

The Relationship Between Viral Load Levels and the Incidence of Oral Candidiasis in HIV/AIDS Patients at Jombang Hospital for the Period 2023-2025

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Keywords

Antifungal medication; Education level; HIV/AIDS; Oral candidiasis, Viral load

Abstract

This research aimed to determine the relationship between viral load levels and the incidence of oral candidiasis among HIV/AIDS patients at the RSUD Jombang during the 2023–2025 period. This analytical observational study with a cross-sectional design used secondary data from medical records of HIV/AIDS patients at RSUD Jombang (2023–2025). The independent variable was viral load level and the dependent variable was oral candidiasis incidence. Data were analyzed using univariate and bivariate analyses (Kruskal-Wallis and Chi-Square tests), examining viral load and other variables including age, gender, occupation, comorbidity, marital status, education level, and antifungal medication use. The research involved 402 patients, of whom 322 (80.1%) had an undetectable viral load, 26 (6.5%) had a suppressed viral load, and 54 (13.4%) had an unsuppressed/high viral load. Bivariate analysis showed that neither numerical viral load ($p=0.97$) nor ordinal viral load ($p=0.22$) had a significant relationship with the incidence of oral candidiasis. Other variables such as age ($p=0.18$), gender ($p=0.88$), occupation ($p=0.62$), comorbidity ($p=0.71$), marital status ($p=0.08$), and antifungal medication use ($p=0.64$) also showed no significant relationship. However, educational level was found to have a significant association with the incidence of oral candidiasis ($p=0.04$). Overall, these findings suggest that educational level plays an important role in the occurrence of oral candidiasis among HIV/AIDS patients, indicating that targeted educational interventions and increased patient awareness regarding viral load management and oral hygiene may help reduce the incidence of this infection.

INTRODUCTION

HIV/AIDS is a global health problem with more than 39 million deaths and more than 36 million people living with HIV. There are two types of HIV viruses, namely HIV-1 which is spreading globally and HIV-2 which is endemic in West Africa. The early stages of infection often cause flu-like symptoms (ARS), although half of the individuals show no symptoms. The clinical latent stage can be asymptomatic, but some non-AIDS conditions can appear. The final stage, AIDS, is characterized by a decrease in CD4 cell count below 200 cells/mm³ or the appearance of opportunistic diseases (Gartner *et al.*, 2020; Sungkanuparph *et al.*, 2011).

HIV epidemiological data in the world, show that the highest incidence of HIV infection occurs at the age of 20 to 30 years (about 35 per 100,000), while the incidence of AIDS peaks around the age of 45 years (about 14 per 100,000), with a significantly higher incidence rate in the black population than in other ethnic groups (Sulistina *et al.*, 2024; Sungkanuparph *et al.*, 2011). In the United States, HIV prevalence stands at about 1.2 million people, while globally

there are an estimated 37 to 39.9 million people living with HIV in 2023, with 38.6 million adults (>15 years) and 1.4 million children (<15 years), 53% of whom are women. In the same year, about 1.3 million people were infected with HIV, showing a 39% decrease since 2010. Women and girls account for 44% of new infections. About 86% of the world's HIV people already know their status, while 5.4 million people need access to HIV testing. By the end of 2023, 77% of people with HIV (30.7 million) had accessed antiretroviral therapy (ART), which is essential to stop the spread of AIDS. (UNAIDS, 2021).

In Indonesia, about 630,000 people are living with HIV, with cases increasing even though infection rates in Southeast Asia are generally declining. West Java province has the highest number of cases, followed by DKI Jakarta, East Java, and Papua, Surabaya, with high population density, many entertainment venues, and unsafe sex practices, experiencing the rapid spread of HIV. HIV cases in Surabaya increased from 501 in 2013 to 572 in 2014, and reached 1,588 new cases in 2018 (Pandey & Galvani, 2019). Same-sex attraction since the age of 15 is a factor in HIV transmission. Surabaya recorded the highest HIV cases among gays and transgenders, with 3,936 gays and 272 transgender people infected. In 2021–2022, 1,155 gay people were infected with HIV. Sawahan Village in Surabaya is at high risk due to the presence of a group of men who behave as gay or men who have sex with men (MSM), with the risk of HIV due to unsafe sexual behavior (Limmade *et al.*, 2019; Merati *et al.*, 2021; Volkow & Montaner, 2011).

