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Prevalence and Factors Associated with Oral Candidiasis Among HIV Patients Attending Fort Portal Regional Referral Hospital, Western Uganda

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ABSTRACT

Faculty of Medicine and Surgery of Kampala International University Western Campus Uganda. **ABSTRACT**
In Uganda, the prevalence of HIV among adults aged 15 to 64 is 6.2%, with higher rates among females (7.6%) than males (4.7%). This corresponds to around 1.2 million people aged 15 to 64 living with HIV in Uganda, and a 0.5% prevalence of HIV among children aged 0-14, which equates to approximately 95,000 children living with HIV in the country. Despite the availability of Highly Active Antiretroviral therapy, which suppresses the virus and reduces HIV-related illness and mortality, oral candidiasis is a common issue in up to 95% of HIV-infected individuals during their illness. This study was conducted at Fort Portal Regional Referral Hospital in Uganda with 287 HIV-positive patients. The study aimed to determine the prevalence of oral candidiasis among these patients and identify associated factors to develop strategies for reducing its prevalence. The study found that 44.26% of HIV-positive patients at Fort Portal Regional Referral Hospital had oral candidiasis, a higher rate than in most other studies in Uganda. Factors independently associated with oral candidiasis were advanced age (≥56 years), which increased the risk, and having a CD4 count of ≥ 200 copies/mm^3, which was protective against oral candidiasis. These findings provide insights into addressing and managing oral candidiasis among HIV patients in this region.

Keywords: HIV/AIDs, Oral candidiasis, HIV-positive patients, CD4+ count.

INTRODUCTION

HIV refers to the Human Immunodeficiency Virus. It targets cells of the immune system, called CD4+ cells, which help the body respond to infection. Within the CD4+ cell, HIV replicates and in turn, damages and destroys the cell resulting in a weakened immune system. This predisposes a patient to the occurrence of any of more than 20 life-threatening cancers or "opportunistic infections" a state referred to as Acquired immunodeficiency syndrome (AIDS) [1]. HIV continues to be a major global public health issue, having claimed 36.3 million lives so far since its discovery in the early 1980s, and by the end of 2020, there were an estimated 37.7 million people living with HIV, over two thirds of whom (25.4 million) are in the WHO African Region. 680,000 people died from HIV-related causes and 1.5 million people acquired HIV. To date, there is no cure for HIV infection. However, with increasing access to effective HIV prevention, diagnosis, treatment and care, including for opportunistic infections, HIV infection has become a manageable chronic health condition, enabling people living with HIV to lead long and healthy lives[2]. In Uganda, the prevalence of HIV among adults aged 15 to 64 is 6.2%: 7.6% among females and 4.7% among males corresponding to approximately 1.2 million people aged 15 to 64 living with HIV in Uganda with a 0.5% prevalence of HIV among children aged 0-14 corresponding to approximately 95,000 children living with HIV in Uganda[2]. Despite the introduction of HAART, AIDS is still more likely to occur in people living with HIV who have not been tested, those who are diagnosed at a late stage of infection, and in people who are not taking ART[1]. The reduced number of CD4 T-cell counts and an impaired immune response increase patient susceptibility to opportunistic infections such as oral candidiasis[3].

Oral candidiasis (OC) is the most frequent opportunistic infection of the oral cavity caused by Candida species overgrowth. It is an opportunistic infection that is often found in people infected with HIV or AIDS characterized by a decrease in CD4+ count[4, 5]. A variety of Candida species are responsible for causing opportunistic fungal infections. However, C. Albicans is the most frequent etiologic agent followed by C. tropicalis, C. parapsilopsis, and C. glabrata[6].Candidiasis usually acts as an early marker for people living with HIV/AIDS despite being a normal flora in the gut, the commensal relationship exists as long as there is a balance between the host immune system and the virulence factors of C. Albicans, however, in the presence of risk factors such as extremes of age,

xerostomia, smoking, alcohol consumption, dental prosthesis, broad spectrum or longer antibiotic usage, low CD4 counts and advanced WHO clinical stage of HIV characterized by immune dysfunction, and damage to the muco-intestinal barrier, dysbiosis of the residential micro biota occurs resulting into development of infections [7, 8]. Oral candidiasis has a wide range of clinical manifestations ranging from late secondary systemic disease to a state where it affects only the oral cavity and perioral area, also referred to as Primary candidiasis. It includes four different conditions: pseudomembranous candidiasis, acute erythematous candidiasis, chronic erythematous candidiasis, and chronic hyperplastic or nodular candidiasis each of which bear slightly different presentations[8].Diagnosis of systemic candidiasis relies on history, physical examination and harvesting swabs smeared and assisted by direct microscopic examination of biological samples after treatment with 10 % KOH solution or Gram staining, the Wright-Giemsa stain can be used to demonstrate hyphae which confirm the diagnosis of Candida and a susceptibility test can be done for treatment [9].

