Speciation of Fungal Dermatoses in HIV-Positive Patients: A Comparative Study of HAART-Experienced and HAART-Naive Individuals in Southern Nigeria.

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Abstract

Background: Fungal dermatoses remain a significant challenge among HIV-positive individuals, particularly in resource-limited settings. Highly active antiretroviral therapy (HAART) has transformed HIV care by reducing opportunistic infections through improved immune response. However, the relationship between HAART use and the prevalence, severity, and spectrum of fungal dermatoses remains inadequately characterized, especially in sub-Saharan Africa. This study aims to compare the patterns and severity of fungal species causing dermatoses among HAART-experienced and HAART-naive HIV-positive individuals in Benin City, Nigeria.

Methods: This comparative cross-sectional study was conducted at the University of Benin Teaching Hospital (UBTH) in Edo State, Nigeria, from July to October 2019. We recruited a total of 300 HIV-positive participants, comprising 150 HAART-experienced individuals and 150 HAART-naive individuals. The systematic random sampling technique was employed. Data collection included demographic and clinical information; clinical examination of skin lesions, and laboratory investigation findings. We confirmed the diagnoses using potassium hydroxide microscopy (10% for skin scrapings and 20% for hair and nail clippings) and fungal cultures. Statistical analysis was conducted using SPSS version 25, with p-values < 0.05 considered statistically significant.

Results: The prevalence of fungal dermatoses was significantly lower in HAART-experienced individuals (14%, 21/150) compared to HAART-naive individuals (24.6%, 37/150) ($\chi^2 = 5.47$, $p = 0.02$). Candida albicans was the most prevalent fungal species in both groups, and was more frequently isolated from HAART-naive individuals. Severe fungal dermatoses were significantly more common among HAART-naive individuals (54.1%, 20/37) compared to HAART-experienced individuals (23.8%, 5/21); ($\chi^2 = 4.99$, $p = 0.02$. HAART-experienced individuals demonstrated a broader spectrum of less severe fungal dermatoses.

Conclusions: HAART-experienced individuals showed significantly reduced prevalence and severity of fungal dermatoses, although fungal species, such as Candida albicans, persisted in both groups. These findings show the importance of improving HAART coverage and adherence to reduce the burden of fungal infections among HIV-positive individuals.

Keywords: Fungal dermatoses, HIV-positive, HAART-experienced, HAART-naive, Candida albicans.

Identification des espèces fongiques responsables de dermatoses chez les patients séropositifs : étude comparative entre patients sous traitement antirétroviral hautement actif (HAART) et patients naïfs au sud du Nigéria.

Résumé

Contexte : Les dermatoses fongiques constituent un problème majeur chez les personnes séropositives, notamment dans les contextes de ressources limitées. Le traitement antirétroviral hautement actif (HAART) a transformé la prise en charge du VIH en réduisant les infections opportunistes grâce à une meilleure réponse immunitaire. Cependant, la relation entre l'utilisation du HAART, la prévalence, la gravité et le spectre des

dermatoses fongiques reste mal caractérisée, en particulier en Afrique subsaharienne. Cette étude vise à comparer les profils et la gravité des espèces fongiques responsables de dermatoses chez les patients séropositifs sous HAART et ceux naïfs de HAART à Benin City, au Nigéria.

Méthodes : Cette étude transversale comparative a été menée au Centre Hospitalier Universitaire de Benin (UBTH), dans l'État d'Edo, au Nigéria, de juillet à octobre 2019. Nous avons recruté 300 participants séropositifs, dont 150 personnes ayant déjà reçu un traitement antirétroviral (TAR) et 150 personnes naïves de TAR. Un échantillonnage aléatoire systématique a été utilisé. La collecte des données comprenait des informations démographiques et cliniques, l'examen clinique des lésions cutanées et les résultats des analyses de laboratoire. Les diagnostics ont été confirmés par microscopie à l'hydroxyde de potassium (10 % pour les prélèvements cutanés et 20 % pour les prélèvements de cheveux et d'ongles) et par culture fongique. L'analyse statistique a été réalisée à l'aide du logiciel SPSS version 25, avec un seuil de signification statistique fixé à $p < 0,05$.