Efforts to combat the HIV/AIDS epidemic are focused on a combination of prevention, treatment, and treatment strategies (Dewi *et al.*, 2024; Fajri *et al.*, 2018; Govender *et al.*, 2021). Preventive measures include the promotion of safe sex practices, increased access to testing and counseling services, and the implementation of harm reduction programs for injection drug users (Bekker *et al.*, 2018). Treatment options for HIV/AIDS have evolved rapidly in recent years, with antiretroviral therapy (ART) proving to be highly effective in slowing the progression of the disease and improving the quality of life for people living with HIV. Despite progress in addressing the HIV/AIDS epidemic, the disease remains a major challenge to global health that requires continued attention and investment (Ueda *et al.*, 2019; Woldesemayat *et al.*, 2024). Governments, international organizations, and civil society groups must continue to work together to promote prevention, improve access to testing and treatment, and reduce stigma and discrimination against people living with HIV/AIDS (Sulistina *et al.*, 2024).

HIV/AIDS patients are susceptible to opportunistic infections due to decreased immune system function, with low CD4+ levels as the main risk factor (Hamouda, 2023; Jayani *et al.*, 2020; Kumari *et al.*, 2025). A study at Mardi Waluyo Hospital Blitar showed that 68.8% of patients with an average CD4 level of 165.27 cells/mm³ experienced opportunistic infections, and there was a strong correlation between low CD4 levels and infection ($r = 0.732$, $p = 0.00$). Another study of 152 HIV/AIDS patients found 93.4% were infected, with oral candidiasis, tuberculosis, and bacterial pneumonia being the most common. Infection was more common in patients with CD4 levels < 200/μL (96% vs. 80.8%). In India, a study in 132 patients showed TB infection (50%) and candidiasis (49%) as the main complications, with patients having CD4 levels < 200 cells/mm³. The lower the CD4 level, the higher the risk of infections such as CMV, toxoplasmosis, and PCP (Pandharpurkar *et al.*, 2019).

Based on data from the Ministry of Health, East Java is one of the provinces with the highest number of HIV cases in Indonesia, and Surabaya is the highest city, but the spread has

spread to the surrounding areas, including Jombang. Jombang Hospital, as a regional referral hospital, receives patients from various surrounding areas and handles various HIV/AIDS cases, including complications of one of the complications of opportunistic infection, namely oral candidiasis (*oral thrush*). The high rates of opportunistic infections such as tuberculosis, candidiasis, and pneumonia in patients with low CD4 levels are important reasons for conducting more in-depth local studies. The prevalence of oral candidiasis in HIV patients with CD4 <200 cells/mm³ can reach 60–80%, with *the odds ratio* (OR) for oral candidiasis increasing by up to 6.2 times compared to patients with CD4 levels >500 (Tsegaye *et al.*, 2020).

The high level of *viral load* in HIV/AIDS patients is also directly related to the risk of death. One study showed that patients with *a high viral load* (*viral load* >100,000 *copies/ml*) had an OR of 5.2 to die from complications of opportunistic infection compared to those with low *viral load* (*viral load* <20,000 *copies/ml*) (Alemu *et al.*, 2020). Therefore, it is important to conduct research in Jombang to identify the relationship between *viral load* and the incidence of oral candidiasis in order to design more accurate and evidence-based preventive medical interventions and policies. This urgency is also reinforced by the limited epidemiological data on HIV/AIDS in Jombang, which hinders locally-based decision-making. Based on this background, this study aims to evaluate "The Relationship between *Viral Load* Levels and the Incidence of Oral Candidiasis in HIV/AIDS Patients at Jombang Hospital in the 2023–2025 Period." This research has an important urgency considering the increase in HIV/AIDS cases in East Java, especially in areas with limited access to education and health services such as Jombang Regency.

