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Original Article

Dermatology Section

# Hair, Nails and Oral Mucosal Disorders among People Living with Human Immunodeficiency Virus and AIDS in Osogbo and Diagnostic Performance on Low CD4 Cells Count

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## ABSTRACT

**Introduction:** The epidemic of HIV/AIDS continues amidst reduce funding in most low and middle-income countries. The need to find low-cost clinical equivalents of the laboratory markers of immunosuppression, therefore become imperative.

**Aim:** To document hair, nails and oral mucosal disorders among People Living with HIV/AIDS (PLWHA) and determine their performance in predicting low CD4 count.

**Materials and Methods:** This cross-sectional study included 315 patients recently diagnosed PLWHA at the HIV clinic of LAUTECH Teaching Hospital, Osogbo, Nigeria. Participants were examined for hair, nails, and oral mucosal disorders and CD4+ cell count was estimated. Sensitivity, specificity, positive and negative likelihood ratio were calculated using online MedCalcR.

**Results:** Mean age of participants was 36.68±10.03 years, and 227 (72.1%) were female. The CD4+cell count below 200 was significantly associated with lower weight, BMI and male gender. The prevalence of integument and oral lesions include blue-black nail pigmentation 17.8%, oral candidiasis 17.5%, fluffy hair 14.9%, lighter colour hair 13.8%, diffuse alopecia 9.2%, oral hyperpigmentation 7.3%, and onychomycosis 5.4%. Disorders significantly associated with median CD4 count <200 cells/mm$^3$ include: blue-black nail pigmentation (p <0.001), fluffy hair (p<0.001), lighter colour hair (p=0.002), oral candidiasis (p=0.004) and aphthous ulcers (p=0.004). Performance of hair, nails and oral disorder in detecting CD4+ cell count <200: Blue nails: sensitivity 92.9%, specificity 64.1%, positive likelihood ratio 2.6, and negative likelihood ratio 0.1; onychomycosis: sensitivity 70.6%, specificity 55.4%, positive likelihood ratio 1.6, and negative likelihood ratio 0.5; fluffy hair: sensitivity 70.2%, specificity 58.2%, positive likelihood ratio 1.7, and negative likelihood ratio 0.5; lighter colour hair: sensitivity 74.1%, specificity 56.6%, positive likelihood ratio 1.7, and negative likelihood ratio 0.5; Oral candidiasis: sensitivity 78.2%, specificity 60.8%, positive likelihood ratio 2.0, and negative likelihood ratio 0.4. The combinations in twos and threes increased the sensitivity (88.9-100.0%) and negative predictive values (85.7-100%), but specificities are reduced below 50%.

**Conclusion:** Although blue-black nail pigmentation, fluffy hair, lighter colour hair, oral candidiasis are associated with low CD4 count, their presence is not a good diagnostic test to detect CD4 count <200 cells/mm$^3$, hence cannot replace the CD4 count machine but their absence make the presence of CD4+cells count <200 cells mm$^3$ reliably unlikely.


**Keywords:** Hair disorders, Nails diseases, Oral lesions

## INTRODUCTION

The skin remains an important window through which many internal diseases including Human Immunodeficiency Virus Infection and Acquired Immunodeficiency Syndrome (HIV/AIDS) is put into proper perspectives. Since the onset of the ongoing HIV/AIDS pandemic, close to 60 million people have been infected, of which about 30 million sufferers had died [1]. Approximately, 69% of the People Living with HIV/AIDS (PLWHA) are dwellers of the sub-Saharan African countries [1]. The dermatologists are playing prominent roles in the diagnosis of sentinel skin/mucosa disorders, management of the disease, alleviation of suffering contributed by the HIV-related skin diseases and curbing of the spread of the disease through effective treatment of other sexually transmitted infections [1,2]. Because the skin is prominently affected, it is widely known, even among the laymen that the sight of peculiar or extensive skin diseases raises the suspicion of the presence of HIV.