Résultats : La prévalence des dermatoses fongiques était significativement plus faible chez les personnes ayant déjà reçu un traitement antirétroviral (14 %, 21/150) que chez celles n'en ayant jamais reçu (24,6 %, 37/150) ($\chi^2 = 5,47$, $p = 0,02$). Candida albicans était l'espèce fongique prévalente dans les deux groupes et était plus fréquemment isolée chez les personnes n'ayant jamais reçu de traitement antirétroviral. Les dermatoses fongiques sévères étaient significativement plus fréquentes chez ces dernières (54,1 %, 20/37) que chez celles ayant déjà reçu un traitement antirétroviral (23,8 %, 5/21). ($\chi^2 = 4,99$, $p = 0,02$). Les personnes ayant déjà reçu un traitement antirétroviral hautement actif (HAART) présentaient un spectre plus large de dermatoses fongiques moins sévères.

Conclusions : Les personnes ayant déjà reçu un HAART présentaient une prévalence et une gravité significativement réduites des dermatoses fongiques, bien que certaines espèces fongiques, comme Candida albicans, persistent dans les deux groupes. Ces résultats soulignent l'importance d'améliorer la couverture et l'observance du HAART afin de réduire la charge des infections fongiques chez les personnes séropositives.

Mots-clés : Dermatoses fongiques, Personne séropositive, HAART, personnes naïves, Candida albicans

Introduction

The advent of highly active antiretroviral therapy (HAART) has revolutionized HIV management.[1] Despite these advancements, fungal dermatoses persist as a significant burden among HIV-positive individuals, particularly in resource-limited settings.[2] These infections range from superficial conditions, such as tinea infections and candidiasis, to more severe invasive forms, reflecting the degree of immunosuppression.[3] Globally, fungal dermatoses are among the most common opportunistic infections in HIV patients, with sub-Saharan Africa bearing the highest prevalence.[4] Factors such as delayed diagnosis, limited access to antifungal therapies, and inconsistent HAART uptake exacerbate this burden.[5] In Nigeria, the dual burden of HIV and constrained healthcare resources creates a challenging environment for the effective management of fungal dermatoses.[6] With over 1.9 million people living with HIV, the country has one of the highest HIV burdens globally, contributing to widespread immunosuppression and a higher susceptibility to opportunistic infections, including fungal dermatoses.[7] These conditions often present as the first clinical manifestations of advanced HIV disease, serving as both diagnostic markers and contributors to morbidity.[8]

Compounding the issue is the limited access to healthcare infrastructure and resources.[9] Diagnostic capabilities for fungal infections, such as culture facilities and molecular speciation tools, are sparse, especially in rural and underserved areas.[9] This limitation often results in delayed or inaccurate diagnoses, leading to suboptimal treatment outcomes.[10] Furthermore, access to antifungal medications is hindered by financial constraints and inconsistent supply chains, leaving many patients untreated or inadequately treated.[11] Gaps in HAART coverage and adherence further complicate the situation. While HAART has significantly reduce the incidence of opportunistic infections through immune reconstitution, coverage in Nigeria remains suboptimal, with statistics showing ART (antiretroviral therapy) coverage being less than 90%

among eligible individuals receiving treatment; falling short of the UNAIDS target of 95-95-95 by the year 2025.[12] Even among those on HAART, challenges such as drug resistance, inconsistent adherence, and treatment interruptions can diminish its protective effects, leaving patients vulnerable to recurrent fungal infections. However, there is limited research exploring the specific fungal species affecting HIV-positive individuals and how HAART modifies these patterns.

Understanding the relationship between HAART and fungal dermatoses is pivotal for optimizing care in HIV-positive populations. HAART-induced immune reconstitution is known to reduce the incidence of many opportunistic infections, yet its impact on fungal dermatoses remains inadequately characterized, particularly in sub-Saharan Africa.

Speciation studies are crucial as they enable targeted antifungal interventions, reduce treatment resistance, and improve patient outcomes. Benin City, Nigeria, presents a unique setting for such research due to the fact that it is a major centre for HIV care in Nigeria and plays host to diverse persons living with HIV from various ethnicities (in South-South, Nigeria).

