Effects of Highly Active Antiretroviral Therapy on Body Mass Index and CD4 Count of HIV Clients Attending Ekiti State University Teaching Hospital, Ado Ekiti

[1]Ojo, B. A., [2]Adebolu, T. T. and [2]Okebugwu, Q. C.
[1]Department of Basic Medical Sciences, College of Health Sciences and Technology Ijero. Ekiti-State.
[2]Department of Microbiology, Federal University of Technology, Akure, Ondo State, Nigeria.
*Corresponding author: dejyme1@yahoo.com. 07068036274.

Abstract: The aim of the study was to assess the effects of Highly Active Antiretroviral Therapy (HAART) on the Body Mass Index (BMI) and Cluster of Differentiation (CD4) cell counts of Human immunodeficiency Virus (HIV) positive individuals attending one of the health institutions in Nigeria. A total of 150 HIV patients were recruited for the study of which 112(74.7%) participants were undergoing HAART while 38(25.3%) were not on HAART. Their BMI and the CD4 counts were determined using standard methods. The result revealed that administration of HAART has no significant effect on the BMI and the CD4 cell counts of the HIV patients recruited for the study. However, the age of the patients on HAART was found to be significantly associated with the CD4 cell counts with those aged 25yrs and below having a higher CD4 cell count of 600.50±272.52cells/mm^3 compared to other age groups ($p<0.05$). This study has shown that the age of the HIV patients may influence the effectiveness of HAART in the management of the infection.

Key words: HIV, HAART, BMI, CD4 cell counts

INTRODUCTION

Patients infected with Human Immunodeficiency virus (HIV) usually present with loss of body mass (Kristine *et al.,* 2016) and low Cluster of Differentiation (CD4) cell counts(Nader *et al*., 2020). In an effort to control the viral load in the body and improve their health status, such patients are being managed with anti-retroviral drugs (HIVinfo, 2021). Over the years the use of combination drugs in form of Highly Active Antiretroviral Therapy (HAART) proves to be efficient in controlling the level of the virus which leads to overall improvement in the body system (HIVinfo, 2021). Foremost in this regard is the increase in the Cluster of Differentiation (CD4) cell counts of the infected patients. The CD4 cell cells are the primary receptors of the HIV virus in the Human body. The gp120 spikes on the surface of HIV lock onto the CD4 receptor and another co-receptor, either CCR5 or CXCR4.The gp41 protein is then used to fuse the HIV envelope with the cell wall. This allows the HIV capsid to enter the CD4 cell (Avert, 2019).

Cluster of differentiation four (CD4) T-lymphocytes and other lymphocytes play great roles in the way the immune system responds to pathogens (Koenig, *et al.,* 1999). CD4 is a glycoprotein found on the surface of immune cells such as T helper cells, monocytes, macrophages, and dendritic cells. They are called helper cells because one of their main roles is to send signals to other types of immune cells, including CD8 killer cells, which then destroy the infectious particle (Wei, *et al.,* 216). Like many cell surface receptors/markers, CD4 is a member of the immunoglobulin superfamily (Gorska, 2004).

Studies have shown that people infected with HIV are characterized by progressive CD4 + T-cell depletion which results in perennial diarrhoea, increased gastrointestinal inflammation, malabsorption of bile acid and vitamin B12 and increased intestinal permeability (Sharpstone, *et al.,* 1999). This decline also affects the Body Mass Index (BMI) of the patients (Trindade, *et al.,* 2007).

Body mass index (BMI) is an important indicator of nutritional status in people with HIV infection. The World Health Organization (WHO) has recommended the following categories based on BMI values: underweight (< 18.5 kg/m^2); normal (18.5–24.9 kg/m^2); overweight (25–29.9 kg/m^2);

obese (30–39.9 kg/m^2) and morbidly obese (≥40 kg/m^2) (Xiaolin, *et al.,* 2019).

The introduction of HAART has decrease the incidence of wasting in HIV dramatically (Carine, *et al.,* 2012) However, the initial loss of total body weight or lean body mass associated with unsuppressed HIV-1 replication may not be fully restored with effective suppression after HAART initiation, despite decreases in pro-inflammatory cytokines, immune activation, and whole body proteolysis

Several studies have reported a comparable immune status among HIV-infected patients under normal, overweight, and obese categories, and higher BMI not directly linked to immunological and viral responses to antiretroviral therapy (Xiaolin *et al.,* 2019). In contrast, other reportpoint out higher immunological reconstitution induced by HAART among overweight HIV patients (Johnson *et al.,* 2014; Koethe et al., 2016).