Studies have shown that certain HIV-related skin diseases correlated with the severity of immunosuppression in HIV/AIDS patients and that the prevalence of mucocutaneous disorders varied widely with geographical locations [2-5]. Although HIV-related skin and mucosa disorders have been studied exhaustively, diseases affecting the hair, nails and their predictive implication on low CD4+ cell count were scarcely documented in African studies [6-9]. During day to day office consultation with PLWHA, examination of the hair, nails and oral mucosa formed an essential component of the general physical examination. Easy access to these areas of the human body at no cost to the patients is advantageous, considering the potentials of serving as a quick and straight forward way of putting the extent of immunosuppression in HIV/AIDS into perspectives. Efforts to find accurate cutaneous predictors or the correlates of the degree of immune involvement in HIV/AIDS continue as resource allocation is dwindling in the tropical Africa. Discovery of any such reliable alternatives would reduce expenses and serve as a quick point of care reference that could aid quick decision making in areas with scarce resources.

A study like this that attempts to solve resource related questions and which have a point of care potential are needed in sub-Sahara Africa. This type of study is relevant because the HIV disease and its

socioeconomic consequences bite harder in this environment than elsewhere. The recurrent change in Government policies coupled with waning interest and reducing funding from the partners to the developing countries are all justification and prompt for caregivers to embark on studies of this nature.

## MATERIALS AND METHODS

This cross-sectional study was conducted at the clinic designated for PLWHA attending LAUTECH Teaching Hospital, Osogbo between January 2010 and December 2011. 315 patients recently diagnosed subjects that satisfied the inclusion criteria were examined for the presence of integument abnormalities and included in the study. The inclusion criteria included: HIV positive adults who were at least 18-year-old and were willing to sign the informed consent form, absence of chronic illness like, tuberculosis, chronic kidney disease, chronic liver disease and chronic anaemia. Those HIV positive individuals younger than 18 years and not willing to sign the informed consent and those with other chronic illness were excluded. A structured questionnaire was used to evaluate demographic characteristics such as age, gender, education and status of employment. Clinical features such as weight and height were assessed. The weight of all the study participants were taken with the clinic weighing scale (in kilograms); weight was obtained in light clothing, and the participants' height (in meters) were obtained using a stadiometer. The Body Mass Index (BMI) was estimated using the formula weight (kg)/height$^2$ (m$^2$) [13]. A Dermatologist and a final year Senior Registrar in Dermatology examined participants' scalp, mouth and nails for documented integument and oral mucosal disorders at the clinic in daylight. Diagnosis of integument and oral mucosal disorders were made clinically, nail clippings and scrapings were done in those conditions when the diagnosis of fungal infections was in doubt.

HIV infection was diagnosed with the two-antibody test done in the serial algorithms recommended by World Health Organisation (WHO) [14]. We estimated CD4+ cell count using FAC Scan Flow Cytometer, (CyFlow SL Green, Partec GmbH, Münster, Germany). The CD4+ cell count was dichotomized into below and >200 cells/mm$^3$. True positivity was defined as those conditions when integument/oral disorders were present, and the CD4+ cell count was <200 cells/mm$^3$, while true negativity were those conditions when integument/oral disorders were absent and CD4+ cell count was at the least 200 cells/mm$^3$ and above. We define false positivity as the presence of integument/oral disorders, and CD4+ cell count was 200 cells/mm$^3$ and above, while false negativity was defined as those situations when integument/oral disorders were absent, but CD4+ cell count was <200 cells/mm$^3$. The findings of the Likelihood Ratio (LR) may range from 0 to infinity. LR findings greater than one argue for the diagnosis of interest. The higher the value of LR, the more convincingly the finding suggests the diagnosis. However, LR ranging between 0 and 1 argue against the diagnosis of interest, the closer the LR to 0, the less likely the disease. LR finding of 1 has no diagnostic value [10-12]. Research Ethics Committee of LAUTECH Teaching Hospital approved the study.