Comparing the patterns of fungal dermatoses in HAART-experienced and HAART-naive patients provides an opportunity to assess HAART's protective effects while identifying persistent gaps in fungal infection management. This study evaluated the patterns and spectrum of fungal dermatoses in HIV-positive patients.

Methods

Study Area: We conducted the study at the President's Emergency Plan for AIDS Relief (PEPFAR) clinics within the University of Benin Teaching Hospital (UBTH), Benin City, Edo State, Nigeria. UBTH, located in Egor Local Government Area, is one of five public tertiary healthcare institutions in Edo State and serves as a multi-speciality healthcare provider in West Africa. For over 40 years, it has been recognized as a centre of excellence, receiving referrals from across Nigeria, including neighbouring states such as Delta, Bayelsa, Kogi, Ondo, Anambra, Ekiti, and the Federal Capital Territory. The hospital has a capacity of 1,200 beds and provides both inpatient and outpatient services. The Dermatology/Venereology Unit of the Department of Internal Medicine oversees the adult PEPFAR clinic, which manages HIV care. The PEPFAR clinic runs four days a week, attending to an average of 80 patients per week who are referred from the General outpatients' clinics, Consultants' outpatient clinics, the Accident and Emergency unit, and neighbouring states.

The diagnosis of fungal dermatoses was made by the Dermato-venereologist who works with the medical officers posted to the unit. The Adherence and Counselling units are operational sub-units within the PEPFAR clinic that are responsible for ensuring patient adherence to HAART medications and clinic visits, as well as providing support and motivation to patients.

Study Design: This study used a comparative cross-sectional design to evaluate differences in fungal dermatoses between HAART-experienced and HAART-naive patients.

Selection Criteria for the Treatment-Experienced Patients: Inclusion Criteria: Patients living with HIV aged ≥18 years who had been on HAART for ≥6 months, regardless of clinical stage, and who provided written informed consent. Exclusion Criteria include Patients with other immunosuppressive conditions (e.g., diabetes mellitus, malignancies, or use of immunosuppressive drugs); pregnant patients; and those experiencing treatment, virologic, or immunologic failures.

Treatment-Naïve Patients: Inclusion Criteria: Patients living with HIV aged ≥18 years who had never been on HAART, and Patients who gave written informed consent. Exclusion Criteria include pregnant patients and those with other immunosuppressive conditions as outlined above.

Sample Size Determination: The sample size for this study was determined using the formula for calculating the two independent proportions.[13] Minimum sample size for each of the study population was_125; 10% of calculated sample size was added as non- response = 12.5; Minimum sample size was therefore =137.5 ≈ 138. For this study. A sample size of 150 for each population group was used.

Study Population: Each group comprised 150 participants.

- Group A: HAART-experienced patients (on therapy for ≥6 months irrespective of clinical stage).
- Group B: HAART-naive patients (recently diagnosed and not yet commenced on therapy).

Ethical Considerations: Ethical approval (ADM/E 22/A/VOL. VII/14563) was obtained from the UBTH Ethical Committee. Informed consent was secured from all participants after explaining the study's purpose, procedures, risks, and benefits. We maintained confidentiality and respected each participant's intellectual property rights.

Sampling Technique: A systematic random sampling technique was used:

HAART-Experienced Patients (Group A): Sampling interval: 26:1, based on an average of 1,280 eligible patients over three months. Participants were selected by ballot, with successive patients chosen at intervals of 26.

HAART-Naive Patients (Group B): Sampling interval: 6:1, based on an average of 320 newly diagnosed patients over three months. Participants were similarly selected at intervals of six using the same balloting method.

Assessment of Severity: A customized severity scoring system was developed using the Wallace Rule of Nines to estimate the body surface area (BSA) involved: mild: 1–9% BSA; moderate: 10–30% BSA, and severe: >30% BSA.[15]

Clinical Examination and Diagnostic Procedures: Clinical examination and relevant laboratory investigations are used to confirm the diagnosis and identify fungal species. Participants were examined in a well-lit, private setting, with chaperones present as needed. We assessed the skin lesions for type, shape, size, and site.