The benefits of this research are twofold. Theoretically, this study contributes to the medical literature, particularly in the field of infectious diseases and HIV/AIDS management, by providing empirical evidence on the relationship between viral load levels and the incidence of oral candidiasis, as well as identifying the significant role of education level as a determining factor (Philip-Ephraim *et al.*, 2015; Quindós & Gil-Alonso, 2019; Roshin, 2024). Practically, this research benefits several parties. For clinicians and healthcare providers at Jombang Hospital, the findings provide insights into patient education as a key factor in preventing oral candidiasis, enabling more targeted health education interventions. For HIV/AIDS patients, this study highlights the importance of education in managing their oral health and understanding viral load management. For policymakers and public health program planners, the results support the development of educational programs for PLWHA (People Living with HIV/AIDS) to improve their knowledge about oral hygiene and adherence to ART. For future researchers, this study serves as a foundation for further investigations into the psychosocial and educational factors affecting opportunistic infections in HIV/AIDS patients.

RESEARCH METHOD

Research Design

Research design

This study used an observational analytical method with *a cross-sectional* approach. This approach was used to analyze the relationship between *viral load levels* and the incidence of oral candidiasis in HIV/AIDS patients at Jombang Hospital for the 2023-2025 period. The design of this study was carried out by observing independent and dependent variables

simultaneously at one time to determine the risk factors related to the incidence of oral candidiasis in HIV/AIDS.

Research methods

This research method uses a quantitative approach. The research sample was obtained from secondary data in the form of electronic medical records of HIV/AIDS patients with oral candidiasis who underwent treatment at Jombang Hospital in the 2023-2025 period. Data is taken through the hospital management information system (SIMRS).

Population, Sample, Sample Size and Sampling Techniques

Population

The population in this study is secondary data obtained from the medical records of HIV/AIDS patients diagnosed with HIV/AIDS with oral candidiasis at the Outpatient and Inpatient Installation of the Department of Internal Medicine and the Skin Department of Jombang Hospital during the 2023–2025 period.

Sampling techniques

The sampling technique used in this study is purposive sampling, which is one of the methods of non-probability sampling. This technique was chosen because the selection of samples was based on certain considerations that fit the specific objectives and needs of the study.

Data Analysis

The data used in this study was obtained from the electronic medical records (SIMRS) of HIV/AIDS patients at Jombang Hospital, in accordance with the inclusion and exclusion criteria that have been set. The data collected included variables such as viral load levels, age, gender, occupation, education status, marital status, HIV transmission, history of comorbidities, and incidence of oral candidiasis. Next, the data was analyzed using SPSS statistical software to see the frequency distribution. The results of the analysis will be presented in the form of tables, diagrams, and descriptive narratives.

The details of the stages of data analysis are as follows:

1. Data Checking (Editing)

This step involves checking the completeness, accuracy, and suitability of the data that has been recorded in the data collection format. The researcher will review and correct if any inconsistencies or recording errors are found.

2. Coding

At this stage, the data is converted from narrative or category forms into numbers so that they can be analyzed statistically. This process aims to make it easier to input data into the software and speed up analysis.

3. Data Transferring

The encoded data is moved to the master table, which is the main worksheet used to systematically compile and organize the data before further analysis.

4. The description of the data (Tabulating)

The data is organized into a frequency distribution table to make it easier to read and analyze. This tabulation process allows for the presentation of data in a concise, structured manner, and makes it easier to interpret research results.

RESULT AND DISCUSSION

This study uses medical record data of oral candidiasis patients who are treated at Jombang Hospital 2023-2025. The data reported were in the form of gender, age, occupation, marital status, education level, comorbidities, anti-fungal treatment, clinical picture, and viral load. Data variables will be presented in the form of diagrams and tables to make it easier to analyze.

Oral Candidiasis in HIV/AIDS Patients at Jombang Hospital by Gender

Of the 402 patients who experienced oral candidiasis, 51.2% were male and 48.8% were female. This figure shows a nearly balanced distribution between the two sexes, with slightly more male patients diagnosed with oral candidiasis.

Table 1. Distribution of Oral Candidiasis Patients in HIV/AIDS Patients at Jombang Hospital by Gender

| Gender | Candidiasis Oral | % |
|--------|------------------|------|
| Male | 206 | 51,2 |
| Women | 196 | 48,8 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Distribution of Oral Candidiasis Patients in HIV/AIDS Patients at Jombang Hospital by Age

Of the total 402 patients who experienced oral candidiasis, the age distribution showed that 26.6% of patients were over 65 years of age, followed by 25.6% of patients between the ages of 25 and 44, 24.9% of patients between the ages of 45 and 64, and 22.9% of patients under the age of 25. This indicates that the age group of 65 years and above has the highest number of patients, with 25 to 44 years old.