## STATISTICAL ANALYSIS

Data were entered into and analysed using Statistical Package for the Social Sciences version 18.0 (SPSS, Chicago Inc., IL, USA). A four by four table was created, sensitivity, specificity, NLR, PLR, PPV, NPV and their confidence intervals were calculated using the online easy to use software MedCalcR 9.2.0.1. The positive and negative likelihood ratios (PLR and NLR) were interpreted by the simple method described by Mcgee [10]. The performances of each hair, nail and oral disorders and their combinations in predicting CD4+ cell <200 cells/mm$^3$ was determined. Results of interest were presented in figure and tables. Fisher-exact statistics were used as indicated and p<0.05 was taken as significant level.

## RESULTS

315 patients recently diagnosed HIV/AIDS were recruited for the study. 227 (72.1%) were female and 88 (27.9%) were male. The mean age±SD of all the participants was 36.68±10.03 years; the men were significantly older than the women (39.81±10.1 vs 35.45±9.76 years p<0.001). Those participants with a higher level of education were more likely to have higher mean CD4 count (p=0.020). 236 (74.9%) of the participants were working in a non-Governmental setting. Those participants that had normal body weight, overweight and obesity were more likely to have CD4 count 200 cells/mm$^3$ or higher (p<0.001) compared to those that were

| Variables | Total (%) | CD4 +Cell Count >200/mm$^3$ (n=145) | CD4+Cell Count >200/mm$^3$ (n=170) | p-value | Male (n=88) | Female (n=227) | p-value |
|---|---|---|---|---|---|---|---|
| **Age** | | | | | | | |
| <50 years | 288 (91.4) | 133 (53.1) | 155 (45.9) | 0.863 | 81 (28.1) | 207 (71.9) | 0.808 |
| >50 years | 27 (8.6) | 12 (8.3) | 15 (8.8) | | 7 (25.9) | 20 (74.1) | |
| Mean age | 36.68±10.03 | 37.8±9.8 | 35.7±10.1 | 0.064 | 39.81±10.1 | 35.45±9.76 | <0.0 01 |
| **Education** | | | | | | | |
| Less secondary | 145 (46.0) | 77 (53.1) | 68 (40.0) | 0.020 | 32 (22.1) | 113 (77.9) | 0.032 |
| Secondary and above | 170 (54.0) | 68 (40.0) | 102 (60.0) | | 56 (32.9) | 114 (67.1) | |
| **Employer** | | | | | | | |
| Government | 79 (25.1) | 38 (26.2) | 41 (24.1) | 0.670 | 35 (44.3) | 44 (55.7) | <0.001 |
| Non-Governmental | 236 (74.9) | 107 (73.8) | 129 (75.9) | | 53 (22.5) | 183 (77.5) | |
| **Employment status** | | | | | | | |
| Full time | 233 (74.0) | 108 (74.5) | 125 (74.5) | 0.848 | 67 (28.8) | 166 (71.2) | 0.585 |
| Part time | 82 (26.0) | 37 (25.5) | 45 (26.5) | | 21 (25.6) | 61 (74.4) | |
| **Body weight** | | | | | | | |
| Under weight | 62 (19.7) | 40 (27.6) | 22 (12.9) | 0.001 | 17 (27.4) | 45 (72.6) | 0.919 |
| Normal weight, over weight and obese | 253 (60.3) | 105 (72.4) | 148 (87.1) | | 71 (28.1) | 182 (71.9) | |
| Mean weight±SD | 57.25±12.29 | 54.7±11.9 | 59.5±12.2 | <0.001 | 60.89±9.77 | 55.85±12.89 | 0.001 |
| Mean height±SD | 1.62±0.09 | 1.62±0.08 | 1.61±0.10 | 0.962 | 1.69±0.11 | 1.58±0.10 | <0.001 |
| Mean BMI±SD | 21.95±4.77 | 20.9±4.5 | 22.8±4.9 | <0.001 | 21.48±4.69 | 22.14±4.80 | 0.274 |
| Mean CD4 Count±SD | 291.36±252.93 | 84.74±54.40 | 467.60±220.17 | <0.001 | 237.06±215.56 | 312.41±263.45 | 0.017 |

**[Table/Fig-1]:** Socio Demographic Characteristics of Participants According to CD4+ Cell and Gender Classification.

under weight. The low CD4 count was significantly associated with lower body weight (54.7±11.9 vs 59.5±12.2, p<0.001), lower BMI (20.9±4.5 vs 22.8±4.9, p<0.001) and male gender (237.06±215.56 vs 312.41±263.45, p=0.017) [Table/Fig-1].

