PATTERN OF CD4 COUNT AND HEMATOLOGICAL INDICES IN HIV SERODISCORDANT PARTNERS IN JOS, PLATEAU STATE, NIGERIA.

ABSTRACT

This was a cross sectional study designed to evaluate the CD4 count and hematological indices in HIV serodiscordant partners in Jos, Nigeria. A total of 20 discordant HIV couples (40 patients) and 20 controls (40 non HIV couples) aged between 18 and 49 years were included in the study. Each participant provided a 5ml venous blood sample that was collected into EDTA containers for the analysis of the CD4 count and hematological indices. The following blood parameters were measured using a three pack full blood count autoanalyzer: white blood cell (WBC), red blood cell (RBC), hematocrit/packed cell volume (HCT/PCV), hemoglobin (HB), platelet count (PLT), lymphocyte, neutrophil, and mixed cell (NUE/NAC) count. The CD4+-T cell was measured using flow cytometry. The results showed that the mean RBC count, platelet count, mixed cell count (Nue/Nac), HCT/PCV and HB levels, as well as the CD4-T cell count, were all significantly lower while the mean age was higher in the HIV discordant test group compared to control group ($p<0.05$) respectively. The mean WBC, lymphocyte, and neutrophil counts in the HIV discordant test group did not differ significantly from the control group ($p>0.05$). The female HIV discordant test group had significantly lower HB, HCT/PCV, RBC, lymphocyte and CD4 count than in the female control group (p=0.008; 0.002; 0.000, 0.008, 0.000) respectively. The male HIV discordant test group had significantly lower mean neutrophil and CD4 counts than in the male control (p=0.000; 0.012) respectively. The female HIV seropositives had a significantly lower mean RBC count (p=0.000), Hb (p=0.037), PCV/HCT (p=0.005) and CD4 count (p=0.000) than in female control while the female HIV exposed seronegatives had significantly lower mean CD4 count (p=0.000) and Hb (p=0.037) levels than in female control while the male HIV seropositives had significantly lower CD4 count compared to male control (p=0.000). This study has revealed significant changes in CD4-T cell count and hematological indices in HIV discordant couples, which calls for an urgent interventional strategy to prevent the potential anemia, leucocytopenia, and weakened immunity that may result in both HIV seropositives and seronegative exposed couples.

Key words: HIV, Discordant couple/partner, CD4-T cell, Hematological indices, anemia, leucocytopenia, age.

INTRODUTION

Comment [WU1]: Abstract should be in block format (Justified)

Comment [WU2]: Write in full

Comment [WU3]: This is contradictory...20 controls and 40 couples? Which do you mean?

Comment [WU4]: Limit usage of abbreviations in abstract...it appears in the entire abstract

Comment [WU5]: Is the difference measured statistically or physically? Reflect the answer appropriately...this statement is not scientific and also confusing.

Comment [WU6]: When you are reporting a statistical result, you should ensure you specify it for clarity. This is because, a result may significantly differ from one another physically but when tested using an analytical test tool, it may not statistically differ. You made this mistake in your entire report; therefore, re-visit and specify appropriately.

Comment [WU7]: Re-arrange in alphabetical order

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Human immunodeficiency virus (HIV), a member of the lentivirus family, causes a range of symptoms anchored on the reduced immune function of its host by causing devastating effects on the host's innate immune capabilities, allowing HIV replication in the host cell, leading to HIV infecting new immune cells, and resulting in the host's susceptibility to infections and If unchecked, this leads to Acquired Immunodeficiency Syndrome (AIDS) (Aaron *et al.*, 2017; UNAIDS, 2019). HIV is a public health issue affecting the world's population; 79.3 million people have been infected with the virus since the epidemic began, 36.3 million have died from AIDS, and recently 37.7 million people were infected with HIV in 2020 (UNAIDS, 2022). It is the main cause of morbidity and mortality in Sub-Saharan Africa (SSA), accounting for 71% of the global population of people living with HIV (James *et al.*, 2018; Roth *et al.*, 2018). In Nigeria, the first HIV/AIDS patient was identified and reported in Lagos in 1985 (Awofala and Ogundele, 2017). Nigeria, the most populous country in Africa (UNFPA, 2020), has 1.9 million people living with HIV (with prevalence of 1.4%) between 15–49 years, making it the third highest in HIV load (UNAIDS, 2019).