Laboratory investigations were done to confirm the diagnosis. Skin scrapings and nail clippings: Examined with potassium hydroxide (KOH), 10% for skin and 20% for nail and hair samples under light microscopy for fungal elements.

Fungal culture: Inoculated on Sabouraud Dextrose Agar and Dermatophyte Test Medium, incubated at 25–30°C for up to four weeks. Culture plates were inoculated at room temperature (27^0C). Cultures were inspected three times weekly for fungal growth. Specimens that failed to yield any growth after three weeks of incubation were discarded, and the results were recorded. For cultures that yielded growth, the macroscopic appearance of the colonies was noted. A cellotape mount for microscopic examination was briefly applied to a microscope slide with a drop of lactophenol cotton blue. The slide was mounted on the microscope and observed at 40x magnification to identify characteristic features of dermatophytes from different genera.

Data Management

Data were collected using a standardized, interviewer-administered questionnaire that captured demographic details, clinical information (e.g., HAART therapy and adherence [4-day recall self-reporting and pill count]), and skin disorders. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Percentages and proportions were used to describe categorical variables, while means and standard deviations were used to summarize continuous variables. The types of fungal dermatoses were represented using charts. The mean ages of the two population groups were compared using independent-samples t-tests. The statistical significance of categorical variables was estimated using the chi-square test. P values less than 0.05 were taken as significant.

Ethical approval (ADM/E 22/A/VOL. VII/14563) was obtained from the UBTH Ethical Committee. Informed consent was secured from all participants after explaining the study's purpose, procedures, risks, and benefits. Confidentiality was maintained, and intellectual property rights respected.

Results

A total of 300 participants were recruited for this study, divided equally into two groups: 150 HAART-experienced and 150 HAART-naive. Table1. The mean age of the HAART-experienced group was 45.02 ± 11.23 years, with an age range of 20 to 72 years. In comparison, the HAART-naive group had a

mean age of 42.62 ± 12.22 years, with a range of 18 to 69 years. In terms of gender distribution, the HAART-naive group comprised 100 females (66.7%) and 50 males (33.3%), with a male-to-female ratio of 1:2. The HAART-experienced group included 114 females (76.0%) and 36 males (24.0%), resulting in a male-to-female ratio of 1:3.2. While females predominated in both groups, the proportion of females was higher in the HAART-experienced group. However, this difference was not statistically significant (p = 0.074).

Marital status data showed that the majority of participants in both groups (153, 51.0%) were married. Specifically, 52% (n = 78) of the HAART-experienced group were married, compared to 50% (n = 75) in the HAART-naive group. The remaining participants in the HAART-experienced group were single (22.7%, n = 34) or widowed (18.6%, n = 28). Similarly, in the HAART-naive group, 32% (n = 48) were single, 14.7% (n = 22) were widowed, and 0.7% (n = 1) were divorced. Educational attainment showed a similar pattern across the two groups, with the majority of participants attaining secondary education: 49 (32.7%) in the HAART-experienced group and 52 (34.7%) in the HAART-naive group. Most participants had completed secondary education, accounting for 37.6% of the HAART-experienced group and 36.0% of the HAART-naive group. The least represented category in both groups was individuals with no formal education (**See Table 1**).

Relationship between Presence and Severity of Fungal Dermatoses in the HAART-experienced and HAART-naive groups. There was a statistically significant difference in the prevalence of fungal dermatoses between the HAART-experienced and HAART-naive groups ($\chi^2 = 5.47$, p = 0.02); Table 2. Specifically, 21 (14%) of the HAART-experienced participants had fungal dermatoses, compared to 37 (24.6%) in the HAART-naive group. Regarding the severity of fungal dermatoses, a statistically significant difference was observed between the two groups. In the HAART-experienced group, 5 (23.8%) participants had severe fungal dermatosis (based to body surface area affected), compared to 20 (54.1%) in the HAART-naive group. Among HAART-experienced participants, 10 (47.6%) had mild fungal dermatoses, while 9 (21.6%) in the HAART-naive group had mild disease ($\chi^2 = 1.42$, p = 0.23). (***See Table 2***).