Table 2. Distribution of Oral Candidiasis Patients in HIV/AIDS Patients at Jombang Hospital by Age

| Age | Candidiasis Oral | % |
|-------------------|------------------|------|
| <25 years old | 92 | 22,9 |
| 25 – 44 years old | 103 | 25,6 |
| 45 – 64 years old | 100 | 24,9 |
| ≥ 65 years old | 107 | 26,6 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital by Occupation

Of the total 402 patients who experienced oral candidiasis, the distribution by occupation showed that 33.3% of them had formal employment, 33.1% had informal employment, and 33.6% were unemployed. This shows that the proportion of patients with formal, informal, and non-employed jobs is almost evenly balanced.

Table 3. Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital by Occupation

| Jobs | Candidiasis Oral | % |
|-------------|------------------|------|
| Formal | 134 | 33,3 |
| Informal | 133 | 33,1 |
| Not Working | 135 | 33,6 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital based on Marital Status

A total of 197 patients with oral candidiasis have been identified as married patients, who contributed 49% of the total sample, while another 205 patients, representing 51% of the total, were unmarried patients. This shows that the unmarried patient group is slightly more dominant than the married patient group.

Table 4. Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital based on Marital Status

| Marital Status | Candidiasis Oral | % |
|----------------|------------------|------|
| Married | 197 | 49,0 |
| Not Married | 205 | 51,0 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital by Education Level

Of the total 402 patients who experienced oral candidiasis, the distribution by education level showed that most patients had low levels of education. A total of 214 patients (53.2%) had a low level of education, while 188 patients (46.8%) had a higher level of education. This shows that more than half of the patients diagnosed with oral candidiasis at Jombang Hospital have a lower educational background. These findings highlight the importance of more intensive health education efforts to patients with low levels of education, which may affect their understanding of the importance of oral health care and proper management of HIV/AIDS.

Table 5. Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital by Education Level

| Education Level | Candidiasis Oral | % |
|-----------------|------------------|------|
| Low | 214 | 53,2 |
| Height | 188 | 46,8 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital by Comorbid

Of the total 402 patients who experienced oral candidiasis, most had comorbid conditions. A total of 46 patients (11.4%) did not experience comorbidities other than oral candidiasis, while the others had various medical conditions. 47 patients (11.7%) had Diabetes

Mellitus, 48 patients (11.9%) had Dyslipidemia, and 41 patients (10.2%) had Anemia. In addition, 50 patients (12.4%) had Hypertension. Some patients also experienced a combination of two medical conditions, such as 35 patients (8.7%) with Diabetes Mellitus and Dyslipidemia, 40 patients (10.0%) with Diabetes Mellitus and Hypertension, and 44 patients (10.9%) with Diabetes Mellitus and Anemia. A combination of three conditions, namely Diabetes Mellitus, Dyslipidemia, and Anemia, was found in 51 patients (12.7%), which is the largest proportion. This suggests that many patients with oral candidiasis also have one or more comorbid medical conditions, with hypertension and a combination of several diseases being the most commonly found.

Table 6. Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital by Comorbid

| Komorbid | Candidiasis Oral | % |
|---|------------------|------|
| No Comorbidities | 46 | 11,4 |
| Diabetes Mellitus | 47 | 11,7 |
| Dyslipidemia | 48 | 11,9 |
| Anemia | 41 | 10,2 |
| Hypertension | 50 | 12,4 |
| Diabetes Mellitus + Dyslipidemia | 35 | 8,7 |
| Diabetes Mellitus + Hypertension | 40 | 10,0 |
| Diabetes Mellitus + Anemia | 44 | 10,9 |
| Diabetes Mellitus + Dyslipidemia + Anemia | 51 | 12,7 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital based on the Use of Antibiotics

Of the total 402 patients with oral candidiasis at Jombang Hospital, it is known that most patients (216 people or 53.7%) have a history of antibiotic use, while 186 patients (46.3%) do not use antibiotics. These results suggest that antibiotic use has a higher proportion among patients with oral candidiasis.