HIV discordance is a situation that occurs when one partner is HIV positive and the other is HIV negative (Mehra*et al.*, 2015). HIV discordant couples are a high-risk group for HIV transmission (Ravikumar and Balakrishna, 2013). In Sub-Saharan Africa, 50% of PLWH are in sero-discordant partnerships (Chemaitelly*et al.*, 2012; Curran *et al.*, 2012). Sero-discordant married or cohabiting couples account for a large proportion of new HIV infections in Sub-Saharan Africa, and transmission within this crucial population is a preventable driver of the epidemic (Irungu*et al.*, 2016; Patel *et al.*, 2018). Thus, HIV preventive and treatment efforts focus on sero-discordant couples.

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HIV causes AIDS, a systemic disease marked by impaired cellular and humoral immune responses (Balasubramaniam*et al.*, 2019; van Woudenbergh*et al.*, 2020) which has been linked with hematological abnormalities. Hematological abnormalities are linked to disease progression and death in HIV patients (Damtie*et al.*, 2021). Anemia, leucopenia, neutropenia, lymphopenia, and thrombocytopenia have been observed in HIV-infected people before or after ART initiation (Bhardwaj*et al.*, 2020; Damtie*et al.*, 2021), indicating that hematological abnormalities in HIV individuals are induced by either the virus or ART. More so, anemia, lymphocyte count, and thrombocytopenia are associated with CD4 levels (Bhardwaj*et al.*, 2020). In addition, hematopoietic progenitor cells express CD4 receptors, type 4 C-X-C chemokine receptors and type 5 chemokine receptors, making them susceptible to being infected by HIV (Tsukamoto, 2020). In light of the above, it is important to evaluate the CD4 Count and hematological indices in HIV discordant partners in Jos, Nigeria. Hematological indices offer physiological insights on the reticuloendothelial system and the blood picture (Okoroiwu*et al.*, 2017), and this has not been investigated in this group before.

MATERIALS AND METHODS

Study Area and Location

Thestudy area for this work was Jos North Local Government Area of Plateau State and location includes APIN (Aids Preventive Initiative of Nigeria) section of Our Lady of Apostles (OLA) Hospital, Faith Alive Foundation Hospital and Plateau State Specialist Hospital where HIV screenings are carried out.

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Comment [WU18]: Where is the ethical approval and consent for participation

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Comment [WU20]: What informed the choice of these centres? Do they represent the districts in Jos. If they do not, then the title of the study should be changed to the particular area covered.

Study Design and Subject Selection

For this investigation, a cross sectional study approach was used. The participants were partners who were known to be HIV positive and exposed seronegatives and are between the ages of 18 and 49 years old. Additionally, HIV-negative couples within the aforementioned age range who appeared to be in good health were employed as controls. The HIV-positive people were already taking medication, but their negative counterparts in a discordant relationship were not on ART.

Study Population

The study population included male and female subjects in discordance relationship within the age of 18 to 49 years attending the APIN section of Our Lady of Apostles Hospital, Faith Alive Foundation and Plateau State Specialist Hospital. A total of 20 discordant HIV couples (40 patients) and 20 controls (40 non HIV couples) were included in the study.

Sample Collection

Each participant gave venous blood sample of 5 ml, which was then drawn into EDTA containers after the collection site had been cleaned with 70% alcohol. This was utilized for the determination of full blood count as well as CD4 count.

Inclusion criteria

Participants who tested HIV-negative and had been in a stable, discordant relationship for at least three months were included. The study comprised participants who were registered patients at the hospital under investigation, between the ages of 18 and 49, and who had the necessary status documentation. Additionally, a control group of people who were within the age bracket and appeared healthy was included in the study (non HIV subjects).

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Comment [WU22]: Recast this sentence

Comment [WU23]: 'that'

Comment [WU24]: What of the sampling and sample size? What is the previous history of the centres with respects to HIV patients. This should be factored before calculating the sample size. Re-visit the sampling and its technique because you should be able to explain how you arrived at 40 patients for both the study group and control group.

Comment [WU25]: Close gap

Comment [WU26]: 'discordant'

Comment [WU27]: This should come after inclusion and exclusion criteria; and merge it with LABORATORY METHOD

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Exclusion Criteria

Participants who were already bedridden due to AIDS, those who were not registered patients or had improper documentation with the institution under research, and those who refused to give informed consent were all excluded from the study.