The prevalence of the leading hair, nails, and oral lesions seen in this survey include; blue-black nail pigmentation, 17.8% (95% CI: 13.7-22.5), oral candidiasis 17.5%, (95%, CI: 13.4-2.1), fluffy hair 14.9% (95% CI: 11.2-9.3), lighter colour hair 13.8% (95%, CI: 8.6-20.5), and diffuse hair loss 9.2% (95% CI: 6.3-13.0). Others include oral pigmentation 7.3% (95% CI: 4.7-10.8) and onychomycosis 5.4% (95% CI: 3.2-8.5) as shown in [Table/Fig-2].

The performances of the hair, nail and oral lesions in predicting CD4 <200 cells/mm$^3$ was as follows: blue-black nail pigmentation: sensitivity of 92.9%, specificity of 64.1%, positive and negative likelihood ratio of 2.6 and 0.1. Onychomycosis: sensitivity of 70.6%, specificity of 55.4%, PLR and NLR ratio of 1.6 and 0.5. The presence of yellow nail and splinter haemorrhage was associated with prevalence below 2% but showed a sensitivity of 83.3 and 75.0%, specificity below 54.5% and PLR of 1.8 and 1.6, and NLR of 0.3 and 0.5 respectively. Other lesions were as shown in [Table/Fig-3].

For the hair disorders, the diffuse hair loss had a sensitivity of 58.1%,

| Integument and Oral Mucosal disorders | Prevalence (%) (95% CI) | Disease Present Median CD4 Count (IQR) | Disease Absent Median CD4 Count (IQR) | p-value |
|---|---|---|---|---|
| **Nail disorders** | | | | |
| Onychom ycosis | 5.4 (3.2-8.5) | 187.0 (63.5,250.5) | 355.0 (95.0, 450.0) | 0.037 |
| Blue-black nail | 17.8 (13.7-22.5) | 106.25 (14.25,120.5) | 381.0 (120.0,501.0) | <0.001 |
| Yellow nail | 1.9 (0.7-4.1) | 138.5 (35.75,174.25) | 356.5 (93.5,450.0) | 0.098 |
| Splinter Haemorrhage | 1.3 (0.4-3.2) | 209.75 (37.50,247.25) | 359.0 (91.0, 450.0) | 0.338 |
| Paronychia | 3.4 (1.6-6.5) | 285.0 (181.25-66.25) | 360.0 (88.0,448.0) | 0.352 |
| **Hair disorders** | | | | |
| Diffuse Alopecia | 9.2 (6.3-13.0) | 238.0 (58.5 – 296.5) | 359.0 (95.0-454.0) | 0.154 |
| Fluffy hair | 14.9 (11.2-9.3) | 190.0 (38.25-228.25) | 375.0 (97.5-472.5) | <0.001 |
| Lighter colour hair | 13.8 (8.6-20.5) | 187.0 (36.0 - 223.0) | 355.75 (95.0-450.75) | 0.002 |
| **Oral mucosa disorders** | | | | |
| Oral candidiasis | 17.5 (13.4-2.1) | 131.0 (27.0-158.0) | 364.25 (115.25-479.5) | 0.004 |
| Oral pigmentation | 7.3 (4.7-10.8) | 185.0 (74.0-259.0) | 357.75 (91.5-449.25) | 0.139 |
| Aphthousulcers | 2.2 (0.9-4.5) | 61.0 (33.0-94.0) | 355.0 (95.0-450.0) | 0.004 |
| Oral Hairy Leucoplakia | 0.3 (0.0-1.8) | 44.0 | 355.25 (92.5-447.75) | 0.279 |
| Geographic tongue | 1.0 (0.2-2.8) | 355.25 | 358.0 (88.75-446.75) | 0.658 |