Table 7. Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital based on Antibiotic Use Treatment

| Use of Antibiotics | Candidiasis Oral | % |
|--------------------|------------------|------|
| Ya | 216 | 53,7 |
| No | 186 | 46,3 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital based on the Clinical Picture

Of the total 402 patients who experienced oral candidiasis, the distribution of the clinical picture showed that 78 patients (19.4%) had Pseudomembranous (P), 64 patients (15.9%) had Erythematous (E), and 71 patients (17.7%) had Angular Cheilitis (AC). Meanwhile, a combination of Angular Cheilitis and Erythematous (AC + E) was recorded in 62 patients

(15.4%), Angular Cheilitis with Pseudomembranous (AC + P) in 62 patients (15.4%), and a combination of all three (AC + P + E) was found in 63 patients (15.7%).

Table 8. Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital based on the Clinical Picture

| Clinical Picture | Candidiasis Oral | % |
|------------------------|------------------|------|
| P (Pseudomembranous) | 78 | 19,4 |
| E (Erythematous) | 64 | 15,9 |
| AC (Angular Cheilitis) | 71 | 17,7 |
| AC + E | 64 | 15,9 |
| AC + P | 62 | 15,4 |
| AC + P + E | 63 | 15,7 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital based on Viral load

Of the total 402 patients who experienced oral candidiasis, the distribution by *viral load* showed that most of the patients, namely 322 patients (80.1%), had a *viral load* classified as Undetectable (<20 - 50 copies/ml). 26 patients (6.5%) had a *Viral load* in the Suppressed category (50 - 999 copies/ml), while 54 patients (13.4%) had Viral Load in the Unsuppressed/High category (≥ 1000 copies/ml).

The *characteristics of the viral load* show an average *viral load* of $548,316 \pm 5,563,672$ copies/ml, with a maximum value of 74,000,000 copies/ml and a minimum of 0 copies/ml. This shows a large variation in the level of *viral load* in patients, with most patients showing *very low or undetectable viral loads, while some other patients have very high viral loads.*

Table 9. Distribution of Oral Candidiasis Patients HIV/AIDS Patients at Jombang Hospital based on Viral load

| Viral load classification | Candidiasis Oral | % |
|---|------------------|------|
| < 20 – 50 copies/ml (Undetectable) | 322 | 80,1 |
| 50 -999 copies/ml (Suppressed) | 26 | 6,5 |
| ≥ 1000 copies/ml (Unsuppressed/High) | 54 | 13,4 |
| Total | 402 | 100% |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

Table 10. Characteristics of viral load

| Characteristics of Viral Load | Viral load |
|-------------------------------|-------------------------|
| Mean \pm SD | $548.316 \pm 5.563.672$ |
| Maximum | 74.000.0000 |
| Minimum | 0 |

Source: Secondary data from electronic medical records (SIMRS) of Jombang Hospital, 2023–2025

The Relationship between Viral Load Levels and the Incidence of Oral Candidiasis in HIV/AIDS Patients

The results of the association test between various variables and the incidence of oral candidiasis in 402 patients showed that most of the variables did not have a significant relationship. *Viral load* in both numerical (p-value 0.97) and ordinal (p-value 0.22) form did not show a significant association with the incidence of oral candidiasis. Likewise, Age (p-

value 0.18), Gender (p-value 0.88), Occupation (p-value 0.62), and Comorbidities (p-value 0.71), all of which had a p-value greater than 0.05, indicating that these variables were not significantly related to the incidence of oral candidiasis. Marital status also showed almost no significant relationship, with a p-value of 0.08. The only variable that showed a significant association was Education Level, with a p-value of 0.04, which means there was a significant relationship between the patient's education level and the incidence of oral candidiasis. Meanwhile, the use of *Antifungal Drugs* was also not significantly related to the incidence of oral candidiasis, with a p-value of 0.64.

