Some Coagulation and Haematological Parameters of Human Immunodeficiency Virus Positive Individuals Accessing Clinic in Haart Centers in Esan South-East Local Government Area of Edo State, Nigeria

[1,*]Itseghosimhe Egiemhe Friday, [1]Ajugwo Anslem
[1]Department of Medical Laboratory Sciences
Igbinedion University, Okada, Edo State, Nigeria
*itseghosimhe.friday@iuokada.edu.ng

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Abstract

Background*: Highly active antiretroviral therapy (HAART) has significantly reduced the scourge of Human Immunodeficiency Virus and its associated mortality, but systemic complications, haematological changes and other complications have been reported in patients receiving HAART (or ART).*

Aim: *This study was carried out to evaluate some coagulation and haematological parameters of Human Immunodeficiency Virus positive individuals assessing clinic in HAART centres in Esan South-East Local Government Area of Edo State, Nigeria.*

Method: *CD4+, Platelet, White blood cell count, Lymphocyte, Granulocyte, Packed cell volume (PCV), Haemoglobin, Monocytes-basophils -eosinophils mixed, Prothrombin time and Activated Partial Thromboplastin Clotting Time were determined in one hundred and twenty (120) samples consisting of forty (40) controls from HAART naïve patients, forty test samples from patients on HAART therapy and forty samples from HIV negative persons, were analysed in this study. Demographic analysis of the study population showed that 27% percent of subjects on HAART were females between the ages of 25 to 35 years, closely followed by 15% for females aged 46 to 55 years. Result of the study showed significant decrease in CD4+ count (p=0.00) in Subjects on HAART (537.7±45.4 cell/mm^3) and Non-HAART subjects (271.3±63.3 cell/mm^3) in comparison with control (4773.3±742.6 cell/mm^3). There was significant decrease in platelet count from 221000 (x10^9/L) in Non-HAART subjects in comparison with 320655.0 (x10^9/L) of control subjects (p=0.04), and Non-HAART subjects had significantly lower PCV that HAART subjects (p=0.04).*

Conclusion: *Haematological and coagulation (clotting) changes observed in HIV positive subjects, which was more severe in non-HAART subjects than subjects on HAART is a clear indication of disease progression which is curtailed by HAART.*

Keywords: *Haematological, Coagulation, Human Immunodeficiency Virus, Anti-retroviral*

Introduction

Human immunodeficiency virus (HIV) is a lentivirus (a member of the retrovirus family) that causes acquired immunodeficiency syndrome (AIDS), a condition in humans in which progressive failure of the immune system allows life-threatening opportunistic infections and cancers to thrive. HIV infects vital cells in the human immune system such as helper T cells (specifically CD4+ T cells), macrophages, and dendritic cells. HIV infection leads to low levels of CD4+ T cells through three main mechanisms: First, direct viral killing of infected cells; second, increased rates of apoptosis in infected cells; and third, killing of infected CD4+ T cells by CD8 cytotoxic lymphocytes that recognize infected cells. When CD4+ T cell numbers decline below a critical level, cell-mediated immunity is lost, and the body becomes progressively more susceptible to opportunistic infections. The Human immunodeficiency virus (HIV) and Acquired immunodeficiency syndrome (AIDS) epidemic have become one of the most important public health problems. In recent years, HIV/AIDS has come to be regarded as a major health problem because of its high rates of morbidity and mortality and its high treatment costs throughout the world. According to the Joint United Nations Program on HIV/AIDS, since the beginning of the HIV epidemic, approximately 78 million people have been infected with HIV, with an approximate 35 million people dying due to AIDS-related illnesses and an estimated 36.7 million people living with HIV worldwide by the end of 2015 and 38.0million people living with HIV at the end of 2019 (UNAIDS, 2020). Nigeria currently ranks fourth in the world with regards to HIV burden. Nigeria has a generalized HIV epidemic with the highest HIV burden in West and Central African sub-region. The country has an estimated 1.8 million people living with HIV (PLHIV) (2019 Spectrum estimate) and an estimated 107,112 new HIV infections which is about 38% of new infections in West and Central African region. Nigeria accounts for about 41% of vertically transmitted HIV infections in children in the region in 2018. In 2018, a population based survey – Nigeria HIV/AIDS Indicator and Impact Survey (NAIIS, 2018) was conducted to estimate HIV prevalence and related health indicators at national and sub-national levels. HIV prevalence from this survey was 1.3% among 15 – 49 years which was an improvement from the last population-based survey conducted in 2012, National HIV/AIDS Reproductive Health and Survey (NARHS) with HIV prevalence of 3.4%. While there has been a remarkable gain in rolling back the epidemic, the total number of people affected by the epidemic remains high. It is estimated that there are about 1.8 million people in Nigeria living with HIV in 2019; about one third do not know their HIIV status resulting in a gap of about 23% to reach the target of 90% of PLHIV knowing their HIV status. Before 2018, millions of people were tested for HIV and received the results using general population testing approach at less than 1% HIV positivity yield. Despite the fact that HAART has been effective in lowering mortality, long-term harmful effects and the rise of non-AIDS-related diseases among HIV-infected people using HAART are causes for concern. Among the major non-AIDS events that cause morbidity and mortality are neurological problems, haematological and organ-related malignancies, bone and connective tissue abnormalities, cardiovascular, renal, and hepatic diseases in HAART era. Highly Active Antiretroviral Therapy (HAART) is the gold standard in the management of HIV/AIDS and all persons who are eligible to ART should be commenced on HAART as soon as possible. ART should be offered to all persons who are eligible in a comprehensive manner, which means that the persons should have access to ongoing HIV adherence counselling, baseline and routine periodic laboratory investigation, management of opportunistic infections (OIs), routine treatment monitoring and follow-up. HAART is the name given to aggressive

treatment regimens used to suppress HIV viral replication and the progression of HIV disease. The typical HAART regimen consists of three or more different medications, such as two NRTIs and a protease inhibitor (PI), two NRTIs and a non-nucleoside reverse transcriptase inhibitor (NNRTI) or other such combinations (WHO, 2016). This study aimed at evaluating some coagulation and haematological parameters of Human Immunodeficiency Virus positive individuals assessing clinic in HAART centres in Esan South-East Local Government Area of Edo State, Nigeria.

Materials and Methods

This study was carried out at Ubiaja. Nigeria's Edo State includes the community of Ubiaja in its Esan South-East Local Government Area. It is 221 meters above sea level. One of the largest ethnic groups in Edo State is the Esan tribe, which makes up the majority of the population. Agriculture is the primary industry of Ubiaja. The "Okuesan," "Emu," "Emunokhua," "Ikeken," "Ebhohimi," and "Okhuodua" make up the local government of Ubiaja. These are the towns that make up Ubiaja's Esan South East Local Government region.