Clinical Types of Fungal Dermatoses in HAART-Experienced and HAART-Naive Groups.

We identified nine clinical types of fungal dermatoses in the study groups. Eight (8) of these occurred in both groups, and they include Tinea corporis (27.6%), Tinea cruris (6.9%), Tinea manuum (3.5%), Tinea faciei (3.5%), Tinea pedis (17.2%), Flexural Candidasis (24.1%), Onychomycosis (10.3%) and Pityriasis vesicolor (5.2%).

Tinea corporis was the most common fungal dermatosis in the HAART-experienced population, representing 28.6%, and in the HAART-naive population, 29.7%, of which 24.3% had only Tinea corporis, 2.7% had Tinea corporis coexisting with onychomycosis, and 2.7% had Tinea corporis with T. capitis. Notably, Tinea capitis was conspicuously absent in the HAART-experienced group; it affected only the HAART-naive group, occurring either singly in 2.7% of those in this group or in combination with other fungal dermatoses (Tinea corporis), affecting 2.7% of the population.

The prevalence of Pityriasis versicolor was only slightly higher in the HAART-naive group (5.4%) than in the HAART-experienced group (4.8%).

Onychomycosis was observed in 4.8% of the HAART-experienced group. In contrast, in the HAART-naive group, it occurred alone in 5.4% of participants and coexisted with T. corporis, T. cruris, and T. faciei, affecting 2.7% of participants.

Tinea manum was seen in 2.7% of the HAART-naive group and 4.8% of the HAART-experienced group; candidiasis was seen in 24.3% of the HAART-naive group and 23.7% of the HAART-experienced group. Tinea pedis was observed in 16.2% of the HAART-naive group and 19% of the experienced groups. There was no significant difference in fungal dermatoses among HAART-experienced and naïve populations (p-value = 0.803). ***(See Table 3).***

Table 1: Demographic Characteristics of Study Participants

Demographic Variables	(Frequency n, %)		p-value
	HAART Naïve (%)	HAART Experience	
Age			
<20 Years	1(0.7)	0(0.0)	**0.256**
20-29 Years	25(16.6)	12(8.0)	
30-39 Years	41(27.3)	40(26.7)	
40-49 Years	40(26.7)	43(28.5)	
50-59 Years	28(18.7)	32(21.3)	
60-69 Years	15(10.0)	21(14.0)	
≥70 Years	0(0.0)	2(1.4)	
Gender			
Female	100(66.7)	114(76.0)	**0.074**
Male	50(33.3)	36(24.0)	
Marital Status			
Divorce	4(2.7)	10(6.7)	**0.150**
Married	75(50.0)	78(52.0)	
Separated	1(0.7)	0(0.0)	
Single	48(32.0)	34(22.7)	
Widow/Widower	22(14.6)	28(18.6)	
Educational Status			
Primary	32(21.3)	45(30.0)	**0.072**
Secondary	49(32.7)	52(34.7)	
Tertiary	61(40.7)	41(27.3)	
None	8(5.3)	12(8.0)	
Occupation			
Civil Servants	17(11.3)	22(14.7)	**0.177**
Drivers	4(2.7)	10(6.7)	
Fashion Designer	9(6.0)	11(7.3)	
Hair Dresser	13(8.7)	14(9.8)	
Health Care Workers	3(2.0)	1(0.7)	
Retired	4(2.7)	2(1.3)	
Students	1(0.7)	6(4.0)	
Traders	77(51.3)	62(41.3)	
Unemployed	11(7.3)	6(4.0)	

Table 2: Relationship between Presence and Severity of Fungal Dermatoses and Study Group

	Frequency n, (100%)		
Variables	**HAART Experienced**	**HAART Naïve**	**Statistic test/p-value**
Fungal Dermatoses			
Present	21 (14.0%)	37 (24.6%)	χ^2=5.47, *p=0.02*
Absent	129 (86.0%)	113 (76.4%)	
Severity of Fungal Dermatoses			
Mild	10 (47.6%)	9 (21.6%)	χ^2= 1.42, p-value = 0.23
Moderate	6 (28.6%)	8 (24.3%)	χ^2= 0.35, p-value = 0.55
Severe	5 (23.8%)	20 (54.1%)	χ^2= 4.99, p-value = 0.02