Another study also shows that obese HIV patients on HAART acquired fewer CD4+ T lymphocytes compared to normal weight HIV-infected patients, indicating that the potentially adverse immune response is associated with excess weight (Crum-Cianflone *et al.,* 2011). This inconsistence in the relationship between BMI and immune reconstitution among HIV patient shows that there is need for more research in this area. Thus, this study assess the effects of HAART on body mass index and CD4 cell counts of HIV positive individuals especially with regards to the age and gender of the infected patients as such information is lacking in the study area.

MATERIALS AND METHODS

This study was conducted in ART Clinic of Ekiti State University Teaching Hospital, Ado Ekiti. Ekiti State. The study populations were male and female adults infected with HIV and are attending the ART Clinic of Ekiti State University Teaching Hospital, Ado Ekiti. Ekiti State. The age ranges were 18–75 years and include HIV patient who are on HAART and those not on HAART.

Study Procedure

Before recruitment into the study, Ethical approval was obtained from the research committee and the caregivers at the clinic were notified about the research. Also patient's informed consent was obtained after which questionnaires were administered and necessary data were collected.

Sampling Method

A random sampling method was use. Males and females HIV patients aged 18–75 years (subjects) who met the inclusion criteria and who agreed to take part and signed a consent form were enrolled during their clinic days.

A total of 150 HIV patients (both on HAART and not on HAART) attending Ekiti State University Teaching Hospital, Ado Ekiti were recruited for the investigation and blood sample was collected from them.

Instrument of Data Collection

Structured questionnaire was administered to the participants recruited to generate demography data after obtaining informed consent from them and clearance from the Ethic clearance Committee of the Hospital. Relevant information such age, sex, marital status, height and weight was collected.

Body Mass index was determined using the formula, Mass Index (BMI) = (Kg/m^3) (WHO, 2010)The study subjects were weighed using the same anthropometric scale, which was calibrated periodically during the study period. Height was measured with the patient standing barefoot against a non-extending vertical shaft, with the neck, buttocks and heels touching the shaft (Mariz, 211).

CD4 cell count Level was determined on the blood samples collected from antecubital fossa of the patients following WHO standard phlebotomy (WHO 2010). The blood sample was collected into EDTA bottle and CD4 count was then determined within 3hrsusing CyFlow Counter (CFC2 S/N:1210100922)(WHO, 2007).

RESULTS

Out of the 150 HIV patients recruited, it was observed that the infection was prevalent among the female 112 (74.7) and among age group 26-35 years (35.3%) (p=0.606). Also, HIV infection was observed to be high among the married (76.9%) (Table 2) while based on different occupations, it was prevalent among traders(26.7%).

Table 1: Age Group and Gender Distribution Of HIV Infection Infected

Age group (years)	Gender		Total (%)
	Males No (%)	Females No (%)	
<25	2(20.0)	8(80.0)	10(6.7)
26-35	13(24.5)	40(75.5)	53(35.3)
36-45	11(21.2)	41(78.8)	52(34.7)
46-56	6(33.3)	12(66.7)	18(12.7)
56-65	3(27.3)	8(72.7)	11(7.3)
66-75	3(50.0)	3(50.0)	6(4.0)
Total	**38(25.3)**	**112(74.7)**	**150(100.0)**

X^2=3.614, df=5; p=0.606

Table 2: Some Demographic Characteristics Of HIV Studied Patients

Characteristics	No (%)
Marital status	
Single	29(19.3)
Married	115(76.7)
Divorced	2(1.3)
No response	4(2.7)
Total	**150(100)**
Occupation	
Civil servants	29(19.3)
Transporters	17(11.3)
Students	15(10.0)
Hair dressers and Barbers	6(4.0)
Farmers	10(6.7)
Traders	40(26.7)
Tailors	8(5.3)
Bankers	5(3.3)
Other Artisans	20(13.3)
Total	**150(100)**

On the effect of age on CD4 cell counts of HIV patients in relation to whether they are on HAART therapy or not, Patients who are on HAART treatment have insignificant higher CD4 count mean when compared with patients who are not HAART (t=0.323, df=76.721, p=0.363).The age group 25yrs and below had a significantly higher (p<0.05) CD4 cell count (600.50±272.52) among HIV patients on HAART (Table 3) while no significant difference in CD4 values was found among the non-HAART HIV patients irrespective of age (Table 1).

