# Prevalence of dyslipidemia in treatment naïve HIV-infected patients attending a Faith -Based Hospital, Jos Plateau State, Nigeria, 2019

*Diddam Magdalene Ohunene[1,2,&], Muhammed Sani Shehu[3], Tamuno-Wari Numbere[1,4], Aisha Bukola Usman[1], Chukwuma David Umeokonkwo[1,5]*

[1]Nigerian Field Epidemiology and Laboratory Training Program, Abuja, Nigeria, [2]National Veterinary Research Institute, Vom, Jos, Plateau State, Nigeria, [3]Department of Histopathology, Amadu Bello University Teaching Hospital, Zaria, Kaduna State Nigeria, [4]Rivers State Ministry of Health, Public health Port Harcourt, Rivers State, Nigeria, [5]Department of Community Medicine, Alex Ekwueme Federal University Teaching Hospital Abakaliki, Ebonyi State Nigeria

**KEYWORDS:** Dyslipidemia, HIV, Prevalence

**[&]CORRESPONDING AUTHOR**
Diddam Magdalene Ohunene, Nigerian Field Epidemiology and Laboratory Training Program, Abuja, Nigeria.
maxyqueen2001@yahoo.com

**RECEIVED**
13/10/2020

**ACCEPTED**
16/12/2022

**PUBLISHED**
09/02/2023

**LINK**

https://www.afenet-journal.net/content/article/6/4/full/

## ABSTRACT

**Introduction:** Antiretroviral therapy (ART) use has greatly reduced the morbidity and mortality that are associated with Human Immunodeficiency Virus (HIV) infection. Dyslipidemia which contributes to cardiovascular disease (CVD) has been reported to be the leading cause of mortality and morbidity in HIV-infected individuals. We estimated the prevalence of dyslipidemia in antiretroviral therapy (ART) naïve people, as well as the risk factors for dyslipidemia. **Methods:** A cross-sectional study was conducted among 350 treatment naïve HIV patients at Faith Alive Foundation Hospital from November 2018 to July 2019. A semi-structured questionnaire was used to collect data on demographics, medical histories, alcohol intake and drug use. Blood samples from clients were taken to determine lipid levels. The High levels of serum LDL, serum total cholesterol, serum triglyceride and low level of serum HDL were calculated, and we examined the relationship between dyslipidemia and sociodemographic characteristics using Chi-Square and logistic regression at a 5% level of significance. **Results:** The overall prevalence of dyslipidemia in the study population was 78.6%. High cholesterol was 0.3%, high triglyceride 62.0%, high low-density lipoprotein 0.3% and low high-density lipoprotein was 29.5% (men) and 46.9% (women). Hypertriglyceridemia was the major lipid abnormality followed by derangement in the lipoproteins. A low level of high-density lipoprotein was seen in 111 (31.7%) patients and a normal level was seen in 239 (68.3) patients with mean standard deviation (±SD) of 1.10 ±0.51 mmol/L. Out of the 217 clients that had a high level of TG triglyceride (TG), 35 (16.1%) had cluster of differentiation (CD4)+ cells <200 cells/µL, whereas those that had low High-Density Lipoprotein Cholesterol HDL-C (111), 41 (30.8%) of them had less than 200 cells/µL CD4+ cell count. The use of an antihypertensive drug (p=0.081), Age (p=0.69), gender (p=0.51), alcohol consumption (p=0.54), smoking (p=0.64) and Body mass index (BMI) all had no significant association with dyslipidemia. **Conclusion:** The overall prevalence of dyslipidemia was high in the study subjects. Before starting ART, HIV-positive individuals should be routinely examined for lipid abnormalities, and those who are found to have dyslipidemia should be promptly referred to attending physicians for appropriate treatment.



**CITATION**
Diddam Magdalene Ohunene et al . Prevalence of dyslipidemia in treatment naïve HIV-infected patients attending a Faith -Based Hospital, Jos Plateau State, Nigeria, 2019. Journal of Interventional Epidemiology and Public Health. 2023 Feb;6(1):4.