In 2017, An estimate by the Leading International Fungal Education portal facilitated on the burden of serious fungal infections for over 5.7 billion people (>80% of the world's population) approximated that there were over 2,000,000 cases of oral candidiasis and over 700,000cases complicating to invasive candidiasis occurring as a consequence of other health problems including asthma, AIDS, cancer, organ transplantation and corticosteroid therapies[10].Whereas oral candidiasis occurs in up to 95% of human immunodeficiency virus (HIV)-infected individuals during the course of their illness, the worldwide prevalence of Oropharyngeal candidiasis ranges between 50 to 95% of HIV- positive patients with C.albicans being the most common causative agent[3, 11, 12]. In sub Saharan Africa, the prevalence of OC ranged from 7.6% to 75.3% with Pseudomembranous candidiasis ranging from 12.1% to 66.7%. Non-Albicans Candida species caused 33.5% of the OC cases with C. glabrata accounting for 23.8% of their cases, erythematous candidiasis (chronic atrophic candidiasis) was highest in Ethiopia, at 40.2%. [13]Despite of the introduction of HAART which showed a 61% reduction in the annual prevalence of Oral candidiasis, By 2017, the prevalence of Oral Candidiasis among HIV patients in Uganda was 12.1% [13], Regional variation showed a higher prevalence of 24.9 % in a study conducted at Hoima Regional Referral Hospital[14]. HIV/AIDS is more prevalent in sub-Saharan African and women are the most afflicted [15]. Whereas Fungal diseases kill more than 1.5 million and affect over a billion people, worldwide, they are still a neglected topic by public health authorities even though most deaths from fungal diseases are avoidable. This is no difference in Uganda, the COVID-19 pandemic halted transportation measures, decreasing accessibility to hospitals resulting into decreased adherence as well as lost to follow up among patients living with HIV, this together with the varying prevalence in several studies depicts in a gap in the Prevalence and Factors associated of oral candidiasis among HIV positive patients making our study inevitable.

METHODOLOGY

Study Design

The study was a hospital based cross sectional survey. An interviewer administered a structured questionnaire to collect information on risk factors whereas oral swabs will be taken to determine antifungal susceptibility.

Area of Study

The study was conducted at Fort Portal Regional Referral Hospital. Fort Portal Regional Referral Hospital was gazetted in 1994 and is among the 14 regional referrals hospitals in Uganda. It has a bed capacity of 384[16] and serves the entire Tooro region consisting of eight Ugandan districts (Bundibugyo, Kabarole, Kyenjojo, Kasese, Kamwenge, Kyegegwa, Bunyangabu and Ntoroko) and a part of eastern Democratic Republic of Congo (DRC). Fort Portal Regional Referral Hospital offers both general and specialized medical services and is also a teaching centre for KIU Medical School and several other institutions.

Study Population

The participants in this study were people living with HIV/AIDS (PLWHA) receiving care from Fort Portal Regional Referral Hospital.

Inclusion Criteria

- All people living with HIV who were diagnosed more than 1 month ago.
- All patients who consented to participate in the study.

Exclusion Criteria

- ❖ All patients who declined to participate in the study were not be included.
- ❖ All patients who wanted to be financially motivated before they responded to the questionnaire will were included.
- ❖ All patients who never gave consent to participate were be included.
- ❖ Patients who consented but withdrew before they finished answering the questionnaire were not included in the study.

Sample Size Determination

The sample size for the study was determined taking the following factors into consideration: Using a study done in Uganda to determine the prevalence of Human Immune Virus (HIV) related oral lesions and their association with Cluster of Differentiation 4 (CD4+) count among treatment naïve HIV positive patients where the prevalence of oral candidiasis was 24.9%[17], And at 95% confidence interval and a margin of error of 5%, the sample size was calculated using the keshie Leslie 1965[18] formulae. As below.

$$N = \frac{Z^2 P (1-P)}{e^2}$$

Where Z=the standard Normal Deviation set at 1.96 and it corresponds to 95% confidence level.

P=proportion of the population with particular characteristics estimated at 24.9% =0.249
e= expected error estimated at 0.05
Therefore N= (1.96*1.96*0.249*0.751)/(0.05*0.05)
N=287 patients.

Therefore, the sample size was 287 patients.

Sampling Method

Convenience sampling technique was employed in this research where all HIV positive Patients of both sexes and all age groups whether on HAART or not were eligible for this study[19].