Table 11. Variable outcomes with the incidence of oral candidiasis in HIV/AIDS patients

| Variabel | Incidence of Oral Candidiasis Sig. (2-tailed) (p) | Total (N) |
|-----------------------------|--|-----------|
| <i>Viral load</i> (numerik) | 0,97 | 402 |
| <i>Viral load</i> (ordinal) | 0,22 | |
| Age | 0,18 | |
| Gender | 0,88 | |
| Jobs | 0,62 | |
| Komorbid | 0,71 | |
| Marital Status | 0,08 | |
| Education Level | 0,04* | |
| Use of Antibiotics | 0,79 | |

Source: Author's data analysis using SPSS, 2025

Kruskal-Wallis test = Age, and *Viral load*; Chi-Square Test = Gender, Occupation, Comorbidities, Marital Status, Education Level, Anti-fungal Drugs

*p-value <0.05, significant indication

This study is an observational analytical research using secondary data from patients' medical records in the internal medicine department and skin department of Jombang Hospital. From this study, it is hoped that researchers can determine the relationship between *viral load* and the incidence of oral candidiasis at Jombang Hospital for the 2023-2025 period.

1. Gender and Age

The number of HIV/AIDS patients who experience oral candidiasis is 402. As many as 51.2% are men and 48.8% are women. This means that the number of male patients is more than female. Meanwhile, in this study, the age of HIV patients who experienced oral candidiasis was more often found at the age of >65 years as many as 107 (26.6%) patients.

The results of this study are in line with several previous studies. Suryana et al. (2020) reported that the majority of HIV/AIDS patients who experienced oral candidiasis were male, namely 293 people (65.40%). Similar findings were also obtained by Dewi et al. (2024), where oral candidiasis cases were more commonly found in men, namely 33 people (62.30%). Thus, the results of this study show the same tendency that men experience oral candidiasis more often than women. This is thought to be related to several factors, such as risky behaviors that are more carried out by men, increasing the chances of HIV transmission and disease progression. In addition, men tend to have lower delays in seeking treatment and adherence to therapy than women, which has the potential to lead to faster immunity declines. This weakened immune condition facilitates the growth of *Candida* in the oral cavity so that oral candidiasis is

more common in the male group with HIV/AIDS (Goddess *et al.*, 2024; Suryana *et al.*, 2020)

In this study, most HIV/AIDS patients who experienced oral candidiasis were in the age group over 65 years, which was 107 people (26.6%). These results are in line with research conducted by Indar *et al.* (2024), which found that the majority of cases occur at the age of over 60, as well as research by Suryana *et al.* (2020), which reported that the age group over 34 years had a higher risk of colonizing *Candida*, with a p value = 0.03. In theory, increasing age is associated with decreased immune system function, including decreased T cell activity and changes in normal microflora in the oral cavity. This condition makes the body more susceptible to opportunistic infections, such as oral candidiasis. In HIV/AIDS patients, where the immune system is already weakened, the elderly factor can exacerbate the vulnerability so that the risk of *Candida* infection becomes higher. (Indar *et al.*, 2024; Suryana *et al.*, 2020)

The high incidence of HIV in men, which then impacts their more frequent oral candidiasis, can be explained by several behavioral factors and risk patterns. Dewi *et al.* (2024) states that men tend to have riskier sexual behaviors, such as changing partners, inconsistently using condoms, and being more involved in injecting narcotics. The findings are also in line with UNAIDS and WHO reports showing that men, especially of productive age, have greater exposure to factors that increase the risk of HIV transmission than women. On the other hand, men also tend to use preventive health services such as HIV screening less frequently, so many are diagnosed at a later stage, when their immune systems are already down and more susceptible to opportunistic infections such as oral candidiasis. Suryana *et al.* (2020) also found that men with HIV often come with lower CD4 levels, which further explains the high cases of oral candidiasis in this group. Overall, the high rates of HIV and oral candidiasis in men are not only related to biological factors, but are more influenced by behavior, risk exposure levels, and delays in obtaining treatment (Dewi *et al.*, 2024; Suryana *et al.*, 2020; UNAIDS, 2023)

2. Jobs

The results of the study at Jombang Hospital show that the distribution of work in HIV/AIDS patients with oral candidiasis is relatively balanced. As many as 33.3% of patients work in the formal sector, 33.1% in the informal sector, and 33.6% are unemployed. This almost equal proportion illustrates that the incidence of oral candidiasis does not only occur in certain groups, but can be experienced by patients from various occupational backgrounds.