DOI:
https://www.doi.org/10.37432/jieph.2023.6.1.76

## Introduction

The immune system can be destroyed by the Human Immunodeficiency Virus (HIV) and it leaves the body vulnerable to a variety of infections [1]. HIV infection affects about 37.9 million people globally with about 24.5 million receiving treatment. This greatly impacts resources in developing countries [2]. The Joint United Nations Programme on HIV/AIDS (UNAIDS) and the National Agency for the Control of AIDS estimated that there are 1.9 million people living with HIV in Nigeria with about 1.5% of the population residing in Plateau state [3]. The introduction of HAART and improved care for opportunistic infection among the ART-naïve population has led to, improved life expectancy and quality of life [2,4].

Though people living with HIV live longer with less complications, non-communicable diseases (NCDs) have always remained the complication associated with HIV disease and its treatment [5]. cardiovascular diseases (CVDs) and metabolic abnormalities have been documented more frequently, and they have become a major cause of sickness and death in HIV-positive people [6]. Potential cardiovascular hazards are now an important aspect of HIV-infected patients' effective and decisive management [7,8]. High levels of serum LDL, serum total cholesterol, serum triglyceride and low level of serum HDL, all together or differently are known as abnormal serum lipids, which define dyslipidaemia [9]. Dyslipidemia, whether in combination or in isolation, has a serious contribution to cardiovascular risk [10]. Factors such as gender, diet, age, hypertension, body mass index (BMI), diabetes mellitus, and combined antiretroviral therapy (cART), among others, have been identified by some studies as the factors associated with dyslipidaemia [11].

Lipid profiles of newly diagnosed treatment naïve HIV patients are not routinely done especially before the commencement of HIV treatment. Therefore, the prevalence of dyslipidemia in these patients remains unquantified. We determined the prevalence of dyslipidemia and its determinates among treatment naïve HIV patients attending a faith-based treatment hospital in Jos, Plateau State Nigeria..

## Methods

### Study site

This study was conducted in Faith Alive Foundation Hospital, a faith-based hospital located in Jos, Plateau state, Nigeria between November 2018, and July 2019. The hospital cares for over 4000 patients in a month and about 300 HIV positive treatment naïve patients monthly by providing ongoing comprehensive care for HIV/AIDS (Acquired Immune Deficiency Syndrome) patients, as well as emergency services of opportunistic infections such as TB and Malaria, surgery, and antenatal services. The hospital has a well-equipped laboratory that runs various tests in clinical chemistry and microbiology using automated laboratory equipment. The hospital also operates small satellite clinics so that patients do not have to travel long distances to receive care at the main hospital in Jos. The main hospital is in Nigeria's north-central area, which has the country's second-highest HIV/AIDS prevalence (2.0%) [3].

### Study design, Population, Sample size, and Sampling

This hospital-based cross-sectional study recruited 350 treatment naïve HIV individuals consecutively from Faith Alive Foundation Hospital using the Leslie Kish formula;

$$n = \frac{Z^2_{(1-\alpha/2)}pq}{d^2}$$

n = Sample size, Z = Standard normal deviate at 95% confidence level 1.96, p = Estimate of proportion (0.5), q = 1-p and d = Precision = 0.05 and also corrected for the finite population using n = nN/n + N - 1.

The inclusion criteria were ART naïve HIV patients between the ages of 15 to 65 years as diagnosed by the hospital from November 2018 to July 2019 who were willing to participate. This study excluded individuals on lipid-lowering agents and pregnant women.

### Definition of variables

The independent variables in this study were ages, sex, BMI (<18.5: underweight, 18.5 to <25: normal weight, 25 to <30: overweight 30 or higher: obese) [12], alcohol consumption, tobacco smoking and drug use (antihypertensive). According to the World health organization (WHO) criteria for the classification of dyslipidemia, the dependent variable (dyslipidemia) was defined as abnormal levels of any of the lipid parameters thus, hypercholesterolemia (TC (total cholesterol)>5.2mmol/L), hypertriglyceridemia (TG>1.7mmol/L), low HDL-C (<0.9mmol/L for men and <1.0mmol/L for women) and high Low-density lipoprotein cholesterol (LDL-C) (>3.5mmol/L) [13].

### Data collection

A semi-structured interviewer-administered questionnaire was used to collect data on demographics (sex, age, education, and occupation) risk behaviour (alcohol use, cigarette smoking, drug history), anthropometrics (weight, height, BMI) and lipid profile. A Western blot assay was done on each participant to confirm their HIV status and a CD4 count was done using flow cytometry.