Data Collection Procedure

The study employed quantitative approach to data collection[20]. The measurement tool for the study was an interviewer administered questionnaire, available in English language. The research team in collaboration with the hospital authorities discussed about the most comfortable language to be used and hence obtained conclusions about the need for translation. The questions were closed ended. It included questions related to demographic characteristics, medical factors and a section for capturing the prevalence of oral candidiasis. The study received ethics approval from the Institutional Research Ethics Committee (IREC) of Kampala International University-Western Campus, A letter of introduction was sent to the Executive Director of Fort Portal Regional Referral Hospital before the study commenced and visits were organized to discuss the research with the IRB of Fort Portal Regional Referral Hospital and acceptance was obtained to conduct the study within the facility. Training involving introduction to the purpose of the study was done. I will be ensured that the assistants were familiar with the study objectives and methodology and they were thoroughly taken through the questionnaire. The research assistants were involved in carrying out the pilot study in which the questionnaire for the study was pre-tested, the researcher and the research assistants carried out the pilot study. Points to be noted and assessed included; availability of the sample needed for the full study, desire of the patients to participate, clarity of the language used and time needed for administering the questionnaire. Based on feedback from the pre-test, the questionnaire was modified to ensure its suitability for the study. The selected patients were allowed to ask questions for clarification, they were assured of confidentiality and anonymity. The subject of voluntary participation was emphasized to allow any patient who wished to withdraw from the study to do so. Selected participants were taken through the questionnaire.

Data Analysis

Data was analyzed by the use of STATA version 14.0. Categorical variables were described in percentages. The variables were compared using Chi-square test. The dependent variable was "occurrence of oral candidiasis" which was coded as "0" for those not having oral candidiasis and coded as "1" for those having oral candidiasis. Binary and multivariate logistic regressions were run to assess the factors associated with oral candidiasis. Significant Variables at bivariate analysis and Variables having P<0.20 level in the bivariate analysis were included in the final multivariate logistic regression analysis, to identify independent factors. The forward stepwise regression method was applied to get a list of best predictors and the statistical test was considered significant at P level less than 0.05 in the final model. Findings were summarized in form of tables, pie charts and graphs as well as plain text.

Quality Control

The Research Assistants underwent a 2-day training where they were introduced to the research protocol and the questionnaire and they underwent interview simulations to polish up their skills. This enabled them to get familiar with the questionnaire, its administration and thus reduced the inconsistencies and biases during the explanation. Each question was explained in English and Rutoroto ensure that participants understood clearly what the question meant. To ensure quality of work, an interviewer guided upon all the questions and crosschecked on data collected. All questionnaires were collected from participants and checked for completeness, accuracy and any irregularities; all completed questionnaire were kept by the researcher for analysis and report writing. At the data analysis stage, again checking for completeness and consistency was done.

Ethical Consideration

Ethical approval for the study was obtained from the Institutional Research Ethics Committee (IREC) of Kampala International University-Western Campus. Administrative clearance was obtained from the executive Director of Fort Portal Regional Referral Hospital, the researcher explained the purpose of the study to all participants after which a written informed consent was obtained from the participants and filled on top of the questionnaire before participating in the study. The respondents were informed that their participation was purely on voluntary terms and that their withdrawal of consent/participation would not affect their relationship with the researcher nor the health institutions neither would it make them barred from receiving services which they were entitled to.

RESULTS

Demographic Characteristics

Table 1 below shows that the highest proportion of the study participants 26.48% (76/287) were in the age group of 36 to 45 years, belonged to female gender62.37% (179/287), and were Catholics 37.28% (107/287). Results further showed that more than half of the participants 53.31% (153/287) were married, meanwhile majority of the participants70.38% (202/287) were employed and 61.32% (176/287) were coming from rural areas of residence. Pertaining to highest level of education, 48.43% (139/287) had attained primary education. Lastly, 53.31% (153/287) and were earning less than 500,000 shillings.

Table 1: Shows Frequency distribution for Demographic Characteristics of the Study Participants.

