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The Effect of Highly Active Antiretroviral Therapy on CD4 Counts and Body Weight in HIV/AIDS Patients in South West Nigeria

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Abstract: Prior to the advent of HAART the diagnosis of HIV/AIDS was a death sentence. Research has shown that this is no more the case. This retrospective study was aimed at determining the effect of HAART on CD4 counts and body weight of HIV-positive subjects. The CD4 counts and body weight of HIV-positive patients were accessed from the records of HIV clinic of LAUTECH Teaching Hospital, Oshogbo. The data comprised of records of the CD4 counts and body weight of fifty HIV-positive patients not on HAART treatment and that of fifty HIV-positive patients on HAART treatment for a period of 1 year. Results showed a significant difference between mean CD4 counts of control subjects and test subjects ($p<0.05$). This significant difference represents an increase in CD4 count of HIV patients on HAART. This study also shows no significant difference between mean body weight of control subjects and test subjects ($p>0.05$). This study highlights the need for importance of regular monitoring of the CD4 count and body weight in HIV patients in order to determine when to start treatment with HAART therapy to prevent the invasion of life threatening opportunistic infections.

Key words: Body weight, CD4 counts, HIV, patients, monotoring

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 the immune system begins to fail, leading to life threatening opportunistic infections. These opportunistic infections include bacterial pneumonia, candiasis, cryptococcosis, tuberculosis toxoplasmosis, mycobacterium avium complex, herpes simplex and herpes zoster, histoplsmosis, leishmaniasis, cytomegalovirus, cryptosporidiosis and isosporiasis previous names for the virus include Human T-Lymphptropic Virus-III (HTLV-III), Lymphpdenopathy Associated Virus (LAV) and AIDS-associated retrovirus (Douck *et al*., 2009) HIV-1 and the less commonly HIV-2 belong to the family of retroviruses. Both species of the virus are thought to have originated in west central Africa. HIV-1 is said to have originated in Southern Cameroon after transferring from wild chimpanzees to humans during the 20th century.

HIV-2, on the other hand is said to have originated from the Sooty Mangabey, an old world monkey of Guinea-Bissau, Gabon and Cameroon (Reeves and Doms, 2002).

Three major classes of HIV-1 have emerged: M (Main), N (New) and O (Outlier). Among M group viruses which account for >90% of HIV infections worldwide, there are 9 subtypes called clades designated by the letters A-D, F-H, J and K as well as many recombinant forms (Gao *et al*., 1999).

Variation between one clade and another in the amino acid sequences of the envelope protein may exceed 30%. Clades A through J are found within the M group. Different strains may infect different cell types which may lead to higher rate of infections (Spira *et al*., 2003). For instance, it is known that Clades C and E occur more commonly through heterosexual sex than B. Both C and E are more likely to infect cells of the vaginal mucosa, cervix and foreskin of the penis but not the wall of rectum Clade B, the most common subtype in the Americas and Western Europe differs considerably from those Clades C and E found in Asia and Africa where HIV is transmitted predominantly through heterosexual sex (Zhu *et al*., 1996).

CD4 (Cluster of Differentiation 4) is a glycoprotein expressed on the surface of T helper cells regulatory T-cells, monocytes, macrophages and dendritic cells. It was discovered in the late 1970s and was originally known as Leu-3 and T4 (after the OKT4 monoclonal antibody reacted with it) before being named CD4 in 1984 in humans, the CD4 protein is encoded by the *CD4* gene. CD4 is a co-receptor that assists the T-Cell Receptor

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(TCR) to activate its T-cell following an interaction with an antigen-presenting cell (BHIVA, 2010; Ansari-Lari *et al*., 1996). Using its portion that resides inside the T-cell, CD4 amplifies the signal generated by the TCR by recruiting an enzyme known as the tyrosine kinase which is essential for activating many molecules involved in the signaling cascade of an activated T-cell. CD4 also, interacts directly with MHC class II molecules on the surface of the antigen-presenting cell using its extracellular domain.