*Odds ratio = $\frac{113x21}{129x37}$ = 0.5

Table 3: Clinical Patterns / Types of Fungal Dermatoses in HAART Experienced and Naive

Clinical Types of Fungal Dermatosis	**HAART**		
	Experience (%)	**Naïve (%)**	
Onychomychosis	1 (4.8)	2 (5.4)	
Pityriasis versicolor	1 (4.8)	2 (5.4)	
Tinea corporis	6 (28.6)	9 (24.3)	
Tinea corporis & onychomycosis	0 (0.0)	2 (5.4)	
Tinea capitis	0 (0.0)	1 (2.7)	
Tinea capitis and corporis	0 (0.0)	1 (2.7)	
Tinea cruris	2 (9.5)	2 (5.4)	
Tinea cruris and onychomycosis	0 (0.0)	1 (2.7)	
Tinea faciei	1 (4.8)	1 (2.7)	
Tinea faciei and onychomycosis	0 (0.0)	1 (2.7)	
Tinea manum	1 (4.8)	1 (2.7)	
Candidasis	5 (23.7)	8 (21.6)	
Tinea pedis	4 (19.0)	6 (16.3)	
Total	**21 (100.0%)**	**37 (100.0)**	p-value = 0.803

Clinical and Mycologic Correlations for HAART-experienced and HAART naïve

There was mycologic evidence (microscopy and culture) of fungal dermatoses in 28 (48.3%) participants out of 58 scrapings. Microscopic evidence of fungal elements (hyphae and/or spores) could be demonstrated in scrapings from 17(60.7%) out of the 28 cases. Meanwhile, demonstration of fungal organisms by culture alone (culture positivity) was observed in 11 (39.3%) of the 28 cases. However, among the 28 participants, 5 (17.7%) had both microscopic and culture evidence.

Of the 17 participants diagnosed with microscopic evidence of fungal dermatoses, 2 (7.1%) were HAART-experienced, while 15 (53.6%) were HAART-naïve. Three (10.7%) of the 11 patients diagnosed with culture positivity were HAART-experienced, while 8 (28.6%) were HAART-naïve.

Among the 2 HAART-experienced participants with microscopic evidence of fungal dermatoses, 1 (3.4%) also had a culture-positive result, for a total of 4 (14.1%) HAART-experienced participants with culture positivity. In the HAART-naïve group, of the 15 participants with microscopic evidence, 4 (14.3%) also had culture positivity, for a total of 12 (42.9%) participants with culture positivity.

Only dermatophytes were cultured in this study. Trichophyton rubrum was the predominant dermatophyte species, isolated from 9 (56.3%) participants, while Trichophyton tonsurans was isolated from 6 (37.5%) participants, and Microsporum canis was isolated from 1 (6.2%) participant.