Variable	Frequency (n)	Percentage (%)
Age in years		
<18 years	38	13.24
18-35 years	71	24.74
36-45 years	76	26.48
46-55 years	54	18.82
56 years and above	48	16.72
Gender		
Male	108	37.63
Female	179	62.37
Religion		
Catholic	107	37.28
Anglican	80	27.87
SDA	26	09.06
Born again	20	06.97
Muslim	44	15.33
Others	10	03.48
Marital Status		
Single	70	24.39
Married	153	53.31
Divorced	39	13.59
Widowed	25	08.71
Employment status		
Employed	202	70.38
Unemployed	85	29.62
Area of Residence		
Urban	111	38.68
Rural	176	61.32
Semi Urban	00	00.00
Education Level		
Uneducated	88	30.66
Primary	139	48.43
Secondary	39	13.59
Tertiary	21	07.32
Estimated Monthly income		
<500,000 /=	153	53.31
≥500,000 /=	134	46.69

Medical Characteristics of study Participants

Shown in table 2 below is the frequency distribution of the medical characteristics of the study participants. As observed from the table, majority of the study participants 73.87% (212/287) said that they were currently consuming alcohol, 66.20% (190/287) were experiencing xerostomia, and 70.79% (229/287) were non cigarette smokers. Furthermore, majority of participants 92.33% (265/287) have HIV-TB coinfection, 57.84% (166/287) had their last CD4 count done in less than 6 months and 59.93% (172/287) has CD4 count of ≥ 200 copies. Additionally, 28.92% (83/287) had been in HIV care for a period of 1 month to 1 year with 32.40% (93/287) being in WHO clinical stage I and 88.15% (253/287) never had hepatitis B infection.

Table 2; Frequency Distribution table for medical Characteristics

Variable	Frequency (n)	Percentage (%)
Alcohol Consumption		
Yes	75	26.13
No	212	73.87
Xerostomia		
Yes	97	33.80
No	190	66.20
Smokes Cigarettes		
Yes	58	20.21
No	229	79.79
TB coinfection		
Yes	22	07.67
No	265	92.33
Duration since last CD4 count was done		
In less than 6 months	166	57.84
Between 6 to 12 months	85	29.62
A year ago	27	09.41
Above 1 year ago	09	03.14
CD4 Level		
< 200 copies	115	40.07
≥ 200 copies	172	59.93
Duration in HIV care		
Less than 1 month	63	21.95
Between 1 month to <1 year	83	28.92
Between 1 year to 5 years	67	23.34
> 5 years	74	25.78
WHO clinical stage		
Stage I	93	32.40
Stage II	64	22.30
Stage III	59	20.56
Stage IV	71	24.74
Hepatitis B infection		
Yes	34	11.85
No	253	88.15

The Prevalence of Oral Candidiasis among HIV/AIDS patients attending Fort Portal Regional Referral Hospital, Western Uganda.

Shown in table 3 below is the Prevalence of Oral Candidiasis among HIV/AIDS patients attending medical ward at Fort Portal Regional Referral Hospital, Western Uganda. As observed the table, the prevalence of Oral Candidiasis was 44.26% (127/287) with 95% confidence interval of 38.47 – 50.03.

Table 3: Prevalence of Oral Candidiasis among HIV/AIDS patients

Candidiasis	Frequency (n)	Percentage (%)	95% Confidence Interval
No	160	55.75	49.97 – 61.53
Yes	127	44.26	38.47 – 50.03

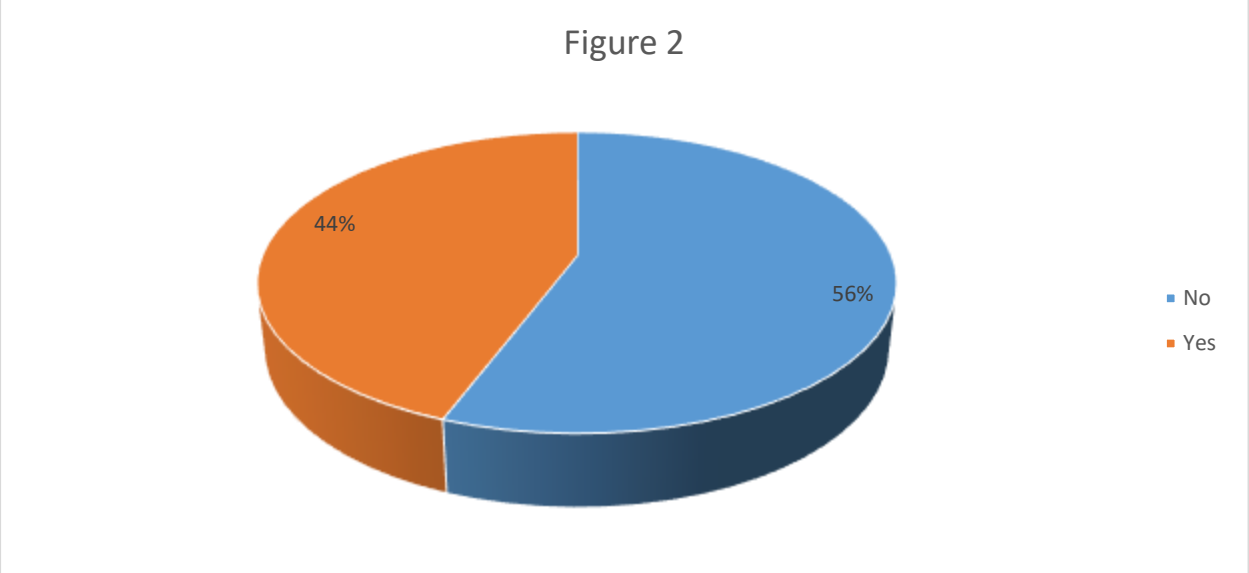

Figure 1; Pie Chart Showing Prevalence of Oral Candidiasis among HIV/AIDS patients

