tertiary (n=40)	2(10%)	12(60%)	2(10%)	2(10%)	2(10%)	
Total (N=40)	6(15%)	20(50%)	6(15%)	2(5%)	6(15%)	

KEY: n = Numbers of participants, N = Grand total, P-value=Significant

Table 9. *Candida* isolates based on the occupational status of the participants.

Occupation status	**Mixed Growth**	***Candida albicans***	***Candida krusei***	***Candida glabrata***	***Candida tropicalis***	***p*-value**
Civil servants (n=10)	0(0%)	6(60%)	2(20%)	0(0%)	2(20%)	0.000*
Military (n=0)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	
Students (n=0)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	
Artisans (n=30)	6(20%)	14(46.67%)	4(13.33%)	2(13.33%)	4(6.67%)	
Unemployed (n=0)	0(0%)	0(0%)	0(0%)	0(0%)	(0%)	
Total (N=40)	6(15%)	20(50%)	6(15%)	2(5%)	6(15%)	

KEY: n = Numbers of participants, N = Grand total, P-value=Significant

Table 10. *Candida* species isolated from participant in relation to HAART usage

HAART USAGE	**Mixed Growth**	***Candida albicans***	***Candida krusei***	***Candida glabrata***	***Candida tropicalis***	***p*-value**
On HAART (n=40)	6(15%)	20(50%)	6(15%)	2(5%)	6(15%)	0.000*
HAART naive (n=0)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	
Total (N=40)	6(15%)	20(50%)	6(15%)	2(5%)	6(15%)	

KEY: n = Numbers of participants, N = Grand total, P-value=Significant

Table 11. Distribution of various *Candida* isolates in relation to the viral load of the participants.

Viral load	**Mixed Growth**	***Candida albicans***	***Candida krusei***	***Candida glabrata***	***Candida tropicalis***	***P*-value**
<10copies/ml (n=10)	2(20%)	6(60%)	2(20%)	0(0%)	0(0%)	0.000*
10-1000copies/ml (n=26)	2(7.69%)	17(53.84%)	2(7.69%)	2(7.69%)	6(23.07%)	
>1000copies/ml (n=4)	2(50%)	0(0%)	2(50%)	0(0%)	0(0%)	
Total (N=40)	6(15%)	20(50%)	4(15%)	2(5%)	6(15%)	

KEY: n = Numbers of participants, N = Grand total, *p*-value=Significant < 10copies/ml = Undetectable, 10- 1000copies/ml= Detectable, >1000copies/ml= Detectable.

Discussion

Oral candidiasis is the most prevalent fungal opportunistic infection in HIV-infected individuals. Prior to the availability of active antiretroviral therapy, oral Candidiasis was a very common finding in patients with HIV/AIDS.

The prevalence of oral candidiasis among HIV/AIDS patients in this study was 40 (13.4%). *Candida* isolation rate in this study is lower than the 29.8% reported by **Emumwen et al.** in Bida (2017) among people living with HIV/AIDS and the previous report by **Enwuru et al.** (2008) among HIV seropositive patients in Lagos, Nigeria which indicated a prevalence of 34.7%. Our observed prevalence is higher than that report by **Lar et al.** (2012) 9.68% in Jos, Nigeria. The observed prevalence is lower than 60.0% recorded by **Nweze et al**. in Abakiliki in (2011).

The observed prevalence of oral candidiasis is lower than that reported in other studies in Africa by **Agwu et al**. (2011) in Uganda (52%) and **Kwamin et al.** (2013) (65.5%) in Ghana. Similarly, our study observed prevalence of oral candidiasis is also lower than that reported (57.5%) in a previous report in Brazil [19]. The rates from similar studies in other African countries vary from 54.1% reported by **Njunda et al.** (2013) in Cameroon to 82.3% reported by **Mulu et al.** (2013) in Ethiopia.

Oral candidiasis was higher among age group 31-40 years 49 (32.7%) out of the overall 20(13.4%) prevalence of oral candidiasis found in this study. This study is in agreement with research conducted in 2003 in Kwara State [19].

This study observed the highest incidence of oral candidiasis in females (65%) to males (35%). However, there was significant difference in the prevalence of oral candidiasis based on gender and HIV positive patients in Ilorin. The findings in this study are in agreement with **Okonkwo et al.** (2013) in Abakaliki reported that more females than males are infected with oral candidiasis. This study is in contrast with research by **Ranganathan et al**. (2004) in India where they observed that more males than female were infected with oral candidiasis [21].

This study shows that HIV positive patient in Ilorin on HAART is predisposed to oral candidiasis which indicates that the usage of HAART is statistically significant in this study. This finding is at variant with the study in Jos, Nigeria [21]. HIV patients on HAART and HAART naïve are predisposed to oral candidiasis [22]. However, this study agrees with **Cassone et al**. (1999) reported that, following the introduction of highly active antiretroviral therapy (HAART) there was a reduction in occurrence of opportunistic infections, prevalence of oral manifestations and oral candidiasis. Also, this study found that the use of HAART protects against symptomatic infection; similar conclusions were reached in a longitudinal follow-up study conducted by **Yang et al**. in Taiwan. **Maurya et al.** and **Sanchez-Vargas et al.** also concluded that antiretroviral therapy did not influence colonization status [22, 23].

The findings with reference to the immune status of the HIV positive patient in this study shows

there was statistically significant difference between oral candidiasis and viral load. However, this study was able to deduce that HIV positive patient with viral load between 10- 1000copies/ml are at a risk of having oral candidiasis with prevalence of 65% followed by HIV positive patient with <10copies/ml with prevalence of 25%. However, there is no previous study on the relationship between viral load and oral candidiasis especially in Kwara State, Nigeria. Studies in the past shows the association between CD4+ and oral candidiasis[24,25].

Conclusion

Overall, the most frequently isolated species was *Candida albicans*. Although *Candida albicans* has been reported as the commonest species isolated from PLWHA in most studies, the frequency varies from study to study. The isolation rate of *Candida albicans* from PLWHA in different African studies has ranged from 40.5 -82.4%. The prevalence of oral candida infection among people living with in Ilorin is 13.4% with species distribution of *C. albicans* 10(6.7%), *Candida tropicalis* 3(2.0%), *Candida glabrata* 1(0.7%), *Candida krusei* 3(2.0%) and mixed of *Candida albican* and *Candida tropicalis* 3(2.0%).

Conflict of interest

The authors declare no conflict of interest.

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Nothing to declare

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