Study Design

A descriptive cross sectional design was used to examine some coagulation and haematological parameters of HIV positive individuals accessing clinic in HAART centres in Esan south -East Local Government Area of Edo state. It is an observational study that analyses data from a population or from a representative subset at a particular time. It is mainly used in medical and social science research. The design uses different groups of people who differ in variable of interests, but share socioeconomic status, educational background and ethnicity.

Participants in the text group included: Male and female HIV positive patients on HAART attending Ubiaja General Hospital. Participant in the control group excluded: HIV positive Females and male on HAART who were not in Ubiaja, Edo state, Nigeria.

Ethical consideration

Ethical approval for this study was sought and obtained from the Edo State Hospital management board with reference number A732/T/5. Informed consent was equally obtained from each participant to indicate voluntary participation in the study.

One hundred and twenty (120) test samples (40 controls from HAART naïve patients , 40 test samples from patients on HAART therapy and 40 samples from HIV negative persons) was used for this research.

Laboratory Procedures

Platelet Count was done using flow-cytometry. Flow-cytometry is a method by which cells or micro particles in suspension is differentiated and counted according to the cell size and internal structure. In the cyflow-SL-3, the fluorescent monoclonal antibodies binds to the CD4 antigen on the mononuclear cell (T- lymphocytes and monocytes) and in a buffer suspension, the complex is passed through the flow cuvette in a single stream of flow. The complex is excited by the solid state laser light at a wavelength of 532nm causing the complex to emit light which is captured by a photomultiplier tube and transmitted into digital read out as count.

Prothrombin time (PT) test; The PT is a screening test for the extrinsic clotting system, i.e. factor VII. It will also detect deficiencies of factors, prothrombin, V, X, and fibrinogen. It is mainly used to monitor patients receiving warfarin anticoagulation.

In PT test, plasma or capillary blood is added to a thromboplastin and calcium chloride reagent at 37^{o}C and the time taken for a clot to form is measured. The clotting time in seconds is converted to the International Normalized Ratio (INR), usually by reference to a table provided by the manufacturer of the reagent or from the formula.

INR = (PT of Patient/PT of Control)^{ISI}

*International sensitivity Index (ISI): This figure is provided by the manufacturer of the thromboplastin reagent. To obtain the INR, calculate the prothrombin ratio, log the ratio, multiply by the ISI, and antilog the result.

Estimation of PTTK; PTTK is also called Activated partial thromboplastin time (APTT) test. The APTT is a screening test of the intrinsic clotting system. It detects the inhibition or deficiency of one or more of the following factors: prothrombin, V, VIII (antihaemophilic factor), IX, X, XI, XII and fibrinogen. The APTT is also used to monitor patients being treated with heparin.

Principle of test; Kaolin (surface activator) and platelet substitute (phospholipid) are incubated with citrated plasma at 37oC for the time specified in the test method. Calcium chloride (CaCl2) is added and the time taken for the mixture to clot is measured.

Full Blood Count was carried out using a Sysmex automated full blood count analyser (KX-21, SYSMEX, 2006)

Principle of test; When blood cells suspended in a conducting solution are made to pass through a tiny aperture simultaneously with electric current between two electrodes, each particle displaces its volume of electrolyte which causes a momentary increase in electrical resistance that generates pulses that represents each cell and the size of each pulse is directly proportional to the size of the cell that generated the pulse. The number of the different blood cells are then counted and recorded electronically. (Bain et al., 2012).

Results

This study evaluated some coagulation and haematological indices of Human Immunodeficiency Virus positive individuals assessing clinic on HAART and those not on HAART. The demographic characteristic of this study population which was made up of forty HIV positive subjects not receiving highly active antiretroviral therapy (HAART) and forty HIV positive persons who were (Non-HAART), showed that 27% percent of subjects on HAART were females between the agesof 25 to 35 years, closely followed by 15% for females aged 46 to 55 years.