The Demographic Factors Associated with Oral Candidiasis among HIV/AIDS patients attending Fort Portal Regional Referral Hospital, Western Uganda.

A modified Poisson regression was run to determine the factors associated with oral candidiasis among HIV/AIDS patients attending medical ward at Fort Portal Regional Referral Hospital. Table 4 shows that the demographic factors associated with oral candidiasis among the study participants. Results of the analysis revealed that age, employment status and education level were the only demographic factors associated with oral candidiasis. Study participants who were 56 years and above were 1.94 times more likely have oral candidiasis than those who were less than 18 years of age (cPR 1.94, 95%CI 1.24-3.02, P=0.003).Furthermore, participants who were unemployed were 1.98 times at risk of having oral candidiasis than their counterparts who were employed (cPR1.98, 95%CI 1.73-2.30, P<0.001). Study participants with primary level of education were 82% less likely to be affected by oral candidiasis compared to their counterparts who were uneducated (cPR0.18, 95%CI 0.12-0.99, P=0.001). Study participants who with secondary level of education were 88% less likely to have oral candidiasis compared to those who were not educated (cPR0.12, 95%CI 10.05-0.73, P<0.001). Study participants who had tertiary level of education were 80%protected from oral candidiasis as opposed to their counterparts who were not educated (cPR0.20, 95%CI 0.16-0.82, P=0.005).

Table 4: Demographic Factors Associated with Oral Candidiasis among HIV/AIDS patients attending medical ward

Variables	Oral Candidiasis		cPR (95% CI)	P Value
	No Count, (%)	Yes Count, (%)		
Age in years				
<18 years	25 (63.16)	14 (36.84)	1.00	
18-35 years	39 (54.93)	32 (45.07)	1.22 (0.75-1.99)	0.420
36-45 years	40 (52.63)	36 (47.37)	1.29 (0.80-2.08)	0.305
46-55 years	31 (57.41)	23 (42.59)	1.16 (0.69-1.94)	0.584
56 years and above	26 (54.17)	22 (45.83)	1.94 (1.24-3.02)	**0.003**
Gender				
Male	62 (57.41)	46 (42.59)	1.00	
Female	98 (54.75)	81 (45.25)	1.06 (0.81-1.39)	0.663
Religion				
Catholic	62 (57.94)	45 (42.06)	1.00	
Anglican	43 (53.75)	37 (46.25)	1.10 (0.79-1.52)	0.566
SDA	14 (53.85)	12 (46.15)	1.10 (0.68-1.76)	0.699
Born again	12 (60.00)	08 (40.00)	0.95 (0.53-1.70)	0.866
Muslim	22 (50.00)	22 (50.00)	1.19 (0.82-1.72)	0.360
Others	07 (70.00)	03 (30.00)	0.71 (0.27-1.89)	0.497
Marital Status				
Single	36 (51.43)	34 (48.57)	1.00	
Married	88 (57.52)	65 (42.48)	0.87 (0.65-1.19)	0.388
Divorced	21 (53.85)	18 (46.15)	0.95 (0.63-1.44)	0.810
Widowed	15 (60.00)	10 (40.00)	0.82 (0.48-1.41)	0.479
Employment status				

Employed	112 (55.45)	90 (44.55)	1.00	
Unemployed	48 (56.47)	37 (43.53)	1.98 (1.73-2.30)	**<0.001**
Area of Residence				
Urban	67 (60.36)	44 (39.64)	1.00	
Rural	93 (52.84)	83 (47.16)	1.19 (0.90-1.57)	0.221
Education Level				
Uneducated	67 (76.14)	21 (23.86)	1.00	
Primary	73 (52.52)	66 (47.48)	0.18 (0.12-0.99)	**0.001**
Secondary	10 (25.64)	29 (74.36)	0.12 (0.05-0.73)	**<0.001**
Tertiary	10 (47.62)	11 (52.38)	0.20 (0.16-0.82)	**0.005**
Estimated Monthly income				
<500,000 /=	78 (50.98)	75 (49.02)	1.00	
≥500,000 /=	82 (61.19)	52 (38.81)	0.79 (0.61-1.03)	0.087

CI = Confidence Interval, cPR = Crude Prevalence Ratio, P Value is Significant at 0.05 level

The Medical Factors Associated with Oral Candidiasis among HIV/AIDS patients attending Fort Portal Regional Referral Hospital, Western Uganda.