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Ethical Approval

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Ethical approval was obtained from the Ethics Committees of the hospitals: Plateau State Specialist Hospital (PSSH/ADM/ETH.CO/2019/005); Faith Alive Foundation Hospital (FAFEC/08/34/25) and Our Lady of Apostles Hospital (dated 13th June, 2018) where the study was carried out.

Laboratory methods

Full blood count was determined using a three pack automated full blood count analyzer while the CD4 count was assayed using Flow cytometry.

Statistical Analysis

The data obtained were analyzed using independent t-test and one-way analysis of variance (ANOVA) with the aid of SPSS statistics tool version 23.0 software. Significant level was assumed at $p<0.05$.

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RESULTS

When compared to the control group, the HIV discordant test group's mean age was significantly higher ($p=0.000$). However, when compared to the control group, the mean RBC count, platelet

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count, mixed cell count (Nue/Nac), HCT/PCV and HB levels, as well as the CD4-T cell count, were all significantly lower in the HIV discordant test group (p 0.05). The mean WBC, lymphocyte, and neutrophil counts, however, did not differ significantly from the control group (p>0.05 in each case). See table 1.

The male control group's mean age was significantly higher than that of the female control group (p=0.000). The female test group's mean age was significantly higher than that of the female control group (p=0.000). Additionally, the mean age of the male test group was significantly higher than that of the female control group and the female test group who tested positive for HIV (p=0.000, respectively). See table 2.

In comparison to the control groups, as well as between the male and female test groups, there was no statistically significant difference in the mean level of total WBC (p=0.524). See table 2.

In comparison to the values seen in the female and male control groups, respectively, the mean level of RBC seen in the female test group was significantly lower (p=0.000). Additionally, the mean RBC level was significantly lower in the male test group than in the female control group (p=0.000). See table 2.

In comparison to the female (12.95±0.98) and male (12.81±1.22) control groups, the mean HB level was significantly lower in the female test group (11.48±1.43) (p=0.008). See table 2.

There was significantly lower HCT/PCV level observed in the female test group (34.90±3.82) when compared to the female (41.00±2.90) and male (39.80±3.30) control groups (p=0.002). Also, the mean HCT/PCV level was significantly lower in the male test group than in female control group (35.98±9.40 Vs 41.00±2.90; p=0.002).

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Comment [WU42]: This P-value should appear immediately after the sentence 'statistically significant'.

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There was significantly lower platelet count observed in the male test group when compared to the female control groups (220.70±70.99 Vs 280.20±60.41; p=0.022). See table 2.

When the test groups of males and females as well as the controls were examined, the mean NUE/NAC levels did not differ significantly (p>0.05). See table 2.

The mean lymphocyte counts were significantly higher in the male test group than in the female test group (52.85±8.41 Vs 44.85±11.16; p=0.008), but significantly lower in the female test group compared to the female (52.00±1.86) and male (52.30±4.23) control groups. See table 2.

In comparison to the female control group, the mean neutrophil counts in the male test group were significantly lower (34.508.66 Vs 40.906.84; p=0.012), but it did not differ significantly from those found in the female test group (p>0.05). See table 2.

Compared to the values seen in the male and female control groups, the mean CD4 count was significantly lower in the female and male test groups (p=0.000) respectively. Also, the mean CD4 count was significantly in the male test group than in the female test group (p=0.000). See table 2.

When the mean ages of the study subjects were compared between the groups, there were significant differences (f-value=15.054; p=0.000).The mean ages of the individuals who were male controls, female HIV positives, and male HIV positives were significantly different from those of the participants who were female controls (p=0.000, respectively). Additionally, as compared to female controls and HIV positive people, the mean age of the male HIV exposed seronegative participants was significantly higher (p=0.000, respectively). See table 3.

When compared across the groups under study, the mean total white blood cell count (WBC), platelet count, and NUE/NAC levels did not differ significantly ($p>0.05$). See table 3.

The mean red blood cell count was significantly lower in the female HIV seropositives than in the male and female control groups ($p=0.000$, respectively) and significantly different between the groups ($F=5.709$; $p=0.000$). See table 3.