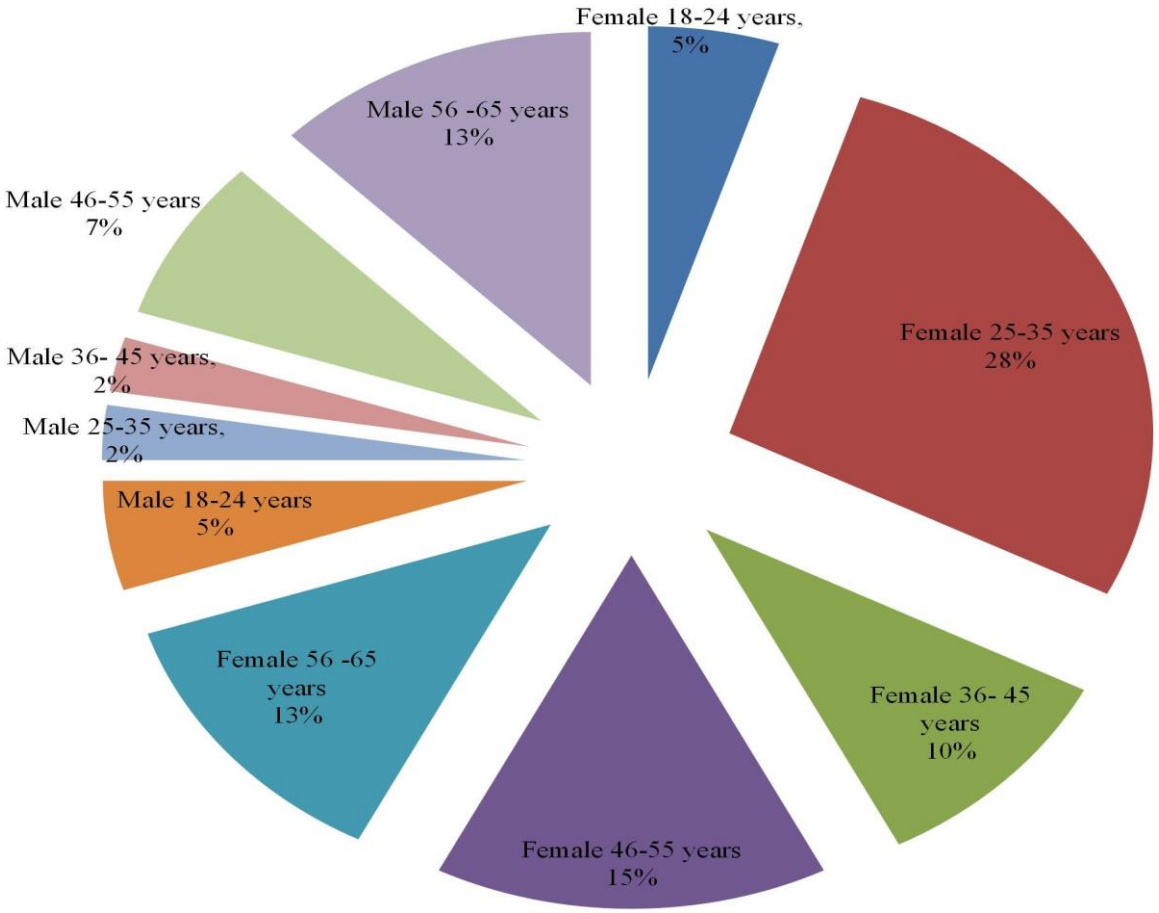

Figure 1: Demographic Characteristic of HIV positive study participants on HAART

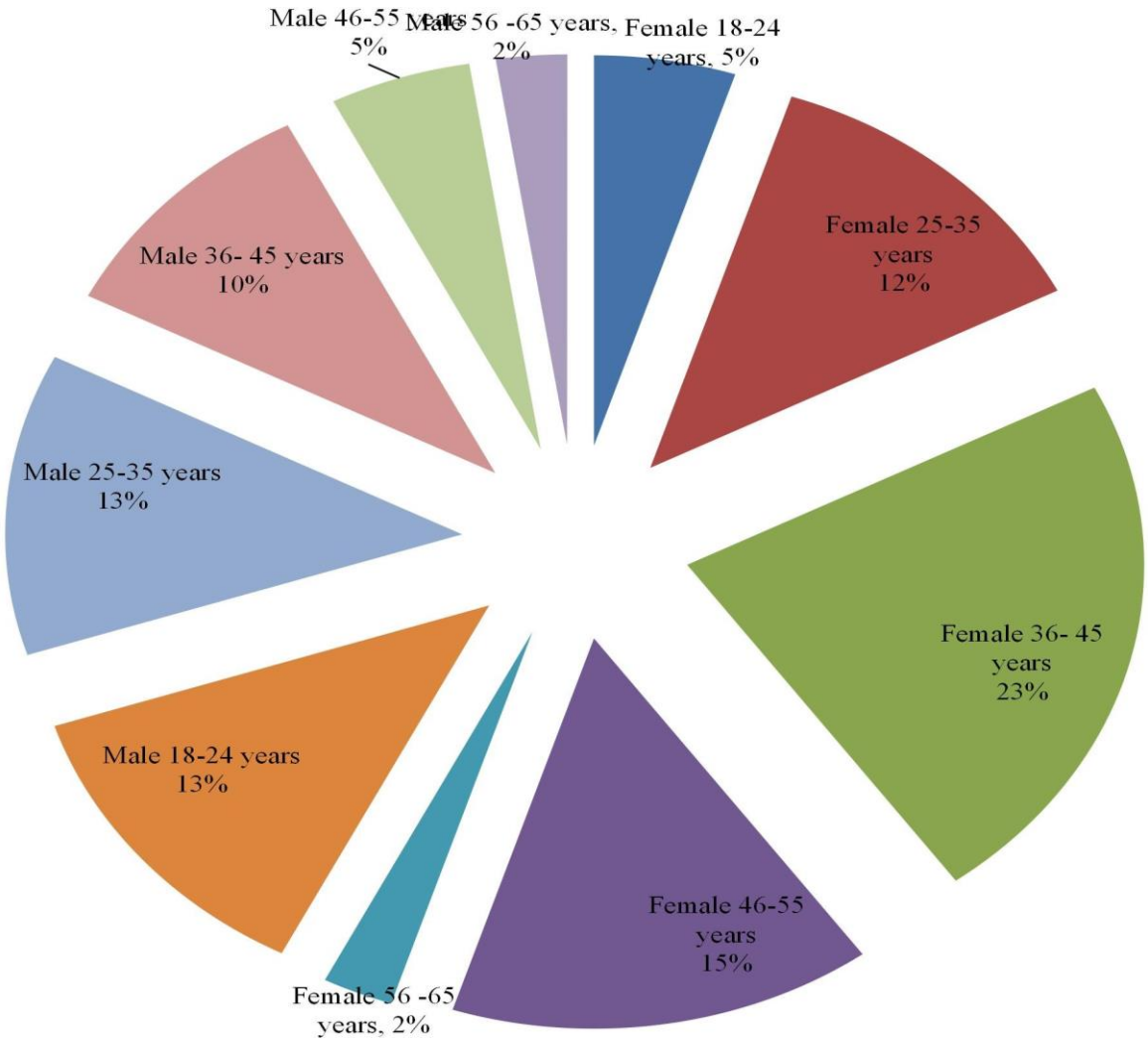

Figure 2: Demographic characteristic of HIV positive study participants not onHAART

Table 1: Haematological and clotting indices of HAART and Non-HAART subjects in comparison with the healthy control using Analysis of Variance (ANOVA) Statistics

Para meters	Control (n=40)	HAART participants (n=40)	Non-HAART participants (n=40)	f-value	p-value
CD4 (cell/mm^3)	4773.3±742.6^a	537.7±45.4^b	271.3±63.3^b	34.33	0.00*
PLT(x10^9/L)	320655.0±59252^a	250925.0±10770^{ab}	221000±15173.4^b	2.03	0.04
WBC(x10^9/L)	60950.0±273.4^a	6460.0±746.7^a	5975.0±509.9^a	0.22	0.81
LYM (%)	40.6±5.3^a	44.8±10.6^a	35.4±15.5^b	6.92	0.00*
GRAN (%)	49.0±8.7^{ab}	44.0±12.3^a	52.0±16.4^b	3.92	0.02*
PCV (%)	36.2±8.2^a	33.3±3.8^b	30.3±6.3^c	8.19	0.00*
HB (g/dl)	13.3±1.0^a	11.2±1.4^b	10.5±2.0^c	35.45	0.00*
MXD (%)	10.9±4.7^a	11.1±4.1^a	13.0±5.8^a	2.15	0.12
PT (Sec)	13.6±1.2^a	15.3±2.2^b	15.4±2.4^b	11.01	0.00*
APTT (Sec)	36.5±1.2^a	38.2±4.0^b	38.7±3.6^b	5.04	0.01*

Key:

*; The mean difference is significantly different at $p \leq 0.05$. Values are Mean ± Standard deviation.

CD4 = Cluster of Differentiation 4; PLT = Platelet; WBC=Total White blood cell count; LYM=Lymphocyte; GRAN= Granulocyte; PCV = Packed cell volume; HB= Haemoglobin; MXD- Monocytes-basophils -eosinophils mixed; PT= Prothrombin time; APTT=Activated Partial Thromboplastin Clotting Time; HAART or ART = Highly Active Antiretroviral therapy; Sec=Seconds.