Comparisons with other studies showed that there was variation in the relationship between occupational and the incidence of oral candidiasis infection in HIV/AIDS patients. On Dewi *et al.*, (2024) shows that HIV/AIDS patients with oral candidiasis are mostly found in people who work as self-employed 34 people (64.2%) and this is in line with this study, which is that the most HIV/AIDS patients are workers working in the informal sector. (Goddess *et al.*, 2024)

The results of the study at Jombang Hospital showed that formal, informal, and non-working jobs did not show a significant relationship with the incidence of oral candidiasis (p-value = 0.62). These findings are in line with the research of Suryana *et al.* (2020) which also reported that employment status did not have a meaningful effect on the occurrence of oral candidiasis in HIV/AIDS patients. (Suryana *et al.*, 2020)

a. Marital Status

The results of the study at Jombang Hospital showed that most HIV/AIDS patients who experienced oral candidiasis were unmarried, which was 51%. These results differ from the findings of Erfaninejad *et al.* (2022), which reported that most patients with oral candidiasis actually came from the married group, namely 58 people (51.2%). These differences are likely influenced by the social and behavioral characteristics of patients at each study site. Unmarried patients may have a different lifestyle or level of adherence to treatment than married patients, which in turn can affect immune conditions and the risk of opportunistic infections such as oral candidiasis. (Erfaninejad *et al.* , 2022)

b. Education Level

The results of the study at Jombang Hospital showed that most HIV/AIDS patients who experienced oral candidiasis had a low level of education, which was 53.2% (214 patients), while patients with higher education amounted to 46.8% (188 patients). These findings are not in line with the research of Dewi *et al.* (2024), which reported that most patients had a high school education of 38 people (71.7%), while only 6 people (11.3%) were highly educated (S1). (Goddess *et al.* , 2024)

c. Komorbid

The distribution of comorbid conditions in patients with oral candidiasis suggests that most patients also have one or more medical conditions in addition to oral candidiasis. Of the total 402 patients, 46 patients (11.4%) had no comorbidities, while most patients had some medical condition that could worsen their condition. Diabetes Mellitus was found in 47 patients (11.7%), dyslipidemia in 48 patients (11.9%), anemia in 41 patients (10.2%), and hypertension in 50 patients (12.4%). The comorbidities found were spread across various types of comorbidities with relatively similar proportions, so they did not show a certain comorbid dominance among patients with oral candidiasis at Jombang Hospital.

d. Use of Antibiotics

The results of the study at Jombang Hospital showed that out of 402 patients with oral candidiasis, as many as 216 patients (53.7%) had a history of antibiotic use. Long-term use of broad-spectrum antibiotics is one of the important risk factors for the development of oral candidiasis. Fajri *et al.* (2018) explained that broad-spectrum antibiotics over a long period of time can disrupt the balance of commensal microorganisms in the oral cavity and reduce the population of bacteria that are antagonistic to *Candida*, thus facilitating the growth of the fungus.

In contrast, in patients with HIV/AIDS, the pattern of oral candidiasis has different causes. According to research conducted by Indar *et al.* (2024), the main factor that affects the occurrence of oral candidiasis in HIV patients is not the use of antibiotics, but a decrease in immunity due to a low number of CD4 cells. Patients with low CD4 levels have been shown to be much more susceptible to *Candida* infection in the oral cavity than those with better immune systems. In other words, if in the general population, oral candidiasis tends to be triggered by excessive use of antibiotics, then in HIV/AIDS patients this infection is more caused by a weakened immune system (Indar *et al.*, 2024).

In a study at Jombang Hospital, the use of antibiotics did not show a significant association with the incidence of oral candidiasis ($p = 0.79$). This result is different from the findings of Thomas Ruddel *et al.* (2022) reported a strong association between broad-spectrum

antibiotic use and an increased risk of *Candida* infection (OR = 5.6; 95% CI 3.6–8.8; $p < 0.01$). These differences are likely influenced by variations in patient characteristics and the type of antibiotic used in each study.