**[Table/Fig-2]:** The Prevalence and the Median CD4 cell count of the Hair, Nail and oral mucosal disorders.

| Integument and Oral Mucosa Disorders | Prevalence (%) (95%CI) | Sensitivity (95% CI) | Specificity (95% CI) | PLR (95% CI) | NLR (95% CI) |
|---|---|---|---|---|---|
| **Nail disorders** | | | | | |
| Oncho mycosis | 5.4 (3.2-8.5) | 70.6 (44.0-89.7) | 55.4 (50.0-61.1) | 1.6 (1.1-2.2) | 0.5 (0.3-1.1) |
| Blue-black nail | 17.8 (13.7-2.5) | 92.9 (82.7-98.0) | 64.1 (57.9-69.9) | 2.6 (2.2-3.1) | 0.1 (0.0--0.3) |
| Yellow nail | 1.9 (0.7-4.1) | 83.3 (35.8-99.6) | 54.7 (49.0-60.3) | 1.8 (1.3-2.7) | 0.3 (0.1-1.8) |
| Splinter haemorrhage | 1.3 (0.4-3.2) | 75.0 (19.4-99.4) | 54.3 (48.6-60.0) | 1.6 (0.9-2.9) | 0.5 (0.1-2.5) |
| Paronychia | 3.4 (1.6-6.5) | 30.0 (6.7-65.3) | 53.4 (47.7-59.2) | 0.6 (0.3-1.7) | 1.3 (0.9-2.0) |
| **Hair disorders** | | | | | |
| Diffuse alopecia | 9.2 (6.3-13.0) | 58.1 (38.9-76.5) | 55.2 (49.3-61.1) | 1.3 (0.9-1.8) | 0.8 (0.5-1.2) |
| Fluffy hair | 14.9 (11.2-9.3) | 70.2 (55.1-82.7) | 58.2 (52.1-64.2) | 1.7 (1.3-2.1) | 0.5 (0.3-0.8) |
| Lighter colour | 13.8 (8.6-20.5) | 74.1(53.7-88.9) | 56.6 (50.7-62.4) | 1.7 (1.3-2.2) | 0.5 (0.2-0.9) |
| **Oral mucosa disorders** | | | | | |
| Oral cand idiasis | 17.5 (13.4-2.1) | 78.2 (65.0-88.2) | 60.8 (54.6-66.7) | 2.0 (1.6-2.5) | 0.4 (0.2-0.6) |
| Aphthous ulcers | 2.2 (0.9-4.5) | 100 (59.0-100.0) | 55.2 (49.5-60.8) | 2.2 (2.0-2.5) | 0 |
| Oral hairy leucoplakia | 0.3 (0.0-1.8) | 100 (2.5-100.0) | 54.1 (48.5-59.8) | 2.2 (1.9-2.5) | 0 |
| Oral pigmentation | 7.3 (4.7–10.8) | 61.0 (38.5-80.3) | 57.1 (51.1- 62.9) | 1.4 (1.0-2.0) | 0.6 (0.4-1.2) |
| Geographic tongue | 1.0 (0.2-2.8) | 33.3 (0.84-90.5) | 53.9 (48.1-59.9) | 0.7 (0.2-3.6) | 1.2 (0.6-2.8) |

**[Table/Fig-3]:** The Prevalence, Sensitivity, Specificity, and Performances of Individual Hair, Nails and Oral Mucosa disorders in predicting CD4+ Cell Count <200 Cells/mm$^3$.

The significance of association of individual hair, nails and oral lesions were examined in relation to median CD4+ cell count. The presence of the following lesions was significantly associated with lower median CD4 count. The blue-black nail pigmentation had a median CD4 count of 106.25 cells/mm$^3$, (IR: 14.25,120.5; p<0.001), fluffy hair 190.0 cells/mm$^3$, (IR: 38.25,228.25; p<0.001), lighter colour hair 187.0 cells/mm$^3$, (IR: 36.0,223.0; p=0.002), oral candidiasis 131.0 cells/mm$^3$, (IR:27.0,158; p=0.004) and aphthous ulcers 61.0 cells/mm$^3$, (IR:33.0-94; p=0.004).

specificity of 55.2%, the PLR and NLR of 1.3 and 0.8. The presence of fluffy and lighter colour hair was associated with of 70.2% and 74.1%, specificity of 58.2% and 56.6%, PLR and NLR of 1.7 and 0.5 respectively [Table/Fig-3].