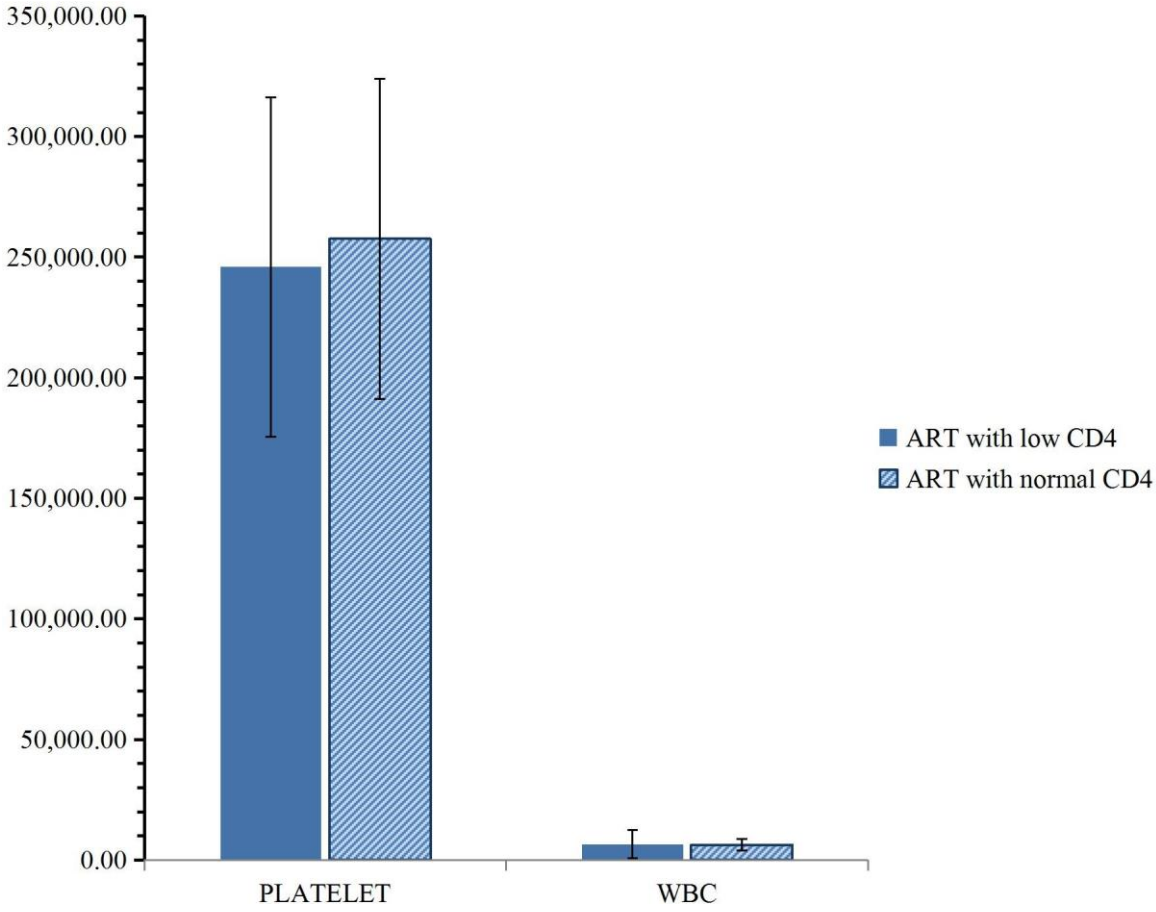

Figure 3: Comparison of Platelet and White blood cell values of ART (HAART) subjects with low CD4 count in comparison with ART (HAART) subjects with normal CD4 count using student t-test on graph-pad prism ($p > 0.05$).

Key: Values are Mean ± Standard deviation; WBC=Total White blood cell count ($x10^9$).

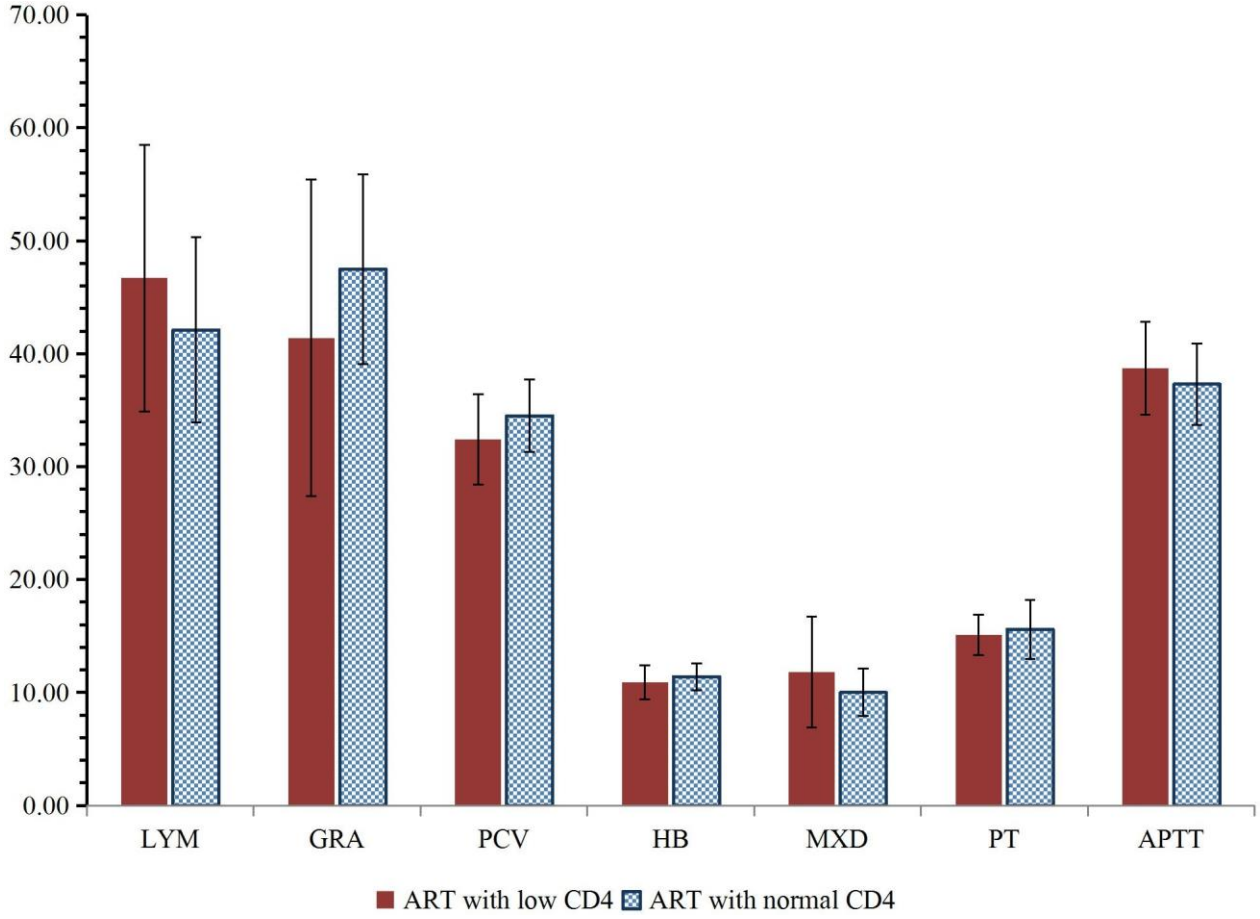

Figure 4: Comparison of haematological and clotting indices of ART (HAART) subjects with low CD4 count in comparison with ART (HAART) subjects with normal CD4 count.