Body composition is the term used to describe the different components that when taken together make up a person s body weight. The human body is composed of a variety of different tissue types including lean tissues (muscle, bone and organs) that are metabolically active and fat (adipose) tissue that is not metabolically active. Body weight is measured in kilograms throughout the world although, in some countries people more often measure and describe body weight in pounds (United States and Canada) or stones and pounds (among people in the common wealth of a nations) and thus may not be well acquainted with measurement in kilogram.

Antiretroviral drugs are medications for the treatment of infections by retroviruses, primarily HIV. When several such drugs, typically three or four are taken in combination, the approach is known as highly active antiretroviral therapy or HAART (Carbonnel *et al*., 1998).

Some researchers have reported that the administration of highly active antiretroviral therapy causes changes in CD4 count and weight in AIDS patient (Cassens *et al*., 2004). This retrospective study is aimed at determining the specific effect of HAART on CD4 counts and body weight of HIV-positive subjects on HAART in LAUTECH TEACHING HOSPITAL, Osogbo South West Nigeria.

MATERIALS AND METHODS

Study site: Ladoke Akintola University of Technology Teaching Hospital, Osogbo.

Subjects: Records of derived data of CD4 counts and body weight of 50 HIV-infected subjects that had been placed on HAART treatment for 1 year and 50 HIV-infected subjects yet to start therapy as positive control were accessed from the HIV clinic of LAUTECH Teaching Hospital Osogbo.

The results of the CD4 counts and body weight record derived from the HIV clinic of LAUTECH Teaching Hospital Osogbo was determined using flow cytometry and a standard body weight scale.

The CD4 counts of both test subjects and control subjects were determined using Partec cyflow machine and their body weight was determined using a standard body weight scale.

About 3 mL of venous blood was collected from an antecubital vein with the subjects comfortably seated. The blood was immediately transferred into EDTA specimen bottles and was carefully mixed.

Shealths fluids, CD4 easy count kit (contains CD4 monoclonal antibody and CD4 buffer), cleaning solution. Decontamination fluid, caliberation beads and count check beads. The cyflow counter is an automated portable flow cytometer for the enumeration of CD4, CD3 and CD8 T-lymphocyte in the whole blood. It uses the range gating strategy to isolate cells of interest.

About 20 μL of the EDTA anticoagulated blood was prepared with 20 μL of CD4 monoclonal antibody PE (Partec Code No. 04-2000). The mixture was incubated for 15 min at room temperature in the dark. To this mixture, 800 μL of no lyse buffer from same lot of Partec easy count kit (Partec Code No. 05-8401) was added. The solution was analyzed with Partec Cyflow® SL-3 counter to count the immunolabelled CD4+ T-cells.

RESULTS AND DISCUSSION

Table 1 shows the frequency distribution in HIV positive patients not on HAART and those on HAART treatment for the period of 1 year.

Table 2 shows that sex means and Standard Deviation (SD) values of body weight (kg) and CD4 counts (cells/μL) (Mean+SD) carried out on HIV positive subjects whose male body weight (56.80+10.27) kg, female body weight (50.96+13.24) kg male CD4 counts (147.55+143.40) cells μL^{-1} and female CD4 counts (134.97+111.52) cells μL^{-1}.

This Table 2 also shows that the sex mean and Standard Deviation (SD) values of body weight (kg) and CD4 counts (cells/μL) (Mean+SD) carried out on HIV negative subjects whose male body weight (63.05+7.22) kg, female body weight (60.89+12.11) kg male CD4 counts (901.81+287.79) cells μL^{-1} and female CD4 count (1023.67+192.72).

Table 3 shows that there was an increase in mean and standard deviation in CD4 count of HIV positive patients

Table 1: The frequency and percentage distribution in HIV-positive patients and HIV-negative subjects

Control and test	Frequency	Percentage
Sample group (HIV patients and HIV-Negative subjects)		
HIV-positive subjects not on HAART treatment	50	50
HIV-positive subjects on HAART treatment	50	-

Table 2: Mean (X) and Standard Deviation (SD) in males and females of weight (kg) and CD4 count (cells/μL) in the research subjects according to gender

Sex HIV-positive patients	Weight (kg)	CD4 count (cells μL^{-1})
Male	56.80+10.27	147.55+143.40
Female	50.96+13.24	134.97+111.52