The United States Centers for Disease Control and Prevention (US CDC) classification for stages of HIV infection was used to divide HIV-infected patients into three categories; category 1: ≥500 cells/μL, category 2: 200 - 499 cells/μL and category 3: <200 cells/μL [14].

**Laboratory methods for lipid profile estimation**

The blood samples were dislodged and spun at 3000rpm for 10 minutes after coagulation. Total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), and triglyceride (TG) levels were measured in serum samples separated, collected, and kept at -4°C within 48 hours of sample collection using an automatic clinical chemistry analyzer. Low-density lipoprotein cholesterol (LDL-C) was calculated using the Friedewald formula;

$$LDL = TC - HDL - \left(\frac{TG}{5}\right)$$ [15].

**Data analysis**

The data obtained was cleaned and analyzed using the Epi Info version 7.2.0.1. We carried out the descriptive analysis of the study participants, estimated the prevalence of dyslipidemia as high levels of serum LDL, serum total cholesterol, serum triglyceride and low level of serum HDL and examined the relationship between the categorical variables (dyslipidemia and sociodemographic characteristics) using Chi-square to determine if their relationship was due to chance or that there is an actual relationship. Those factors that had a p-value of 0.1 (not significant at the bivariate level) and above were modelled in a logistic regression to identify the predictors of dyslipidemia at a 5% level of significance.

**Ethical Consideration**

Ethical approval and permission to conduct the research were obtained from the Ethics and Scientific Committee of the hospital with protocol number FAFEC/08/34/31. Written Informed consent from each participant was obtained. Parental consent was also obtained from the parents of participants aged 15 to less than 18 years. Information collected from the study was treated as confidential and stored in a password-protected computer system.

## Results

A total of 350 treatment naïve HIV patients participated in this study out of which, 211 (60.3%) were females. The mean age of the patients was 35.9 ± 10.2 years. The majority, 204 (58.3%) of the participants had completed their secondary education 157 (44.9%) were self-employed. In most of the study population, 222 (63.4%) had a normal body mass index Table 1.

In the study population, the total prevalence of dyslipidemia was 78.6%. The prevalence of high cholesterol was 0.3%, high triglyceride 62.0%, high low-density lipoprotein 0.3% and low high-density lipoprotein was 29.5% (men) and 46.9% (women) Table 2.

Dyslipidemia (High Triglyceride and Low High-density lipoprotein) from this study is significantly associated with the level of immunosuppression (P=0.003 and 0.014); p values less than 0.1 at the bivariate level. Out of the 217 HIV-infected patients that had a high level of TG, 35 (16.1%) had CD4+ cells <200 cells/μL. Among those that had low HDL-C (111), 41 (30.8%) of them had less than 200 cells/μL CD4+ cell count Table 3. None of the parameters investigated was found to be significantly linked to dyslipidemia after logistic regression in the research population Table 4.

## Discussion

This study assessed the prevalence of dyslipidemia in ART-naïve individuals as well as the possible risk factors associated with dyslipidemia namely alcohol consumption, smoking, use of antihypertensive and BMI. Our findings illustrate that dyslipidemia was significantly high in the study population characterized by high triglyceride and low levels of high-density lipoprotein. This is to be expected because hypertriglyceridemia in combination with low HDL-C increases the burden of cardiovascular diseases in HIV-infected patients, especially when not on any form of antiretroviral [16].

The overall prevalence of dyslipidemia among treatment naïve HIV-infected patients found in this study is slightly higher than what was reported by an earlier study in the same area. [16] In China, Yinzhong Shen et al., reported a similar prevalence [17]. Our findings corroborate two studies that found notably lower levels of total cholesterol and high-density lipoprotein, as well as greater levels of triglyceride, in HIV-infected people who had never received treatment. However, the study in Jos also found relatively high levels of low-density lipoprotein in HIV-positive patients unlike what we found [16]. Although the catchment area for both hospitals is similar, our observation shows a slightly lower prevalence of LDL-C. This could be attributed to the fact that the study recruited HIV-infected patients with other illnesses like diabetes and hypertension.