When the mean hemoglobin (HB) levels of the groups were examined, there was a significant difference ($F=2.523$; $p=0.000$). See table 3.

When participants' mean levels of haematocrit and packed cell volume were compared across the study groups, there were significant differences ($F=3.726$; $p=0.005$) as well as between the female HIV positive and male HIV exposed seronegative groups than in the female control group. See table 3.

The mean lymphocyte level varied significantly amongst the groups under investigation ($F=2.456$; $p=0.041$). See table 3.

Comparing the levels of neutrophils in the various study groups revealed additional significant differences ($F=2.423$; $p=0.043$). In addition, male HIV exposed seronegatives had significantly lower mean neutrophil levels than female HIV positives ($p=0.043$). See table 3.

Comparing the mean CD4 counts of the study groups revealed significant differences ($F=16.6672$; $p=0.000$). Compared to the values seen in the male and female control groups, the mean CD4 count was significantly lower in the female HIV seropositives, female exposed HIV seronegatives, and male HIV seropositives ($p=0.000$, respectively). Male HIV exposed seronegatives had a significantly lower mean CD4 count than female HIV positives ($p=0.000$).

See table 3.

Table 1: CD4 count and levels of Hematological indices in the HIV discordant and control groups studied (Mean±SD).

*Statistically significant at p<0.05.

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Table 2: Levels of CD4 count and hematological indices in the male and female HIV discordant test groups studied (mean±SD).

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Parameter	Control group (n=40)	HIV Discordant Test group (n=40)	t-value	p-value
Age	35.6±6.9	40.5±6.1	3.350	0.000*
WBC	5610.00±1401.43	5220.00±1502.85	1.200	0.234
RBC	4.64±0.43	4.10±0.54	4.879	0.000*
HB	12.88±1.10	11.92±1.76	2.923	0.005*
HCT/PCV	40.40±3.13	35.41±7.10	4.041	0.000*
Platelet	277.95±56.29	241.20±75.48	2.468	0.016*
NUE/NAC(Mixed cells)	7.40±1.68	6.65±1.17	2.322	0.023*
Lymphocyte	52.15±6.17	48.85±10.56	1.706	0.092
Neutrophil	40.45±5.46	38.20±9.71	1.277	0.205
CD4	1035.20±141.11	616.48±348.28	7.047	0.000*

Parameter	Female control (n=20)	Male control (n=20)	Female discordant test group (n=20)	Male discordant test group (n=20)	f-value	p-value
Age	30.5±4.5	40.7±4.6[a]	37.5±5.6[a]	43.5±5.2[a,b]	25.128	0.000
WBC	5820.0±1821.97	5400.00±786.73	5790.00±1622.57	5250.00±1414.77	0.753	0.524
RBC	4.71±0.51	4.57±0.33	3.98±0.38[a,b]	4.23±0.65[a]	9.246	0.000
HB	12.95±0.98	12.81±1.22	11.48±1.43[a,b]	12.37±1.97	4.192	0.008
HCT/PCV	41.00±2.90	39.80±3.30	34.90±3.82[a,b]	35.98±9.40[a]	5.648	0.002
Platelet	280.20±60.41	275.70±53.34	261.70±75.97	220.70±70.99[a]	3.392	0.022
NUE/NAC (mixed cells)	7.10±1.86	7.70±1.45	6.80±1.28	6.50±1.05	2.522	0.064
Lymphocyte	52.00±1.86	52.30±4.23	44.85±11.16[a,b]	52.85±8.41[c]	4.189	0.008
Neutrophil	40.90±6.84	40.00±3.73	41.90±9.49	34.50±8.66[a]	3.881	0.012
CD4	1042.95±109.86	1027.45±169.33	469.20±270.79 a,,b	763.75±360.55[a,b,c]	23.909	0.000

Key:

a=compared with female control

b= compared with male control

c= compared with female test group

Table 3: Levels of CD4 and hematological indices in the participants studied (mean±SD).