Key: *; The mean difference is significantly different at $p \leq 0.05$. Values are Mean ± Standard deviation.

CD4 = Cluster of Differentiation 4; LYM=Lymphocyte; GRAN= Granulocyte; PCV = Packed cell volume; HB= Haemoglobin; MXD- Monocytes-basophils -eosinophils mixed; PT=Prothrombin time; Activated Partial Thromboplastin Clotting Time; ART = Antiretroviral therapy.

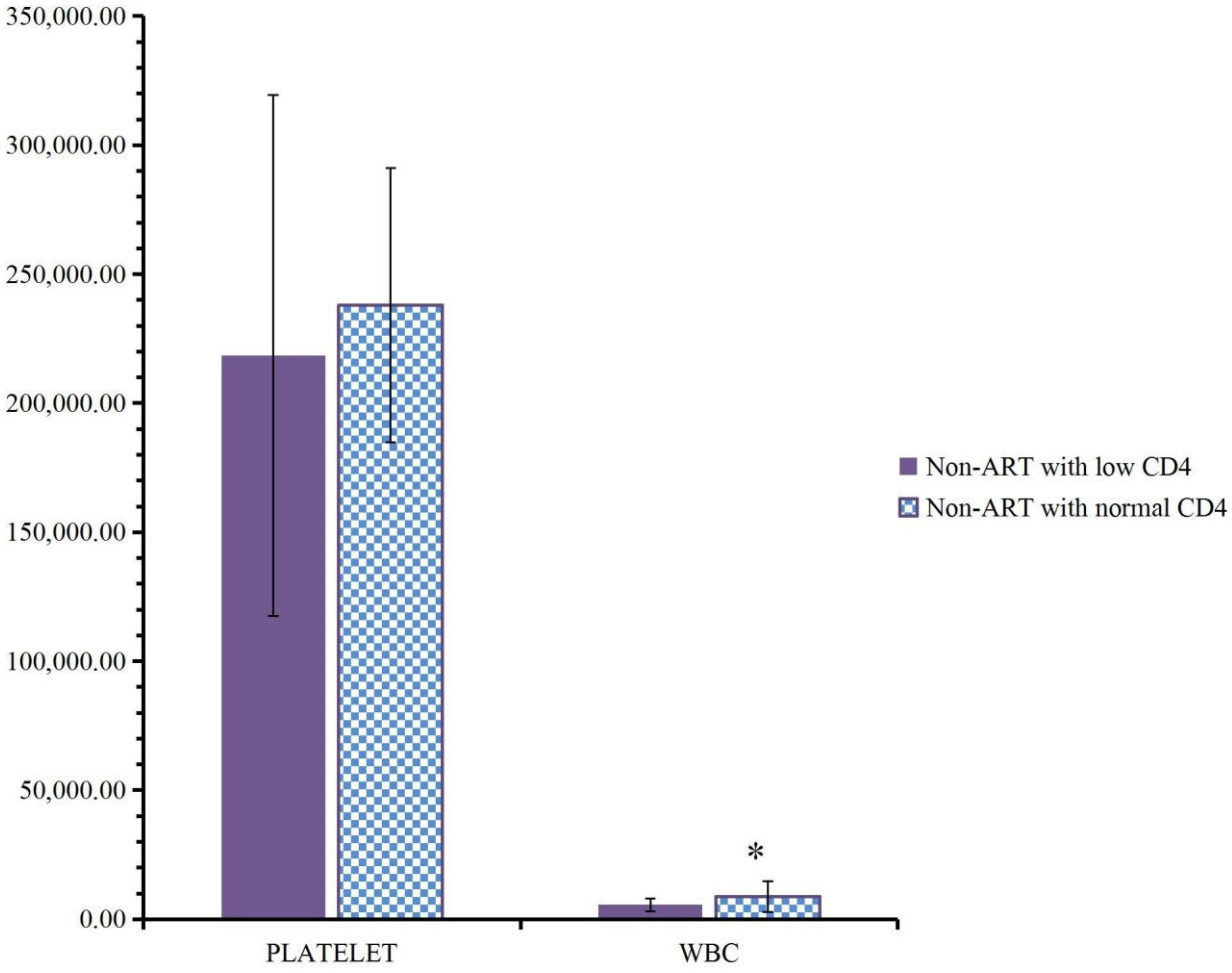

Figure 5: Comparison of Platelet and White blood cell (WBC) values of Non-ART (Non-HAART) subjects with low CD4 count in comparison with Non-ART (Non-HAART) subjects with normal CD4 count

Key: *; The mean difference is significantly different at $p \leq 0.05$. Values are Mean ± Standarddeviation.