Two studies, conducted in Tanzania on the treatment naïve HIV-infected individuals, however, reported significantly lower overall prevalence [18,19]. Perhaps, there could be some nutritional or other factors unknown

to us that might account for this difference though it was observed that our study recruited a wider age range (15 to 65 years) than these studies (20 to 50 years). The current study observed low high-density lipoprotein for both men and women a prevalence almost the same as that documented in the study done by Manuthu et al., in East Africa on the treatment naïve HIV-infected subjects, [18]. Similarly, a study in a general population in Southeast Nigeria by Anyabolu, 2017 also reported a low serum high-density lipoprotein prevalence [20]. Although it is believed that dyslipidemia in HIV-infected patients poses a similar risk in HIV-negative populations [20], low HDL-C levels in combination with hypertriglyceridemia have been shown to significantly enhance the risk of cardiovascular disease in HIV patients. This is because both hypertriglyceridemia and low HDL-C are known risk factors for coronary heart disease [20]. Dyslipidemia was previously thought to be rare in Black Africa, including Nigeria, early reports suggested that blacks have a lower prevalence of dyslipidemia possibly due to genetic, nutritional, and environmental factors [19]. Some believed that protective (HDL-C) cholesterol was significantly higher in Tropical Africa, like reports showing that populations with increased intake of fish and marine mammals have high levels of HDL-C [21].

This study found that antiretroviral-naive HIV-infected people had a variety of lipid abnormalities, including significant triglyceride elevation and lower levels of total cholesterol, low-density lipoprotein, and low levels of high-density lipoprotein when compared to reference ranges, which could be due to lipid-containing foods commonly available in the state. A study published in Ghana in 2010 found a similar pattern of lipid abnormalities among antiretroviral-naive HIV populations, [22,23]. Similarly, the study conducted in treatment naïve HIV patients in Jos, Nigeria and its environs also showed that such individuals had significantly lower levels of total cholesterol and high-density lipoprotein as well as significantly higher levels of triglycerides [16].

In the same vein, both studies observed that mean of total cholesterol was more than twice the mean of low-density lipoprotein. Our findings are also consistent with prior research conducted in the United States and parts of Sub-Saharan Africa, which found that treatment-naive HIV-infected patients had lower levels of total cholesterol and high-density lipoprotein, as well as higher levels of triglycerides [22]. However, these studies found relatively higher levels of low-density lipoprotein among HIV-positive patients unlike what we found. A study from the south-south region of Nigeria in 2010 observed in their treatment naïve HIV-infected patients significantly lower total cholesterol, and high-density lipoprotein but significantly higher levels of low-density lipoprotein and triglycerides [24]. Low-density lipoprotein seems to be inconsistent compared with other lipid parameters in most studies. A possible explanation could be because of the differences in stages of immunosuppression of the study participants as observed by a similar study [16].

A significant association was observed between serum triglycerides and CD4+ cell count. There was also an observed significant association between high-density lipoprotein and CD4+ cell count which reveals that dyslipidemia has a strong link to the stage of HIV infection as also observed by Yinzhong Shen et al., in China [17] and the other studies conducted in Southeast and South-south Nigeria [20,24]. However, the relationship between immune status with total cholesterol and low-density lipoprotein was not statistically significant. It further observed that the prevalence of dyslipidemia increased as CD4+ cell count increased, similar to the observation in the study conducted in the Eastern part of Nigeria [20].

In contrast with the studies done in Jos, Nigeria, and Tanzania [16,19], risk factors such as age, sex, alcohol consumption, smoking, BMI and use of antihypertensive drugs were all not significantly associated with dyslipidemia, though a study as far back as 2001 discussed the potentially harmful effects of antihypertensive drugs like diuretics on lipoprotein metabolism [25].

Our study was not without limitations. Since the study design was cross-sectional, it is not possible to explain the temporal relationship between being infected with HIV and developing dyslipidemia. There is a need for further studies to investigate the development of dyslipidemia in HIV populations.

## Conclusion

Dyslipidemia is highly prevalent amongst treatment naïve HIV-infected patients attending Faith Alive Foundation, Hospital, Jos even without the evidence of known risk factors for dyslipidemia. This was characterized by high triglycerides and low High-density lipoprotein, which were associated with low CD4+ cell count. All treatment naïve HIV-infected patients should be regularly screened for dyslipidemia as part of the routine test before beginning antiretroviral treatment because it is believed that dyslipidemia can be more severe in ART-experienced individuals, and those discovered with dyslipidemia be aptly referred to attending physicians.