The results of a modified Poisson regression revealed that 5medical factors were statistically associated with oral candidiasis among HIV patients as shown in table 5 below. The factors include; Cigarette smoking (cPR0.75, 95%CI 0.57-0.99, P=0.045), HIV-TB coinfection (cPR 0.50, 95%CI 0.39-0.64, P<0.001), duration of above 1 year since last CD4 count was done(cPR1.90, 95%CI 1.28-2.82, P=0.001), WHO clinical stage IV(cPR 1.28, 95%CI 1.14-1.44, P<0.001) meanwhile CD4 of ≥ 200 copies is protective against oral candidiasis (cPR0.24, 95%CI 0.14-0.99, P=0.028).

Table 5: Medical Factors Associated with Oral Candidiasis among HIV/AIDS patients attending medical ward

Variables	Oral Candidiasis		cPR (95% CI)	P Value
	No Count, (%)	Yes Count, (%)		
Alcohol Consumption				
Yes	147 (62.67)	28 (37.33)	1.00	
No	113 (53.30)	99 (46.70)	1.25 (0.90-1.73)	0.180
Xerostomia				
Yes	49 (50.52)	48 (49.48)	1.00	
No	111 (58.42)	79 (41.58)	0.84 (0.65-1.09)	0.194
Smokes Cigarettes				
Yes	26 (44.83)	32 (55.17)	1.00	
No	134 (58.52)	95 (41.48)	0.75 (0.57-0.99)	**0.045**
HIV-TB coinfection				
Yes	04 (18.18)	18 (81.82)	1.00	
No	156 (58.87)	109 (41.13)	0.50 (0.39-0.64)	**<0.001**
Duration since last CD4 count was done				
In less than 6 months	98 (59.04)	68 (40.96)	1.00	
Between 6 to 12 months	44 (51.76)	41 (48.24)	1.18 (0.89-1.57)	0.264
A year ago	16 (59.26)	11 (40.74)	0.99 (0.61-1.63)	0.983
Above 1 year ago	02 (22.22)	07 (77.78)	1.90 (1.28-2.82)	**0.001**
CD4 Level				
< 200 copies	67 (58.26)	48 (41.74)	1.00	
≥ 200 copies	93 (54.07)	79 (45.93)	0.24 (0.14-0.99)	**0.028**
Duration in HIV care				
Less than 1 month	40 (63.49)	23 (36.51)	1.00	
Between 1 month to <1 year	46 (55.42)	37 (44.58)	1.22 (0.81-1.83)	0.334
Between 1 year to 5 years	36 (53.73)	31 (46.27)	1.27 (0.84-1.92)	0.265
> 5 years	38 (51.35)	36 (48.65)	1.33 (0.89-1.99)	0.161
WHO clinical stage				
Stage I	44 (47.31)	49 (52.69)	1.00	
Stage II	60 (93.75)	04 (06.25)	0.12 (0.04-3.31)	0.678
Stage III	26 (44.07)	33 (55.93)	1.06 (0.79-1.43)	0.694
Stage IV	30 (42.25)	41 (57.75)	1.28 (1.14-1.44)	**<0.001**

Hepatitis B infection				
Yes	24 (70.59)	10 (29.41)	1.00	
No	136 (53.75)	117 (46.25)	1.57 (0.92-2.69)	0.499

CI = Confidence Interval, cPR = Crude Prevalence Ratio, P Value is Significant at 0.05 level

Multivariate Analysis to Factors Independently Associated with Oral Candidiasis among HIV/AIDS patients attending Fort Portal Regional Referral Hospital.

In multivariate model, factors which were found to be having p-values less than 0.20 at bivariate analysis were included in the model and a multivariate analysis was run so as to establish factors independently associated with oral candidiasis among the study participants. Through a stepwise regression with removal of least significant variables in each step the following factors remained independently associated with oral candidiasis: Age of ≥56 years was a risk factor for oral candidiasis (aPR6.50, 95%CI 3.30-12.80, P=0.013) meanwhile CD4 count of ≥ 200 copies/mm^3 was protective against oral candidiasis (aPR0.36, 95%CI 0.14-0.99, P=0.018).