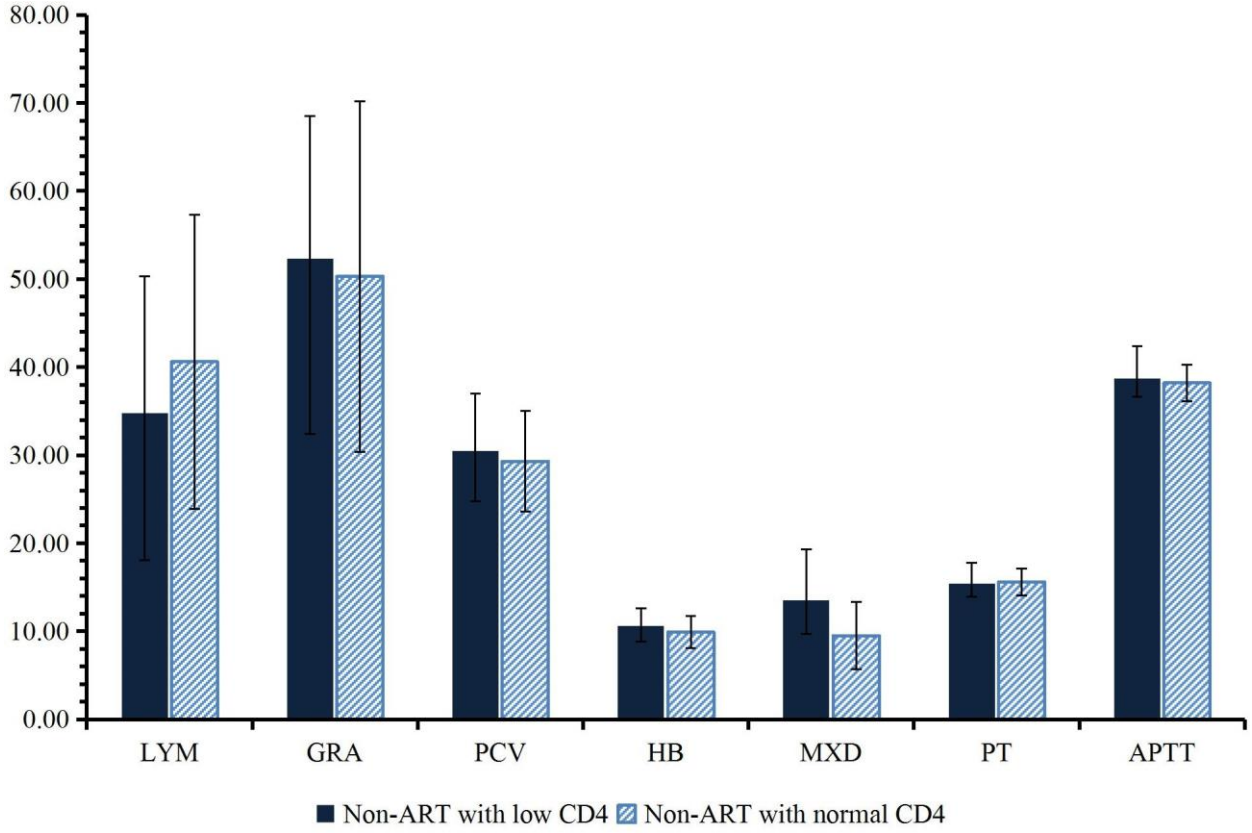

Figure 6: Comparison of haematological and clotting indices of Non-ART (Non- HAART) subjects with low CD4 count in comparison with Non-ART (Non- HAART) subjects with normal CD4 count.

Key: *; The mean difference is significantly different at $p \leq 0.05$. Values are Mean ± Standard deviation.

CD4 = Cluster of Differentiation 4; LYM=Lymphocyte; GRAN= Granulocyte; PCV = Packed cell volume; HB= Haemoglobin; MXD- Monocytes-basophils -eosinophils mixed; PT= Prothrombin time; Activated Partial Thromboplastin Clotting Time; ART = Antiretroviral therapy.

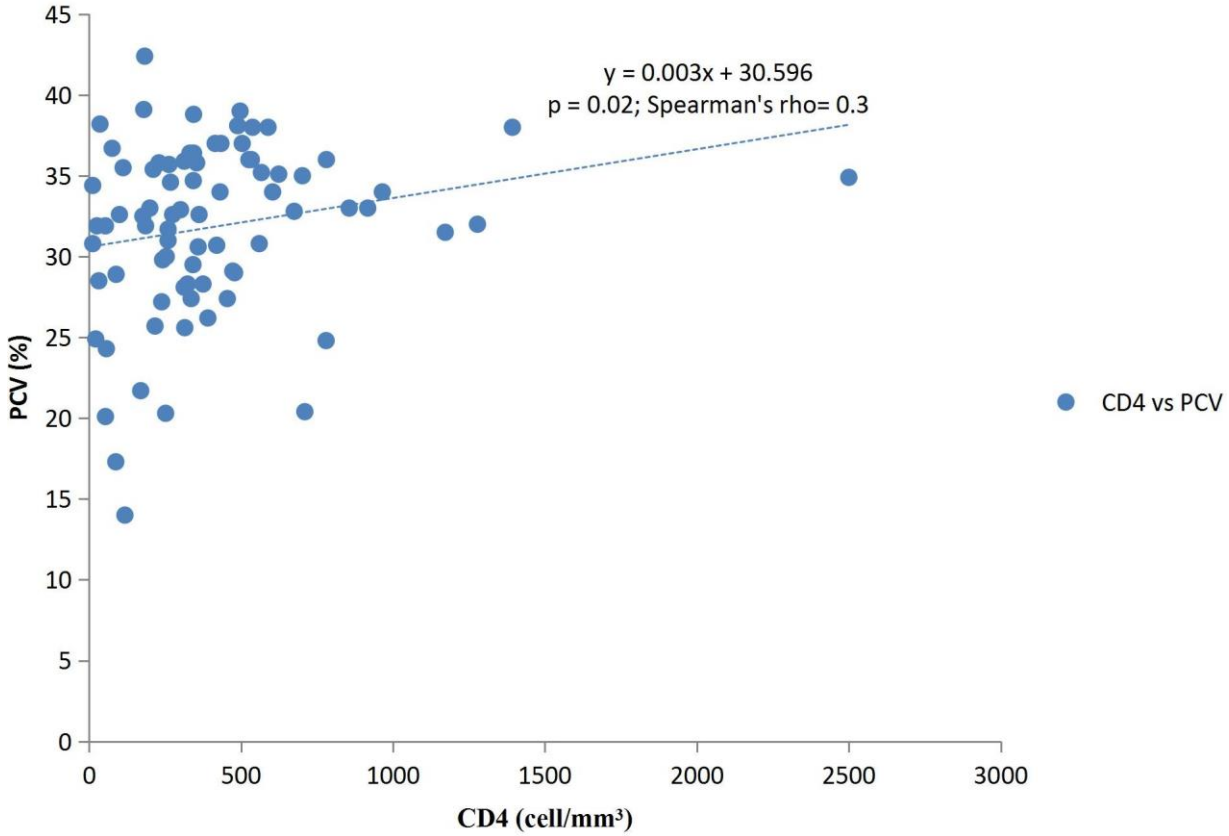

Figure 7: Correlation between CD4 count versus packed cell volume of HIV Subjects (both those on HAART and Non-HAART subjects).