Table 3: The mean (X) Standard Deviation (SD) and p-value of weight (kg) and CD4 count (cells/μL) in HIV-positive patients not on HAART treatment and HIV-positive patients on HAART treatment

Subjects	Weight (kg)	CD4 count (cells μL^{-1})
HIV-positive patients not on HAART treatment (n = 50)	53.29+12.37	140.00+123.99
HIV-positive on HAART treatment (n = 50)	58.99+12.93	298.96+135.47
p-value	0.078	0.000

Values are given as X±SD

on HAART treatment when compared with HIV-positive patients not on HAART treatment which gave a significant difference of ($p<0.05$). But there was no significant difference between the mean and standard deviation in body weight of HIV-positive patients on HAART treatment and those not on HAART which gave a $p>0.05$, 0.0.

Human Immunodeficiency Virus (HIV) is a lentivirus that causes Acquired Immuno Deficiency Syndrome (AIDS), a condition in humans in which immune system begins to fail, leading to life threatening opportunistic infections. These life threatening opportunistic infections trigger recurrent chronic gastro intestinal infection which is main cause weight loss in HIV-positive patients.

The use of Highly Active Antiretroviral Therapy (HAART) creates multiple obstacles to HIV replication to keep the viral load low and reduce the possibility of superior mutation.

HIV-associated body weight loss is reduced in HAART-treated individuals (Sepkowitz, 1998). This is presumed to be caused by the suppression of viral replication in HIV infected individuals which are thought to lead to improvements in patient's body weight. Also finding of Carbonnel *et al*. (1998) have it that observed body weight changes correlated strongly with changes in CD4 cell count as a result of treatment with the protease inhibitor Indinavir However, there are limited data to support these presumptions. In this current study, body weight changes did not correspond to the degree of CD4+ T-cell reconstitution that resulted from treatment.

In this study CD4 counts and body weight were determined prior to initiation of therapy and after 1 year of treatment with HAART. The Mean+Standard Deviation (SD) of body weight before initiation of therapy was (53.29+12.37) kg and after HAART treatment for 1 year for the mean+SD were (58.99+12.93) kg. The mean+SD of CD4 counts before initiation of therapy was (140.00+123.99) cells μL^{-1} and after HAART treatment for 1 year the mean were (298.96+135.47) cell μL^{-1}. This is illustrated in Table 2 which shows that there was significant difference ($p<0.05$) between CD4 counts of HIV-positive patients on HAART treatment and HIV treatment. The significant difference in CD4 count indicates a significant increase in CD4 count of HIV-positive patients on HAART treatment for the regime of 1 year. In this study, there was no significant increase in body weight among HIV-positive patients on HAART treatment for a treatment regime of 1 year. This implies that the degree of CD4+ T-cell reconstitution of HIV-positive patients on HAAART treatment does not correspond with body weight change that resulted from treatment.

This study with the findings of Friedman (1997) which states that body weight control of an individual is an integral part of the energy balance. This energy balance depends on food intake, energy storage in body fat and energy expenditure. This study is also in agreement with the findings of Wiss and colleagues. Who deduced that the HIV-infected weight loss is due to anorexia? Diminished appetite and cachexia. There is also increased energy expenditure caused by a metabolic disorder leading to weight loss greater than that caused by reduced food intake alone. The central neural and peripheral factors are believed to contribute to AIDS-induced anorexia and cachexia. This implies that the use of HAART treatment in HIV-positive patients can cause a spontaneous increase in CD4 count of the patient and restore immune defense against opportunistic infections but increase in body weight is a product of energy balance in such an individual.

CONCLUSION

This study highlights the importance of regular monitoring of the CD4 count in HIV patients in order to determine when to start treatment with HAART therapy to prevent the invasion of life-threatening opportunistic infection. This study also highlights the need for improved dietary needs increase energy storage in body fat and energy expenditure in HIV patients during the course of treatment with HAART in order to increase body weight and improve their sense of well being. This would determine adjustment of drug dosage or introduction of alternative drugs as indicated.

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