The performances of oral lesions were as follow: aphthous ulcers and oral hairy leukoplakia: sensitivity: 100% respectively, specificity 55.2% and 54.1%, PLR and NLR of 2.2 and 0 respectively. Oral candidiasis: sensitivity 78.2%, specificity 60.8%, the PLR and NLR ratio of 2.0 and 0.4. However, oral pigmentation demonstrated a

| Combination of integument and oral mucosa disorders | Prevalence (%) (95%CI) | Sensitivity | Specificity (95% CI) | PLR (95% CI) | NLR (95% CI) |
|---|---|---|---|---|---|
| **Two Disorders** | | | | | |
| Blue-black nail/ fluffy hair | 31.9 (19.1-47.1) | 100.0 | 43.8 | 45.5 | 100 |
| Blue-black nail/ lighter hair | 40.7 (22.4-61.2) | 100.0 | 43.8 | 55.0 | 100 |
| Blue-black nail/ oral candidiasis | 41.8 (28.7-55.9) | 95.7 | 34.4 | 51.2 | 91.7 |
| Fluffy hair/oral candidiasis | 38.3 (24.5-53.6) | 88.9 | 41.4 | 48.5 | 85.7 |
| Lighter hair/oral candidiasis | 48.2 (28.7-68.1) | 92.3 | 42.9 | 60.0 | 85.7 |
| **Three disorders** | | | | | |
| Blue-black nail/fluffy hair/oral candidiasis | 55.6 (30.8-78.5) | 100.0 | 25.0 | 62.5 | 100 |
| Blue-black nail/ lighter hair/oral candidiasis | 55.6 (30.8-78.5) | 100.0 | 25.0 | 62.5 | 100 |

**[Table/Fig-4]:** The Prevalence, Sensitivity, Specificity and Performances of Combinations of Hair, Nails and Oral Mucosa disorders in predicting CD4+ Cell Count <200 Cells/mm$^3$.

sensitivity of 61.0%, specificity of 57.1% and PLR and NLR of 1.4 and 0.6 respectively. Others were as shown in [Table/Fig-3].

In [Table/Fig-4], the combinations of disorders that were significantly associated with low CD4 count were considered and their diagnostic precision in predicting CD4 count <200 cell/mm$^3$ was estimated. The most frequent combinations of integuments and oral mucosa disorders were blue-black nail/fluffy hair/oral candidiasis and blue-black nail/lighter hair/oral candidiasis accounting for 55.6% prevalence respectively. This was followed by lighter hair/oral candidiasis (48.2%), blue-black nail/oral candidiasis (41.8%), blue-black nail/lighter hair (40.7%) and blue-black nail/fluffy hair (31.9%). The combination of two and three disorders increased the sensitivity beyond individual sensitivity to between 88.9–100.0%, however specificities for low CD4+ cell count were reduced below that of single integument and oral mucosal disorders and were mostly between 25.0-43.8%.

The PPV of the combination of three lesions was the highest at 62.5% and that of the two lesions combined range between 45.5-60.0%. However, NPV of the combinations (2 and 3) were high and range between 85.7-100.0%.

## DISCUSSION

The leading integument disorders found in the current study and their prevalence include blue-black nail pigmentation (17.8%), fluffy hair (14.9%), lighter colour hair (13.8%), diffuse hair loss (9.2%), onychomycosis (5.4%) and paronychia (3.4%). The prevalence of oral lesions found included oral candidiasis (17.5%), oral pigmentation (7.3%), aphthous ulcers (2.2%) and geographic tongue (1.0%). Most of the published studies that examined the spectrum of mucocutaneous disorders of HIV infection focused on the diseases affecting the skin and oral mucosa [3-5]. Researchers gave little attention to the disorders of the hair and the nails in published studies; most probably because integument disorders are common accompaniments other chronic medical conditions [12].