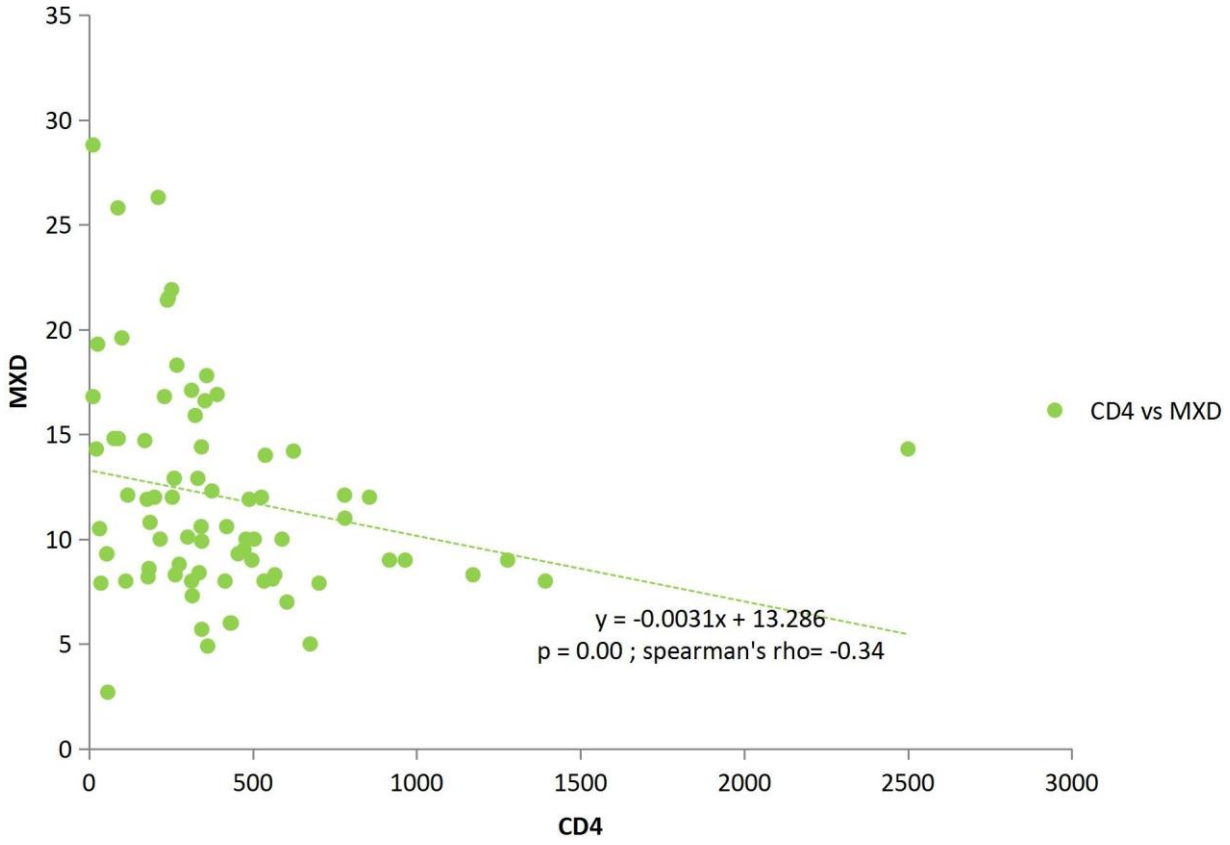

Figure 8: Correlation between CD4 count versus MXD of HIV subjects (both those on HAART and Non-HAART subjects).

Discussion

This study was carried out to evaluate some coagulation and haematological indices of Human Immunodeficiency Virus positive individuals assessing clinic in HAART centres in Esan South- East Local Government Area of Edo State, Nigeria. Findings of higher prevalence amongst females agree with the demographic report of Akinyemi et al., (2017) in a study carried out at the University College Hospital, Ibadan Nigeria. Males between ages 56 to 65 years had the highest male population of study participants on HAART, followed by 8% for males between age 46 to 55 years. Males between ages 56 to 65 years had 5% of total HAART; females of 18-24 years had 5% of the total HAART subjects in this study population as shown on figure 4.1. The findings in this study agrees with the trend in global HIV epidemic which shows that the percentage of persons aged 50 years and over (older adults) living with the virus has been increasing since the past decade. According to the Joint United Nations Programme on HIV/AIDS, as of year 2012, the proportion ranged from 6% in Middle East and North Africa to 9% in sub-Saharan Africa, and 33% in Western, Central Europe and North America. Three reasons have been identified as contributing to the phenomenon known as "aging of the HIV epidemic": Antiretroviral medication has extended life expectancy; HIV incidence has decreased in younger individuals; and elderly adults have latent risky sexual behaviours (Akinyemi et al., 2017; United Nations Programme on HIV/AIDS, 2013).

Findings from the demographic characteristics of this study showed that females aged 36 to 45 years constituted 22% of study participants not on antiretroviral therapy, while males between the ages of 18 to 24 years and 25 to 35 years had 13% each of study subject's not on antiretroviral therapy. This finding agrees with the report of Musa et al., (2015) which reported that females had the highest frequency of non-HAART HIV positive subjects and age demographic of 30 to 49 years had the highest frequency of non-HAART HIV positive subjects at the Aminu Kano Teaching Hospital, Kano (AKTH), Nigeria. Females and males within the ages of 56 to 65 years had the lowest prevalence of 2% and 3% respectively of study subjects not on antiretroviral therapy as shown on figure 4.2. These values are less than the study of Stephen et al., (2015) which reported a prevalence of 8.2% among older adults in southeast Nigeria. This could be due to poor health seeking behaviour, higher HIV mortality rate in our study population, or even lower sample size used in this present study.

Some haematological and clotting indices of HAART subjects and Non-HAART subjects in comparison with the healthy control as shown in table 1, showed significant decrease in CD4+ count ($p=0.00$). Subjects on HAART had higher CD4+ count than Non-HAART subjects, although there was no statistical significant decrease in CD4+ count for Non-HAART subjects ($p>0.05$). Findings of low CD4+ count in this study agrees with reports of Anastos et al., (2004), Tagoe & Asantewaa, (2011) and Balogun et al., (2020) which reported significant CD4+decline in HAART naïve HIV patients. The absolute CD4+ T count of an individual is of immense value in the evaluation of the body immune system. It is an important surrogate marker for assessing the risk of progression to AIDS or developing certain opportunistic infections in HIV infected individuals (Balogun et al., 2020). Changes in the peripheral blood cells counts resulting in haematological abnormalities which are documented as strong independent predictors of morbidity and mortality occurs in HIV infection (Anastos et al., 2004; Rahmana et al., 2014;). All three blood cell lineages are apparently affected by these anomalies, which may be related to both the direct and indirect impacts of the virus (De Carvalho, 2010; Tagoe & Asantewaa, 2011). According to reports, as the disease progresses, the haematological abnormalities in peripheral blood cell counts become more common and severe. (Anastos et al., 2004; Tagoe & Asantewaa, 2011).

From this study, there was no statistically significant difference total white blood cell (WBC) and MXD of HAART subjects, Non-HAART subjects and control ($p > 0.05$). There was significant decrease in platelet count mean values from 221000 ($x10^9$/L) in Non-HAART subjects in comparison with 320655.0 ($x10^9$/L) of control subjects ($p=0.04$). Although Non-HAART subjects had markedly lower platelet count than 250925.0 ($x10^9$/L) of HAART subjects, it was not statistically significant ($p > 0.05$). This finding of significant thrombocytopenia in Non-HAART HIV subjects was in agreement with the report of Balogun et al., (2020) which reported significant thrombocytopenia HIV-positive adults who are consenting, consecutive, and new to antiretroviral therapy patients in Lagos, Nigeria. Similar findings have also been reported by Adetifa et al., (2006) and Parinitha et al., (2012). Thrombocytopenia may be an early manifestation of HIV infection and a result of increased platelet destruction or a decreased production which may be immune-mediated (Ellaine, 2005).

Although findings from this study revealed no statistically significant difference between total WBC of HAART subjects (6460.0±746.7($x10^9$/L)) with Non-HAART subjects (5975.0±509.9

($x10^9$/L)) and also with control (60950.0±273.4 ($x10^9$/L) ($p > 0.05$), it was observed that mean total WBC count of HAART subjects was markedly higher, while that of Non-HAART subjects were markedly lower. This aligns with the findings of Chukwuezi et al., (2013), Ebonyi et al., (2017) and Gunda et al., (2017) which reported that the use of antiretroviral medications in HIV infection improves the body's immune status and haematological parameters like the haemoglobin (Hb) levels, the haematocrit, white cell and platelet counts. HIV-associated cytopenias are frequent and often worsen with worsening disease. There was a significant decrease in lymphocyte count in non-HAART subjects in comparison with control subjects and subjects on ART (p=0.00), while granulocytes were significantly higher in non-HAART subjects in comparison with subjects on HAART and not with control (p=0.02), as shown in table 4.1.