Table 6: Multivariate Analysis to Show Factors Independently Associated with Oral Candidiasis among HIV/AIDS patients

Variables	Oral Candidiasis		aPR (95% CI)	P Value
	Yes Count, (%)	No Count, (%)		
Age in years				
<18 years	25 (63.16)	14 (36.84)	1.00	
18-35 years	39 (54.93)	32 (45.07)	0.91 (0.60-1.39)	0.679
36-45 years	40 (52.63)	36 (47.37)	1.03 (0.60-1.76)	0.924
46-55 years	31 (57.41)	23 (42.59)	1.01 (0.40-2.59)	0.976
56 years and above	26 (54.17)	22 (45.83)	6.50 (3.30-12.80)	**0.013**
Employment Status				
Employed	112 (55.45)	90 (44.55)	1.00	
Unemployed	48 (56.47)	37 (43.53)	1.08 (1.02-1.24)	0.378
Education Level				
Uneducated	67 (76.14)	21 (23.86)	1.00	
Primary	73 (52.52)	66 (47.48)	0.84 (0.46-15)	0.561
Secondary	10 (25.64)	29 (74.36)	1.03 (0.77-1.79)	0.463
Tertiary	10 (47.62)	11 (52.38)	1.03 (0.69-1.53)	0.900
Estimated Monthly income				
<500,000 /=	78 (50.98)	75 (49.02)	1.00	
≥500,000 /=	82 (61.19)	52 (38.81)	0.68 (0.41-1.18)	0.127
Alcohol Consumption				
Yes	147 (62.67)	28 (37.33)	1.00	
No	113 (53.30)	99 (46.70)	0.79 (0.49-1.27)	0.328
Xerostomia				
Yes	49 (50.52)	48 (49.48)	1.00	
No	111 (58.42)	79 (41.58)	1.30 (0.76-2.25)	0.340
Smokes Cigarettes				
Yes	26 (44.83)	32 (55.17)	1.00	
No	134 (58.52)	95 (41.48)	1.15 (0.75-1.78)	0.517
TB coinfection				
Yes	04 (18.18)	18 (81.82)	1.00	
No	156 (58.87)	109 (41.13)	0.95 (0.61-1.48)	0.830
Duration since last CD4 count was done				
In less than 6 months	98 (59.04)	68 (40.96)	1.00	
Between 6 to 12 months	44 (51.76)	41 (48.24)	1.34 (0.70-2.58)	0.387
A year ago	16 (59.26)	11 (40.74)	0.59 (0.22-1.54)	0.280
Above 1 year ago	02 (22.22)	07 (77.78)	1.32 (0.82-2.11)	0.257
CD4 Level				
< 200 copies copies/mm^3	67 (58.26)	48 (41.74)	1.00	

≥ 200 copiescopies/mm³	93 (54.07)	79 (45.93)	0.36 (0.14-0.99)	**0.018**
WHO clinical stage				
Stage I	44 (47.31)	49 (52.69)	1.00	
Stage II	60 (93.75)	04 (06.25)	2.14 (0.82-5.55)	0.116
Stage III	26 (44.07)	33 (55.93)	0.99 (0.82-1.20)	0.911
Stage IV	30 (42.25)	41 (57.75)	1.03 (0.93-1.13)	0.590

CI = Confidence Interval, aPR = Adjusted Prevalence Ratio, P Value is Significant at 0.05 level

DISCUSSIONS

The Prevalence of Oral Candidiasis among HIV/AIDS patients attending Fort Portal Regional Referral Hospital, Western Uganda.

Findings of the present study showed that the prevalence of Oral Candidias is among HIV patients attending Fort Portal regional referral hospital was 44.26%. Among the immunosuppressed population, oral candidiasis is the most common human fungal infection [21]. The prevalence of oral candidiasis found in the present study is higher than the prevalence which was found in a study done from southwest Iran which showed that the overall prevalence of oral candidiasis was 41% [22]. The disagreement in the study findings can be explained by the variations in the study designs as well as the sampling techniques employed. On the other hand, the prevalence of oral candidiasis found in the present study is lower than the prevalence of 59.5 reported by [23] in a Columbia based study. The discrepancy in the study findings can be explained by the fact that the two studies were conducted in different geographical locations with variations in study participants. Furthermore, the prevalence of oral candidiasis found in this study is higher than the results of an analytic cross sectional study done among HIV positive patients in Hoima Regional Referral Hospital which revealed that the prevalence of oral candidiasis was 24.9% [17]. Much as both studies were conducted from Western Uganda, the disagreement in the study findings can be explained by the difference in the level of care provided by the health workers in the 2 study settings. Another possible reason for the discrepancy in the study findings could be because the study participants in the previous study had good health seeking behaviors and hence the low prevalence of oral candidiasis meanwhile the participants in the present study could be having poor health seeking behaviors and present late to the hospital. Additionally, the prevalence of oral candidiasis found in the present study is lower than what was found in a study by [24] who reported that the overall pooled prevalence of HIV-associated oral candidiasis was 12%. The disagreement in the study results can be explained by the fact that the previous study was a systematic review and meta-analysis which utilized studies conducted in Sub-Saharan Africa meanwhile the present study was conducted from only one tertiary hospital in Western Uganda.