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Parameter	Female control (n=20)	male control (n=20)	Female positives (n=16)	Female negatives (n=4)	male positives (n=16)	male negatives (n=4)	f-value	p-value
Age	30.5±4.5	40.7±4.6[a]	37.1±5.6[a]	38.8±6.4	45.3±7.5[a]	43.1±4.6[a,c]	15.054	0.000
WBC	5820.0±1821.97	5400.00±786.73	5168±1709.47	5275.00±1431.49	5087.50±1340.09	5415.00±1457.07	0.644	0.667
RBC	4.71±0.51	4.57±0.33	3.99±0.24[a,b]	3.95±0.79	4.29±0.65	4.37±0.56	5.709	0.000
HB	12.95±0.98	12.81±1.22	11.54±1.05	11.23±2.72	12.43±1.98	12.40±1.53	2.523	0.037
HCT/PCV	41.00±2.90	39.80±3.30	34.88±3.28[a]	35.00±6.22	35.16±9.85	37.92±6.00[a]	3.726	0.005
Platelet	280.20±60.41	275.70±53.34	263.88±78.03	253.00±77.36	225.63±67.35	259.5u8±68.70	2.101	0.075
NUE/NAC (Mixed cells)	7.10±1.86	7.70±1.45	6.94±1.29	6.25±1.26	6.50±1.03	7.03±1.48	1.631	0.163
Lymphocyte	52.00±1.86	52.30±4.23	44.69±12.31	45.50±5.45	52.94±7.61	50.50±8.75	2.456	0.041
Neutrophil	40.90±6.84	40.00±3.73	42.31±10.40	40.25±4.92	33.94±8.05	39.33±7.91[c]	2.423	0.043
CD4	1042.95±109.86	1027.45±169.33	442.00±264.68[a,b]	578.00±309.25[a,b]	828.88±357.65[a,b]	825.84±337.79[c]	16.672	0.000

Key:

a=compared with female control

b= compared with male control

c= compared with female HIV positive

DISCUSSION

Individuals with HIV-1 infection, those not receiving antiretroviral medication, and those with the disease in its advanced stages typically report having hematological abnormalities of the major blood cell lines (Duguma*et al*., 2021). Due to its destructive effects on the immune system and various organs in the human body, which result in considerable unfavorable alterations in several hematological indices, HIV continues to be a topic of enormous health relevance and debate around the world. The present study evaluated the CD4 count and hematological indicators in HIV discordant partners in JOS, Nigeria.

In the current investigation, the mean age was significantly higher in the HIV discordant test group (40.5±6.1) than in the control group (35.6±6.9). Given that the mean age of HIV-positive people indicates that they are among the country's working population, proper and prompt therapeutic management of these people will further increase their productivity throughout the economic cycle.

The mean RBC count, platelet count, mixed cell count (Nue/Nac), HCT/PCV and HB levels, as well as the CD4-T cell count, were all significantly lower in the HIV discordant test group when compared to the control group. The lower levels of RBC count, HCT/PCV and HB recorded in this study shows that the HIV serodiscordant couples are at risk of anemia. Previous studies have also reported similar findings to the present study (Ositadinma*et al.*, 2016; Aaron *et al*., 2021). Furthermore, lower level of platelet count documented in the HIV serodiscordant couple in this study is an indication that these persons are at greater risk of thrombocytopenia. This is in keeping with findings in previous studies involving HIV subjects (Enawgaw*et al.*, 2014; Aaron *et al*., 2021). Anemia, leucopenia, neutropenia, lymphopenia, and thrombocytopenia have been observed in HIV-infected people before or after ART initiation (Bhardwaj *et al.*, 2020; Damtie*et al*., 2021), indicating that hematological abnormalities in HIV individuals are induced by either

Comment [WU54]: Recast this sentence...too ambiguous and unclear

Comment [WU55]: Try to make your sentences short, clear, simple and comprehensible...recast sentence

Comment [WU56]: Expunge

Comment [WU57]: This is a repetition of the result...you are expected to discuss your findings and not re-presenting the results

Comment [WU58]: Expunge or re-write appropriately.

Explain why it happened and support it with reports from existing literatures.

Note: RESULTS presents what happened in a research; whereas the DISCUSSION presents why it happened.

Comment [WU59]: What are the findings previous studies reported...you are expected to argue and support your findings with reports from existing literatures and not repeating your results

Comment [WU60]: What was exactly reported in these findings you cited

the virus or ART. More so, anemia, lymphocyte count, and thrombocytopenia are associated with CD4 levels (Bhardwaj *et al*., 2020).