Result of this study revealed significant decrease in packed cell volume (PCV) and haemoglobin concentration (HB) in both HAART subjects and non-HAART subjects in comparison with the control (p=0.00 & p=0.00 respectively). This finding was consistent with the work of Obiomah et al., (2018), which reported reduced haemoglobin and red blood cell values in HIV seropositive subjects both on HAART and non -HAART compared with the controls. This decrease was also consistent with the findings of Amegor et al., (2009) and Dangana & Nuhu (2010), but did not align with the findings of Erhabor et al., (2008) and Akinbami et al., (2010). Also, Non- HAART subjects had significantly lower PCV that HAART subjects (p=0.04) in this present study. This finding agrees with the study of Ngwu & Eneh, (2022) which reported significantly increased level of PCV, HB, MCV and RBC in HIV-subjects under antiretroviral treatment compared to those not under antiretroviral treatment. The anaemia seen in this study could be due to the systemic effect of HIV/AIDS on erythropoiesis through the inhibition of the precursor cells from differentiating and developing to mature red blood cells. One of the major purposes of the haematological test is to detect anaemia. Packed cell volume is the percentage of red blood cells in peripheral blood, and a decreased PCV is indicative of red blood cell loss as a result of cell destruction, blood loss, and failure of bone marrow production. An increased PCV can be due to dehydration or an abnormal increase in red blood cell production. This study showed decreased PCV in HIV patients, not on HAART which is in line with the observation made by Ballah et al., (2013) on HIV subjects on HAART in Northern Nigeria. Haemoglobin plays a crucial role in maintaining the shape of red blood cells. A decreased haemoglobin level is referred to as anaemia, a lower than normal number of red blood cells is also anaemia and haemoglobin levels reflect this number (Zhou et al., 2012).. Red blood cells carry oxygen from the lungs to the tissues. The mature human red blood cell is covered with a membrane composed of lipids and proteins, lacks a nucleus, and contains haemoglobin. Some of the HAART drugs are associated with neutropenia and macrocytic anaemia (Harris et al., 2008).

PT (Prothrombin time) and APTT (Activated Partial Thromboplastin Clotting Time) was significantly increased in subjects on HAART and Non-HAART subjects in comparison with control (p=0.00 and p=0.01 respectively). PT and APTT levels of HAART in comparison with non-HAART subjects were not significant (p=0.87 and p=0.48 respectively) as shown on table 1. This finding is consistent with the reports of Osime et al., (2015), Ifeanyichukwu et al., (2016) and Getawa & Adane, (2022) which showed HIV- related thrombocytopenia,

significantly higher PT and prolonged APTT in HIV patients on HAART, and HAART -naïve patients. They also reported that the level of APTT and PT had no statistical difference between HAART and HAART -naïve (non-HAART) subjects, which corresponds with findings of this study. Studies have shown that in HIV infection, markers related to inflammation such as IL-6 and C-reactive protein and coagulation including tissue factor expression, thrombin, factor VIII, fibrinogen and D-dimer levels are increased and cause thrombotic risk and mortality (Funderburg and Lederman, 2014).

The most significant biomarkers of disease stage and progression in HIV infected patients are CD4+ count and HIV RNA concentration. This study took CD4 count as the index of disease severity. The HIV positive HAART subjects were divided into two groups using a CD4 count of < 500 cells/mm^3 as cut off for low CD4+ count and > 500 cells/mm^3 as cut off for normal CD4+ count. Findings from this study showed no significant increase in platelet count of subjects on HAART with low CD4 count in comparison with HAART subjects with normal CD4. Also, there was no significant difference between total white blood cell (WBC) count, Lymphocyte, Granulocyte, Packed cell volume, Haemoglobin, Monocytes-basophils -eosinophils mixed, Prothrombin time and Activated Partial Thromboplastin Clotting Time of HAART subjects with low CD4 count and HAART subjects with normal CD4 count ($p>0.05$). This finding shows that HAART confers a degree of stability regardless of the variation in CD4+. This finding aligns with the study of Thulasi Raman et al., (2016) which reported that HIV subjects on HAART with CD4 count less than 200 cells / mm^3 showed no significant difference for platelets, PT and APTT in comparison with HIV positive HAART subjects with CD4 count greater than 200 cells/ mm^3.

The correlation between CD4 count and packed cell volume of HIV Subjects (both those on HAART and Non-HAART subjects) was determined using the spearman's correlation. There was a weak positive correlation (Spearman's rho= 0.3; p = 0.02), there was a corresponding increase in packed cell volume with increasing CD4 count in HIV subjects in the study population (figure 7). Anaemia is one of the haematological complications that are commonly present in human immunodeficiency virus (HIV) infection, and anaemia becomes more noticeable as the disease progresses (Haider et al., 2019). Ngwu & Eneh, (2022) reported that morbidity and mortality in HIV patients are most times caused by anaemia, and anaemia in HIV-infected patients is a sign of transition to acquired immune deficiency syndrome (AIDS) or death. Anaemia occurs in more than 70% of individuals living with HIV.

The correlation between Monocytes-basophils -eosinophils mixed (MXD) andCD4 count of HIV Subjects (both those on HAART and Non-HAART subjects) was determined using the spearman's correlation. There was a significant negative correlation (Spearman's rho= -0.34; p = 0.00), there was a corresponding decrease in Monocytes-basophils-eosinophils mixed (MXD) with increasing CD4 count in HIV subjects in the study population (figure 8). In a similar study, Asemota et al., (2018) reported significant decrease in MXD in HIV-seropositive subjects attending University of Calabar Teaching Hospital, Nigeria, which is consistent with the findings of this present study.

Conclusion

This study has extensively described the characteristics of patients on antiretroviral therapy (ART), as well as those not on antiretroviral therapies (Non-ART) in this study area, revealing the dominance of middle age females in HIV epidemiology in the study area. Haematological indices of Non-ART subjects in comparison with the healthy control which showed a significant decrease in packed cell volume, Haemoglobin, platelet, CD4+count and total lymphocyte count, is indicative of HIV-induced anaemia, thrombocytopenia and immune suppression, which was markedly resolved in ART subjects. Clotting indices of Non-ART subjects and ART subjects in comparison with the healthy control which revealed a significant increase in prothrombin time and Activated Partial Thromboplastin Clotting Time shows significantly increased thrombotic risk and mortality in HIV disease. The relationship between CD4+ an index of HIV disease severity with packed cell volume, Monocytes-basophils-eosinophils mixed (MXD) uncovered in this study, could play an important role in monitoring and preventing HIV-disease severity and optimising management.

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