The Demographic Factors Associated with Oral Candidiasis among HIV/AIDS patients attending Fort Portal Regional Referral Hospital, Western Uganda.

When a multivariate analysis to adjust for confounders was done, results of the present study revealed that age was the only socio-demographic factor associated with candidiasis among HIV patients attending Fort Portal Regional Referral Hospital. Participants who were 56 years and above were 6.50 times more likely to have oral candidiasis than those less than 18 years of age. The result of the present study is in line with results of a Study conducted in Brazil which revealed that age was a confirmed risk factor for oral colonization by Candida species with patients aged 45 to 59 years and 60 years or older being at a higher risk of oral colonization [3]. Much as the previous study was done in a developed country, the present study was conducted in a developing country but the findings are still similar probably because with advanced age, the immunity of an individual gets further suppressed. Similar to the finding of the present study, the results of a study conducted from Nepal showed that age group of (41–50) years had the highest candida infection (34.2%; 14/41) followed by age group (31–40) years (31.7%; 13/41)[25]. The noticeable differences in age groups are in discrepancy, with both studies counteracting each other in regards to the age groups most commonly affected thus making it inevitable to assess the association between age and oral candidiasis among patients with HIV/AIDS. In line with the findings from the present, [26] conducted a study among Airlangga University hospital HIV patients and found that advanced age was associated with the occurrence of oral candidiasis. The finding of this study is further supported by the results of studies conducted by [27] and [22] which all showed that age had statistically significant association with oral candidiasis.

The Medical Factors Associated with Oral Candidiasis among HIV/AIDS patients attending Fort Portal Regional Referral Hospital, Western Uganda.

This study showed thatCD4 level was the only medical factor associated with oral candidiasis among the study participants. CD4 count of ≥ 200 copies was protective against oral candidiasis in that participants who had CD4 count of ≥ 200 copies were 64% less likely to be affected by oral candidiasis as compared to their counterparts who had CD4 count of <200 copies/mm³. The cluster of differentiation 4 (CD4) cell count is more sensitive to sudden changes in a person's immunity and, thus, is a better indicator of HIV/AIDS progression [28]. CD4 counts can

differ among individuals, depending on their age, sex and immune status. Oral lesions are generally an early sign of HIV infection, but could also be used to predict the progression of HIV/AIDS in patients[29].Similar to the findings of the present study, [22] conducted a study among HIV patients from southwest Iran and found that CD4 count ≤ 200 cells/mm3 was a the predictor of oral candidiasis in the final model of multiple logistic regression analysis.[30]conducted a study on oral manifestations of HIV infection and their correlation with CD4 count. Similar to the result of the present study, they found that reduced CD4 cell count below 200 cells/mm^3 was significantly correlated with oral candidiasis. The finding of the present study is in agreement with the results of a study conducted in Ghana by[31] to determine oral manifestations and their correlation to baseline CD4 count of HIV/AIDS patients. They found that declining baseline CD4 count was significantly associated with occurrence of oral candidiasis[32]showed that C. non-albicans was more common in highly active ARV therapy (HAART)-naive patients, and use of HAART was associated with the decrease of these species. HAART may act directly by inhibition of secretory aspartyl proteinase enzymes needed for growth of Candidal hyphae, and indirectly by improving CD4 levels to reduce Candida colonization [33, 34].

Conclusion

The study has shown that the prevalence of Oral Candidiasis was 44.26% among HIV patients attending Fort Port Regional Referral Hospital. This prevalence is higher than the prevalence of oral Candidiasis found in most studies conducted in Uganda. This study showed that advance age was significantly associated with oral candidiasis meanwhile CD4 count of ≥ 200 copies/$mm^3$was protective against oral candidiasis among HIV patients attending Fort Portal Regional Referral Hospital.

Recommendations

- ✓ Health workers should pay more attention to HIV patients with advancing age and such patient should be made to undergo clinical assessment regularly.
- ✓ HIV positive patients having CD4 count less than 200 copies/mm^3should be identified and strategies put in put to ensure that their CD4 counts rise above 200 copies/mm^3.
- ✓ HIV positive patients should be sensitized about the merits of adhering to ARVsas this will make them to have suppressed viral load and it increase their CD4 count.

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