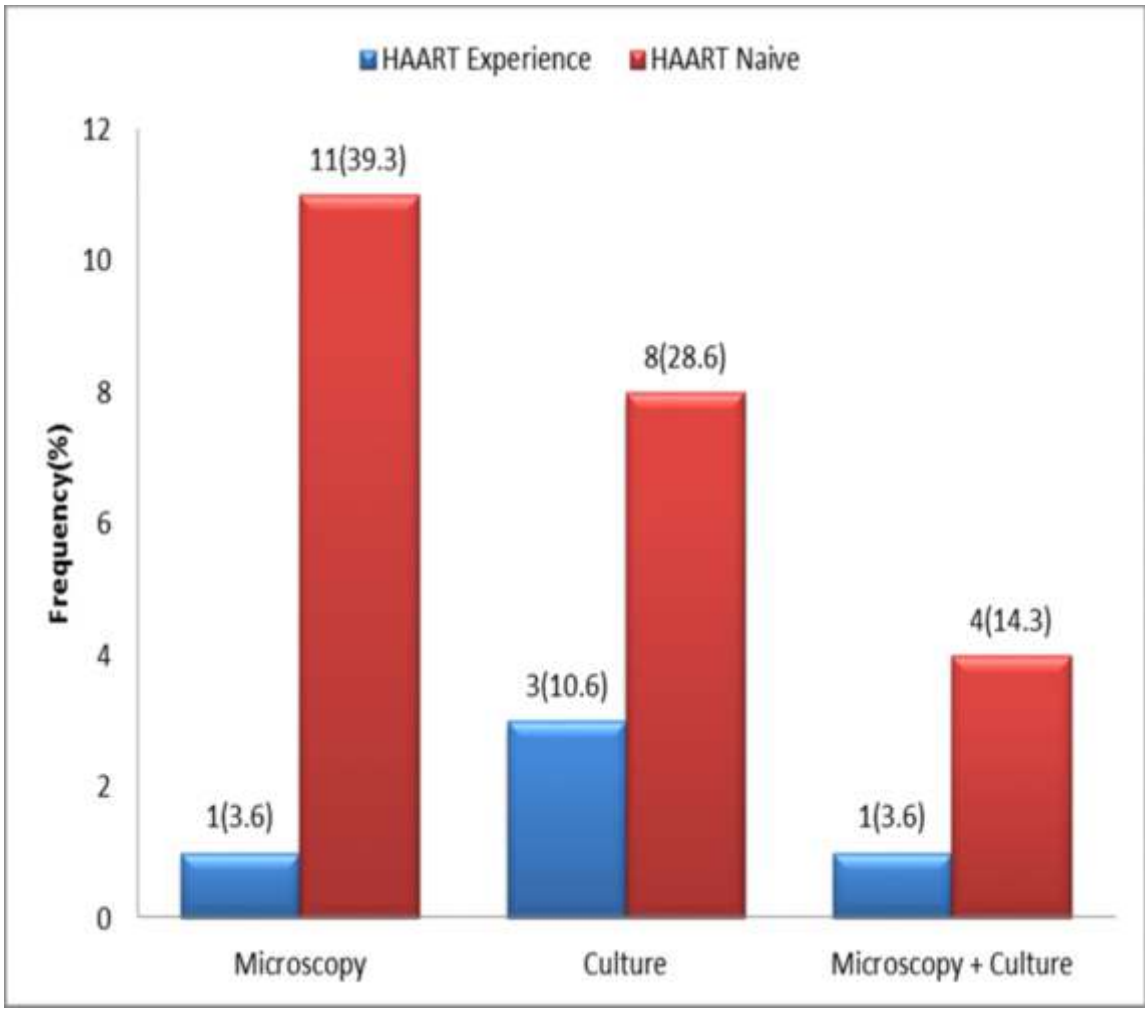

Figure 1: Clinical- Mycologic Correlations for HAART-experienced and HAART naïve

Discussion

The findings of this study highlight significant differences in the prevalence, severity, and microbiological characteristics of fungal dermatoses between HAART-experienced and HAART-naive individuals. These results show the impact of HAART on the immunological milieu (the complex local environment of immune cells and molecules that interact to facilitate immune responses) and its role in modifying susceptibility to fungal infections. The study found a lower prevalence of fungal dermatoses among HAART-experienced participants than among HAART-naive participants. This difference is consistent with HAART's protective role in reducing opportunistic infections through immune restoration. HAART therapy increases CD4+ T-cell counts and reduces viral load, thereby mitigating the immunosuppression that predisposes individuals to fungal infections.[16] The higher prevalence in HAART-naive individuals aligns with previous research indicating that fungal dermatoses are common markers of advanced HIV disease and immunosuppression.[17,18]

In terms of severity, fungal dermatoses were significantly more severe in HAART-naive individuals. This finding further supports the immunological benefits of HAART, as immune reconstitution reduces the severity and extent of infections.[19] Additionally, the higher proportion of mild cases in the HAART-experienced group suggests that even when fungal dermatoses occur in this population, they are more likely to be less severe, likely due to partial immune recovery.