### Nail Disorders in HIV/AIDS

The present study shows the blue-black nail pigmentation (17.8%) and onychomycosis (5.4%) were the commonest nail diseases found. Furth and Kazakis [15] first reported nail pigmentation among HIV patients in 1987. Following their report, several observations have been made about “melanonychia” [16] or “blue pigmentation” [9] or more recently blue-black pigmentation” [5] of the nails among HIV-positive patients [15-21]. Various variegation of colours that vary from “pale blue to dark purple colour” noted by workers [15-21]. Different patterns of blue pigmentation have been described, which include the diffuse [9], the linear [1], and lunule [9] onset blue-black pigmentation of the nails. The highest number of patients reported in the literature was 75 in the pre-Highly Active Antiretroviral Therapy (HAART) era in Tanzania by Leppard [9]. Most of his patients had the diffuse type of pigmentation that appeared to take origin from lunule and spread distally [9]. Pigmentation had occurred before the commencement of HAART, and uniformly involved all finger nails/toe digits and persisted [5,9]. Our observation is similar as 56 of our patients had predominant diffuse blue-black pigmentation of the nails, but some participants had linear pigmentation despite not on HAART. The linear type of blue-black nail pigmentation has been observed secondary to the commencement of drugs such a Zidovudine among HIV-infected people in some reports [17,19,21]. It must be mentioned that some of the participants had taken antifungal or antibiotics for the treatment of opportunistic infections at some points before the survey, but none had commenced antiretroviral therapy. Cribier B et al., found a prevalence of longitudinal melanonychia (14.8%) in their study which is close to 17.8% found in the present study [20]. Studies have shown that blue-black nail pigmentation in HIV patients could signify the presence of CD4+ cell count <200 cell/mm [3,5,9].

The prevalence of onychomycosis found in our study is 5.4% is close to 4.3% documented in a previous study from the same centre [5]. Most of our patients had distal and lateral superficial onychomycosis (DLSO) and total dystrophic onychomycosis (TDO). Our finding is also slightly above the 3.22% estimated for the general population in a systematic review by Gupta AK et al., but below 10.40% documented among the HIV-positive people in the same study [22]. In comparison to other studies, the prevalence of onychomycosis (5.4%) is significantly lower than 19.9% documented for HIV positive Canadians [23] and 17.0% reported in a Mexican population [24]. The difference in prevalence could be attributed to culture method employed in those studies and the availability and experience of the Microscopist. The higher prevalence of onychomycosis among HIV-infected people has been attributed to altered immunity, reduced peripheral circulation and alteration in nail plate that rendered sufferers to be more prone [22,24].

### Hair Disorders in HIV/AIDS

Frequently found in HIV-infected patients in this study are fluffy, lighter colour hair and diffuse alopecia. Fluffy hair and lighter colour hair apart from being racial could occur following certain protein losing chronic illness like malignancy, chronic kidney diseases and chronic liver diseases. It has also been viewed as a secondary skin disorders seen among patients with HIV [25]. Fluffy hair and lighter colour hair have been related to low serum selenium [26] which, in turn, was shown to be a correlate of hypoalbuminemia in a previous study [27]. The low serum albumin (<35g/dl) could identify adults that should initiate antiretroviral therapy in a study and was found to be a marker of mortality and pulmonary tuberculosis [27]. A study has also shown clustering of fluffy/lighter hair conditions with noticeable weight loss, pulmonary tuberculosis, diarrheal diseases and anaemia [27] among PLWHA. A previous report by Leonidas [8], however, showed particular hair changes that include spontaneous lengthening, softer, silkier and occasionally discoloured hair occurred among dark skin chronically HIV-infected patients as a primary condition. As per the presence of diffuse hair loss, possible contributing factors to diffuse hair loss in this HIV-positive cohort could include some common hair disorders in our environment such as traction alopecia following prolong pressure on hair root, loose anagen hair syndrome, straight hair syndrome, trichorrhexis nodosa, premature canities as reported by Sadick [28]. Certain hair disorders like alopecia areata and tinea capitis were not documented in this cohort.