Expectedly, this study found that the CD4+T-cell count was significantly lower in HIV serodiscordant participants compared to controls. This finding is in line with earlier studies (Nsonwu-Anyanwu*et al*., 2017; Ezeugwunne*et al*., 2021; Ezeugwunne*et al*., 2021). A progressive decrease in CD4+ T-cell populations, along with a steady decline in cellular immunity characterizes HIV infection.

The present study showed that the mean level of total WBC However, there was no significant difference in the mean WBC, lymphocyte, or neutrophil counts observed in the discordant group compared to the control group. This finding is consistent with that of Asemota and colleagues, who found no significant differences between control and HIV-naive patients and HIV-infected participants in terms of the mean WBC counts (Asemota*et al*., 2018). The limited sample size used in this study as well as the stage of HIV infection may have had an impact on the findings. did not differ statistically significantly from the control groups or between the male and female HIV discordant test groups. Also, the mean NUE/NAC (mixed cells) levels did not differ significantly between the test groups of males and females HIV discordant couples as well as the controls. This finding is consistent with that of Asemota and colleagues, who found no significant differences between control and HIV-naive patients and HIV-infected participants in terms of the mean WBC and mixed cells counts (Asemota*et al*., 2018) but differs with some other reports (Aaron *et al*., 2021). This result may imply that in the participants in the study, gender differences do not significantly affect either the WBC or the mixed cells count (which includes monocyte, eosinophil, and basophil count).

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There was significantly lower platelet count observed in the male HIV discordant test group when compared to the female control group. This demonstrates that male HIV-positive discordant couples may be more susceptible to thrombocytopenia than the general or healthy population. Thrombocytopenia has been reported in the literature among the HIV positive individuals previously (Abdulrahaman*et al*., 2014) which agrees with the current results. Thrombocytopenia is the second most frequent complication of human immunodeficiency virus (HIV) infection with varied prevalence documented across the globe (Akinbami*et al*., 2010; Gunda*et al*., 2017; Butale, 2019; Gebrewold*et al*., 2020; Patil and Patil, 2020).

In this study, the mean level of RBC in the female HIV discordant test group was significantly lower than the levels observed in the female and male control groups, respectively. Additionally, compared to the female control group, the mean RBC level was significantly lower in the male HIV discordant test group. The mean HB level in the female HIV discordant test group was significantly lower than it was in the male and female control groups. When compared to the female and male control groups, the HCT/PCV level in the female HIV discordant test group was significantly lower. Additionally, the mean HCT/PCV level in the male HIV discordant test group was significantly lower than in the female control group. This research demonstrates that while men are similarly susceptible to anemia brought on by HIV infection and exposure, it affects women more severely. Impaired haematopoiesis, immune-mediated processes, opportunistic infections, lymphoma, and the myelotoxic effects of antiretroviral medications are some of the aetiopathogenesis factors for anemia in HIV infection (Hoffbrand*et al*., 2006). Anemia in HIV-positive people has been shown in several investigations as evidenced by significantly lower mean RBC, Hb, and PCV levels (Ositadinma*et al*., 2016; Aaron *et al*., 2021).

Furthermore, the mean lymphocyte counts were significantly higher in the male HIV discordant test group than in the female HIV discordant test group, but significantly lower in the female HIV discordant test group compared to the female and male control groups. In comparison to the female control group, the mean neutrophil counts in the male HIV discordant test group were significantly lower, but it did not differ significantly from those found in the female test group. This suggests that while the male discordant test group may be more susceptible to neutropenia than the female discordant group, the female discordant group may be more susceptible to lymphopenia. Numerous studies have recorded varying degrees of leucopenaia characterized by lymphopenia and/or neutropenia (Balogun*et al*., 2020) which corroborates with the present findings. Leucopenia and neutropenia have been linked to HIV infection in previous research (Munyazesa*et al*., 2012; Parinitha and Kulkarni, 2012) While neutropenia makes HIV patients more vulnerable to bacterial infections, leucopenia is believed to increase the frequency of opportunistic infections (Tagoe and Asantewaa, 2011). According to reports, lymphopenia and a low lymphocyte total count are frequent symptoms of HIV infection (Dangana*et al*., 2010; Parinitha and Kulkarni, 2012).