## What is known about this topic

- There is a high prevalence of dyslipidemia among patients living with HIV
- Dyslipidemia is of high Triglyceride and Low High-density lipoprotein type

- Dyslipidemia is associated with the severe immunosuppression

## What this study add

- Dyslipidemia is associated with high levels of serum LDL, serum total cholesterol, serum triglyceride and low level of serum HDL, all together or separately
- HIV infection is associated with immunosuppression

## Competing interests

The authors declare no competing interests.

## Authors' Contributions

MOD, MSS, ABU and CDU participated in the planning and execution of the study. MOD, MSS, and TM performed the data analysis and wrote the initial manuscript. The manuscript was revised and approved by all authors.


## Acknowledgements

The authors are grateful to the African Field Epidemiology Network and Nigeria Field Epidemiology, Laboratory Training Programme, Amadu Bello University, Zaria, and Faith Alive Foundation Hospital for their support in preparing this manuscript.


## Table and Figures

Table 1: Socio-demographic characteristics of treatment naïve HIV seropositive patients in Jos - Plateau State, 2019
Table 2: Prevalence of dyslipidemia among treatment naïve HIV seropositive patients Jos -Plateau State, 2019
Table 3: Lipid profile pattern among treatment naïve HIV seropositive patients according to CD4+ cell category, Jos - Plateau State, 2019
Table 4: Factors of dyslipidemia among treatment naïve HIV seropositive patients, Jos - Plateau State, 2019

## References


1. Zhang F, Dou Z, Ma Y, Zhang Y, Zhao Y, Zhao D, Zhou S, Bulterys M, Zhu H, Chen RY. Effect of earlier initiation of antiretroviral treatment and increased treatment coverage on HIV-related mortality in China: a national observational cohort study. The Lancet Infectious Diseases[Internet]. 2011 Jul;11(7):516-24. https://doi.org/10.1016/S1473-3099(11)70097-4 . Google Scholar

2. UNAIDS. UNAIDS data 2019[Internet]. UNAIDS; 2019 Dec 4[cited 2023 Jan 17].

3. UNAIDS. New survey results indicate that Nigeria has an HIV prevalence of 1.4%.[Internet] UNAIDS; 2019 March 14[cited 2023 Jan 17]..

4. Wandeler G, Johnson LF, Egger M. Trends in life expectancy of HIV-positive adults on antiretroviral therapy across the globe: comparisons with general population. Current Opinion in HIV and AIDS[Internet]. 2016 Sep[cited 2023 Jan 17]; 11(5):492-500. https://doi.org/10.1097/COH.0000000000000298 . PubMed | Google Scholar

5. Blanco F, San Román J, Vispo E, López M, Salto A, Abad V, Soriano V. Management of metabolic complications and cardiovascular risk in HIV-infected patients. AIDS Rev[Internet]. 2010[cited 2023 Feb 3];12(4):231-41. Google Scholar

6. Hasse B, Ledergerber B, Furrer H, Battegay M, Hirschel B, Cavassini M, Bertisch B, Bernasconi E, Weber R, the Swiss HIV Cohort Study. Morbidity and aging in hiv-infected persons: the swiss hiv cohort study. Clinical Infectious Diseases[Internet]. 2011 Dec 1[cited 2023 Jan 17]; 53(11):1130-9. https://doi.org/10.1093/cid/cir626 . Google Scholar

7. Falutz J. Therapy Insight: body-shape changes and metabolic complications associated with HIV and highly active antiretroviral therapy. Nat Rev Endocrinol[Internet]. 2007 Sep[cited 2023 Jan 17]; 3(9):651-61. https://doi.org/10.1038/ncpendmet0587 . Google Scholar

8. Dara PR, Suram RP. Lipid Profile in Art Treated and Untreated Patients Of HIV Positive Cases. JEBMH[Internet]. 2016 Jul 26[cited 2023 Jan 23]; 3(60):3229-32. https://doi.org/10.18410/jebmh/2016/699. Google Scholar