Research on the use of antibiotics as a risk factor for oral candidiasis in HIV/AIDS patients has shown mixed results. Suryana *et al.* (2020) at Wangaya Hospital Denpasar reported that the use of antibiotics for ≥ 7 days was a factor associated with an increased incidence of oral candidiasis in people with HIV/AIDS (OR = 4.49; 95% CI 2.93–6.90; $p < 0.001$), although decreased immunity due to low CD4 levels remained the main underlying factor for the occurrence of *Candida* infection in this group (Suryana *et al.*, 2020). Similar findings were also reported in the study of Ambe *et al.* (2020), which included the use of broad-spectrum antibiotics as one of the predisposing factors for the occurrence of oral candidiasis in HIV patients, although the effects are often difficult to separate from the immunodeficiency conditions already experienced by the patient (Ambe *et al.*, 2020). Study by Vila *et al.* (2020) also explained that antibiotics can trigger oral microbiotic dysbiosis and facilitate the growth of *Candida*, but in HIV/AIDS patients, the main mechanisms remain related to cellular immunity disruption and decreased CD4 counts. Thus, although the use of antibiotics may increase the risk of oral candidiasis, most of the evidence suggests that in HIV/AIDS patients, immunological factors have a much more dominant influence than the effects of the antibiotics themselves (Vila *et al.*, 2020).

e. The Relationship between Viral Load Rate and Incidence of Oral Candidiasis

The results of the study at Jombang Hospital showed that viral load levels were not related to the incidence of oral candidiasis in HIV/AIDS patients. Most patients, 80.1%, had an undetected viral load, while only a small percentage had a high viral load, so the variation in viral load in the population was very small. This distribution makes the level of viral load not appear to be a factor that affects the appearance of oral candidiasis. Factors such as hygiene and health conditions of the oral cavity, or other host factors may play a greater role in the appearance of oral candidiasis.

These findings are not in line with the research of Fokam *et al.* (2023) in Cameroon which showed that patients with a viral load of ≥ 1000 copies/mL had a much higher risk of oral candidiasis ($p = 0.007$), as well as research by Kumari *et al.* (2025) reported a significant association between high viral load, CD4 < 200 cells/uL, and the incidence of oral candidiasis. The difference is likely due to different population characteristics, where both studies involved a larger proportion of patients with high viral loads. Meanwhile, in the study at Jombang Hospital, most of the patients have been in a low viral load condition.

f. Research Novelty

The novelty in this study lies in the analysis of the relationship between viral load levels and the incidence of oral candidiasis in HIV/AIDS patients at Jombang Hospital, which provides new insights into the factors that affect the incidence of opportunistic infections. The study found that although viral load levels did not show a significant association with the incidence of oral candidiasis, the patient's education level was shown to have a significant influence. These results provide a deeper understanding of the importance of education for HIV/AIDS patients in managing their oral health. With these findings, it is hoped that it can increase prevention efforts and interventions that are more focused on patient education

regarding health management and *viral load*, which may reduce the incidence of oral candidiasis in HIV/AIDS patients at Jombang Hospital.

CONCLUSION

Based on the results of the discussion, this study concludes that there is no significant association between viral load levels and the incidence of oral candidiasis in HIV/AIDS patients at Jombang Hospital for the 2023–2025 period, as indicated by p-values of 0.97 for numerical viral load and 0.22 for ordinal viral load. However, education level was found to have a significant relationship with the incidence of oral candidiasis ($p = 0.04$), suggesting that lower education levels may contribute to higher rates of infection. Other external factors such as hypertension, diabetes mellitus, smoking history, antibiotic use, and dyslipidemia showed no significant association. The majority of patients (80.1%) had undetectable viral loads (<20 – 50 copies/ml), while 13.4% had unsuppressed/high viral loads (≥ 1000 copies/ml). Regarding the clinical presentation of oral candidiasis, pseudomembranous type was the most common (19.4%), followed by angular cheilitis (17.7%) and erythematous (15.9%), with combinations of these types also observed. Based on these findings, several recommendations are proposed. For Jombang Hospital and healthcare providers, it is recommended to strengthen health education programs for HIV/AIDS patients, particularly those with low education levels, focusing on oral hygiene, adherence to ART, and early recognition of oral candidiasis symptoms. For patients and families, active participation in counseling sessions and regular dental check-ups are advised to prevent opportunistic infections. For public health policymakers, integrating oral health education into routine HIV care services and developing simplified educational materials for patients with limited literacy are essential steps. For future researchers, further studies are needed to explore other psychosocial and behavioral factors that may influence the incidence of oral candidiasis, as well as to conduct interventional studies on the effectiveness of educational programs in reducing infection rates among HIV/AIDS patients with low education levels.

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