Table 3: Effect Of Age On CD4 Counts Of HIV Patients On HAART

	CD4 CELL COUNT (cells/mm^3)	
Age Group (years)	**HIV patients on HAART**	**HIV patients not on HAART**
<25	600.50±272.52[b]	232.75±175.74[a]
26-35	292.49±236.06[a]	335.92±243.47[a]
36-45	416.57±286.33[a b]	377.06±197.08[a]
46-55	300.41±185.14[a]	-
56-65	301.00±138.12[a]	420.33±93.72[a]
66-75	293.67±92.93[a]	136.50±115.26[a]

Note: Groups with the same letter within column are not statistically significant in means (p>0.05)

Table 4 shows the association between BMI and HAART therapy. HIV patients who are on HAART treatment were observed to have higher BMI as compared with HIV patients who have not started HAART treatment. This however was not statistically significant(P=0.878)

Table 4: Effect of HAART on Body Mass Index (BMI)

Body mass Index	**HAART Treatment Status**	
	Undergoing HAART therapy	Not Undergoing HAART Therapy
≥18.5kg/m^2	8(7.1)	3(7.9)
≤18.5kg/m^2	112(92%)	35(92.1)
Total	**112(100)**	**38(100)**

X^2=0.024, df=1; p>0.05

Table 5 shows the effect of gender on theCD4 cell countsamong HIV patients studied .Females were observed to have an insignificantly higher mean CD4 cell count of 361.93±246.27cells/mm^3 compared with the 308.76±219.19cells/mm^{3}of themale counterpart (t = 1.181, df=148, P>0.05)

Table 5: CD4 Counts of HIV Positive Patients By Gender

Gender	**No. studied**	**Mean CD4 cell count (cells/mm^3)**
Male	38	308.76±219.19
Female	112	361.93±246.27

t = 1.181, df=148, P>0.05

DISCUSSION

This study investigated the effect of HAART on the Body Mass Index and CD4 counts of HIV positive individuals attending ART clinic in a tertiary health center in Ekiti State, Nigeria over a period of 4 months. Out of the 150 HIV patients recruited for this study, the infection was higher in the age group 26-35years (35.3%). This agrees with previous works which reported high prevalence of HIV infection among this age group, therefore more orientation about the infection should be directed to this age group as they are prone to majorities of the risk of HIV infection (CDC, 2015).

Infection was also found to be high among the married 115(76.7%). This goes contrary to the report of Okerentugba *et al.* (2015) who recorded 80% among singles. However the high percentage of the infection recorded among traders (40(26.7%) in this study agrees with Okerentugba *et al.* (2015).

The high prevalence of this infection among the people could be associated with the precarious working locations of traders (working at night, at truck stops, and traffic intersections), their impoverishment and interaction with transient men may influence women's involvement in transactional sex, or 'paid' relationships as a means of survival (Nattrass, 2003).

Forty three percent (43%) of the HIV patients recruited for this study were observed to have CD4 cell count >350cells/mm^3. This goes contrary to the report of Akinsegun *et al.* (2012), who observed that 67.4% of HIV individuals in their investigation had CD4 cell count>350cells/mm^3.

The study findings revealed that the use of HAART by HIV patients does not significantly increase their BMI as only a small percentage of them have BMI greater than 18.5kg/m^2.The study therefore, identified that HAART treatment does not contribute to weight gain of HIV patients.

The higher percentage of patients who are undergoing HAART treatment observed to have CD4 count greater than 200cells/mm^3 agrees with Adeolu(2013) who recorded a similar observation.

The CD4 level of age group 66-75years was significantly lower ($p \leq 0.05$) compared to that of age group of less than 25 years (for those treated with HAART). This result is similar to the report of Yah *et al.*(2008), who reported highest CD4 counts among the age group 21-30years. The high level CD4 counts among this age group could be as a result of the fact that they are in their active metabolic stage as this group is still classified as growing stage.

In this study, females (361.93±246.27cell/mm^3) were observed to have higher mean of CD4 count among the HIV patients investigated compared with their male (308.76±219.19cell/mm^3) counterpart though the results are not statistically significant. This agrees with the report of Akinsegun *et al.* (2012) who reported higher mean CD4 count among females compared to the males.

CONCLUSION

This study has shown that HAARThas no significant effect on the BMI of HIV patients. Therefore there is the need further research to identify contributions of other factors to BMI changes among HIV patients on HAART and more effective therapies for effective management of HIV patients to prolong their longevity is suspected.

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