Interestingly, the mean CD4 count was significantly lower in the male and female discordant test groups, respectively, than the values observed in the male and female control groups, while the mean CD4 count was significantly higher in the male discordant test group than in the female discordant test group. This result is consistent with past research (Nsonwu-Anyanwu*et al*., 2017; Ezeugwunne*et al*., 2021; Ezeugwunne*et al*., 2021).

The mean red blood cell count was significantly different between the groups and significantly lower in the female HIV seropositives than in the male and female control groups respectively. There was a significant difference between the groups' mean hemoglobin (HB) levels as well. In

comparison to controls, female HIV seropositives and exposed HIV seronegatives had significantly lower levels of hemoglobin (Hb). Furthermore, compared to female controls, PCV/HCT were significantly lower in female HIV-seropositives as well as exposed seronegative males. These results suggest that anemia caused by HIV infection and/or exposure affects both female HIV positives and HIV exposed seronegatives in a similar way. The fact that the current study identified partner HIV exposure as a risk factor that can result in anemia in such individuals is quite significant. Several studies have documented anemia in HIV infected individuals indicated by significantly lower mean levels of RBC, Hb and PCV (Ositadinma*et al*., 2016; Aaron *et al*., 2021). The most prevalent hematologic abnormality among HIV-positive individuals is anemia, which is also linked to the course of the disease and a higher mortality risk for the patients (Cao *et al*., 2022). Patients with HIV experience anemia for a variety of reasons. Hematopoietic stem/progenitor cells (HSPCs), which are found in the bone marrow, may be negatively affected by HIV both directly and indirectly (Durandt*et al*., 2019; Marchionatti and Parisi, 2021). Additionally, the proliferation and differentiation of HSPCs during hematopoiesis may be impacted by ART medications, inflammatory mediators generated during HIV infection, coinfections, or opportunistic infections (Durandt*et al*., 2019; Marchionatti and Parisi, 2021). So, either the gradual depletion of HSPCs or the inhibition of their action may be the cause of anemia. In addition, a number of publications have noted that some ART combinations or monotherapy can cause anemia (Zerihun*et al*., 2019; Kayode*et al*., 2020), which is consistent with the results of the current study. An important indicator that the anemia experienced by the HIV exposed seronegative participants in this study may be caused by their exposure to HIV infection in their partners is the fact that their HB, RBC, and PCV/HCT were significantly lower

than in control subjects. As a result, it is important to monitor these indices in the exposed participants.

As anticipated, this study found that the CD4+T-cell count was significantly lower in the female HIV seropositives, female exposed HIV seronegatives, and male HIV seropositives as compared to the values seen in the male and female control groups. In comparison to female HIV positives, male HIV exposed seronegatives had a considerably lower mean CD4 count. As anticipated, this study found that the CD4+T-cell count was significantly lower in HIV-positive participants compared to controls. This finding is in line with earlier studies (Nsonwu-Anyanwu*et al*., 2017; Ezeugwunne*et al*., 2021; Ezeugwunne*et al*., 2021). A progressive decrease in CD4+ T-cell populations, along with a steady decline in cellular immunity and an increase in vulnerability to opportunistic infections, is the defining feature of HIV infection and, subsequently, AIDS pathogenesis (Okoye and Picker, 2013). Furthermore, previous studies has shown no significant alterations in mean CD4 counts in HIV infected male and female participants (Ogbodo*et al*., 2021). This finding suggests that seronegative exposed partners also experience diminishing CD4+ T-cell counts as a result of HIV exposure, and as a result, continual depletion of these immune cells makes these people more susceptible to infections that can worsen immunological function. Therefore, it may be appropriate to suggest that these people start taking ART in order to further protect them from the rising viraemia caused by untreated HIV infection.

CONCLUSION

This study has revealed significant changes in CD4-T cell count and hematological indices, most notably significant declines in PCV/HCT, HB, RBC, WBC count as well as CD4-T cell count in HIV discordant couples, which calls for an urgent interventional strategy to prevent the potential

anemia, leucocytopenia, and weakened immunity that may result in both HIV seropositives and seronegative exposed couples.

Comment [WU68]: This is short...summarize your findings here and possibly make recommendations if there is any

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Comment [WU69]: Arrange references in alphabetical order...they are disorganized

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Comment [WU70]: Is this the volume number or issue number? Add both

Note: Reflect this in the entire bibliography

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Comment [WU75]: Check referencing style and cite appropriately

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