### Oral Mucosa Disorders in HIV/AIDS

Oral lesions occur significantly in HIV-infected people when CD4 is <200 cells/mm$^3$ [25,29]. In the present study, oral candidiasis (17.5%), oral pigmentation (7.3%), and aphthous ulceration (2.2%) are the lesions of significance. Oral candidiasis is the commonest mucocutaneous manifestation of HIV in Africa and Asia [3,5]. The oral candidiasis prevalence of 17.5% documented in the present study is close to the finding of other studies, [5] but lower than the prevalence of 39.5% and 36.0% documented by Shobana A et al., and Nayak SK et al., respectively [3,29]. The median CD4 count of 131.0 cells/mm$^3$ found among participants with oral candidiasis Is close, but lower than a mean of 143.95 cells/mm$^3$ by Nayak SK et al., and 149.5 cells/mm$^3$ documented by Glick M et al., [29,30].

Nayak SK et al., also showed aphthous ulceration was associated with profound immune involvement with a mean CD4 count of 37 cells/mm$^3$, which is lower than 61.0 cells/mm$^3$ seen in this study [29]. The prevalence of oral hyperpigmentation this study (7.3%) is higher than 0.96% documented by Nayak SK et al., [29] but below 32.8% reported by Sivapathasundharam B et al., [31]. The prevalence of oral pigmentation was higher among HAART-treated HIV-infected people compared to HAART naïve participants [29]. In our study oral hyperpigmentation could be post-inflammatory secondary to treatment received for opportunistic infections (OI) at various points before they were referred to the HAART centre.

### Diagnostic Significance of Hair, Nail and Oral mucosa disorders on CD4+ cell count <200 cells/mm$^3$

The blue-black nail pigmentation, onychomycosis, oral candidiasis, aphthous ulcers lighter hair and fluffy hair are the integument and oral mucosa disorders that demonstrate a significant association with a median CD4 count <200 cell/mm$^3$ in our study. The presence of oral candidiasis, blue-black nail pigmentation, oral hairy leukoplakia, and aphthous ulcers could only unreliable increase the probability of having CD4+ cell count <200 cells/mm$^3$ to between 15–20% (PLR: 2.0 to 2.6). The absence of same single lesions (NLR 0.8–0.1) however increases the likelihood of not having CD4+ cell count <200 cells/mm$^3$ over a wide range between 20% to 100%. Therefore, diagnosing CD4 count <200 cells/mm$^3$ base on the presence of these individual lesions alone would be less reliable. This finding is similar to that of Namakoola I et al., [7]. The combinations of these lesions expectedly increase the prevalence, the sensitivity and PPV above values for individual lesions but gave low to moderate specificity value for CD4 count <200 cells/mm$^3$ which are of little diagnostic importance. The high NPV (85.7-100%) however is of negative diagnostic significance, as the absence of these combinations reliably makes the possibility of the presence of CD4 count <200 cells/mm$^3$ unlikely.

Therefore, while assessing PLWHA, suspicion of CD4 <200 cells/mm$^3$ could only be based on the presence of blue-black nail pigmentation, oral candidiasis, fluffy hair and lighter hair. It is still necessary to request for the CD4 count and other laboratory markers of immunosuppression, as this cutaneous entity could not reliably detect the presence of CD4 count <200 cells/mm$^3$. This call for more supports for the low and middle-income countries in the management of HIV/AIDS.

## LIMITATION

The limitation of this study is its restriction to care centre because of the general stigma associated with a diagnosis of HIV. The same reason might restrict its extrapolation to the general population.

## CONCLUSION

The prevalence of the hair, nail and oral mucosa lesions are comparable to prevalence documented elsewhere. The presence of blue-black nail pigmentation, onychomycosis, oral candidiasis, lighter colour hair and fluffy hair and aphthous ulcers were significantly associated with a median CD4 count <200 cell/mm$^3$. The presence of blue-black nail pigmentation, fluffy hair, lighter hair, and oral candidiasis or their combinations are not good diagnostic test to suspect low CD4+ cell count, but their absence could make the presence of CD4+ cell count <200 cells/mm$^3$ very much unlikely.

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