This study identified nine clinical types of fungal dermatoses, with eight occurring in both groups and Tinea capitis occurring exclusively in HAART-naive individuals. The most common fungal dermatosis in both groups was Tinea corporis, accounting for over a quarter (25.9%) of the dermatosis. This suggests that Tinea corporis may be prevalent across various levels of immunosuppression but more severe in individuals with lower immune function, as observed in HAART-naive participants. The exclusive occurrence of Tinea capitis in the HAART-naive group reflects a higher susceptibility to specific dermatophyte infections in the absence of HAART-mediated immune restoration.

Onychomycosis and candidiasis were also prevalent in both groups, with slightly higher rates in the HAART-naive group. However, the differences were not statistically significant. Pityriasis versicolor and Tinea pedis showed a similar distribution across groups, further suggesting that, while HAART improves immune function, certain fungal infections persist due to other predisposing factors, such as environmental conditions or personal hygiene practices.[20]

Mycological investigations revealed notable differences in the rates of positive microscopy and culture findings between the groups. Microscopic evidence of fungal elements was higher in HAART-naive individuals compared to HAART-experienced individuals. Similarly, culture positivity was more frequent in the HAART-naive group than in the HAART-experienced group. These findings emphasize the increased fungal burden in HAART-naive individuals and reflect the higher prevalence and severity of fungal dermatoses in this population. However, there is a paucity of studies specifically designed to determine the outcomes of laboratory fungal testing in this study population.

The predominance of dermatophytes, specifically *Trichophyton rubrum* as the most commonly isolated species, aligns with existing literature on fungal infections in immunosuppressed populations.[21, 22] Other species, such as *Trichophyton tonsurans* and *Microsporum canis*, were also identified, indicating a diverse spectrum of dermatophyte infections. The higher isolation rates of *T. rubrum* may be linked to its ability to persist on keratinized tissues, making it a significant pathogen in both immunocompromised and immunocompetent individuals.[22,23]

These findings have several implications for public health and clinical practice in Nigeria. The higher prevalence and severity of fungal dermatoses in HAART-naive individuals highlight the need to prioritize early initiation of HAART to prevent opportunistic infections. Integrating dermatologic assessments into routine HIV care could enable early identification and management of fungal infections, improving the quality of life for people living with HIV. The predominance of dermatophyte infections, particularly *T. rubrum*, suggests that antifungal

treatments targeting these pathogens should be a focus of therapeutic strategies.

Limitations

This study has been able to highlight the differences in the patterns of superficial mycoses and fungal disease burden among HAART-experienced and HAART-naive individuals, emphasizing the role of HAART in the care of HIV positive individuals. This study, however, being a cross-sectional study, precludes the establishment of causal relationships between HAART use and reduced fungal dermatoses. Longitudinal studies are needed to monitor changes in fungal infection patterns, prevalence and severity over time in individuals initiating HAART. Furthermore, environmental and socioeconomic factors influencing fungal dermatoses were not assessed and warrant further exploration. Future research should investigate the role of specific immunological markers, such as CD4+ T-cell counts and viral load, in predicting susceptibility to fungal dermatoses. Additionally, evaluating the efficacy of antifungal therapies in HAART- and non-HAART-treated populations could inform targeted interventions.

Conclusion

This study provides information on the patterns, speciation, and severity of fungal dermatoses comparing HAART-experienced and HAART-naive populations. The findings demonstrate that fungal dermatoses remain a significant clinical challenge, with a higher prevalence and severity observed in HAART-naive individuals. This shows the protective role of HAART in mitigating opportunistic infections through immune reconstitution while demonstrating the importance of early initiation and adherence to HAART therapy. The identification of specific fungal species prevalent in this population emphasizes the need for routine fungal speciation in clinical practice to guide targeted antifungal treatment and mitigate the risk of drug resistance.

Future research should explore longitudinal trends in fungal dermatoses in relation to HAART adherence, resistance patterns, and the potential emergence of antifungal-resistant strains. Additionally, strengthening public health initiatives aimed at improving access to HAART and enhancing adherence will be pivotal in reducing the burden of fungal dermatoses among HIV-positive populations.

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Conflicts of Interest: Nil

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