9. Ni WQ, Liu XL, Zhuo ZP, Yuan XL, Song JP, Chi HS, Xu J. Serum lipids and associated factors of dyslipidemia in the adult population in Shenzhen. Lipids Health Dis[Internet]. 2015 Jul 14[cited 2023 Jan 17]; 14(1):71. https://doi.org/10.1186/s12944-015-0073-7 . PubMed | Google Scholar

10. Piepoli MF, Hoes AW, Agewall S, Albus C, Brotons C, Catapano AL, Cooney MT, Corrà U, Cosyns B, Deaton C, Graham I, Hall MS, Hobbs FDR, Løchen ML, Löllgen H, Marques-Vidal P, Perk J, Prescott E, Redon J, Richter DJ, Sattar N, Smulders Y, Tiberi M, van der Worp HB, van Dis I, Verschuren WMM. 2016 European Guidelines On Cardiovascular Disease Prevention in Clinical Practice: The Sixth Joint Task Force of the European Society of Cardiology And Other Societies On Cardiovascular Disease Prevention in Clinical Practice (Constituted by Representatives of 10 Societies and by Invited Experts) Developed with the Special Contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur Heart J[Internet]. 2016 Aug 1[cited 2023 Jan 17]; 37(29):2315-81. https://doi.org/1093/eurheartj/ehw106 . Pub Med | Google Scholar

11. Njuguna B, Kiplagat J, Bloomfield GS, Pastakia SD, Vedanthan R, Koethe JR. Prevalence, risk factors, and pathophysiology of dysglycemia among people living with hiv in sub-saharan africa. Journal of Diabetes Research[Internet]. 2018 May 23[cited 2023 Jan 17]; 2018:1-12. https://doi.org/10.1155/2018/6916497 . Pub Med | Google Scholar

12. Centers for Disease Control and Prevention (CDC). Overweight & Obesity[Internet]. Atlanta (GA): Centers for Disease Control and Prevention. 2018 Aug 20[reviewed 2022 September 27;cited 2023 Jan 17].

13. Kaptoge S, Pennells L, De Bacquer D, Cooney MT, Kavousi M, Stevens G, Riley LM, Savin S, Khan T, Altay S, Amouyel P, Assmann G, Bell S, Ben-Shlomo Y, Berkman L, Beulens JW, Björkelund C, Blaha M, Blazer DG, Bolton T, Bonita Beaglehole R, Brenner H, Brunner EJ, Casiglia E, Chamnan P, Choi YH, Chowdry R, Coady S, Crespo CJ, Cushman M, Dagenais GR, D'Agostino Sr RB, Daimon M, Davidson KW, Engström G, Ford I, Gallacher J, Gansevoort RT, Gaziano TA, Giampaoli S, Grandits G, Grimsgaard S, Grobbee DE, Gudnason V, Guo Q, Tolonen H, Humphries S, Iso H, Jukema JW, Kauhanen J, Kengne AP, Khalili D, Koenig W, Kromhout D, Krumholz H, Lam T, Laughlin G, Marín Ibañez A, Meade TW, Moons KGM, Nietert PJ, Ninomiya T, Nordestgaard BG, O'Donnell C, Palmieri L, Patel A, Perel P, Price JF, Providencia R, Ridker PM, Rodriguez B, Rosengren A, Roussel R, Sakurai M, Salomaa V, Sato S, Schöttker B, Shara N, Shaw JE, Shin HC, Simons LA, Sofianopoulou E, Sundström J, Völzke H, Wallace RB, Wareham NJ, Willeit P, Wood D, Wood A, Zhao D, Woodward M, Danaei G, Roth G, Mendis S, Onuma O, Varghese C, Ezzati M, Graham I, Jackson R, Danesh J, Di Angelantonio E. World Health Organization cardiovascular disease risk charts: revised models to estimate risk in 21 global regions. The Lancet Global Health[Internet]. 2019 Oct[cited 2023 Jan 17]; 7(10):e1332-45.https://doi.org/10.1016/S2214-109X(19)30318-3 . PubMed | Google Scholar

14. Samaras K. Metabolic consequences and therapeutic options in highly active antiretroviral therapy in human immunodeficiency virus-1 infection. Journal of Antimicrobial Chemotherapy[Internet]. 2007 Dec 19[cited 2023 Jan 17]; 61(2):238-45.https://doi.org/10.1093/jac/dkm475 . Google Scholar

15. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the Concentration of Low-Density Lipoprotein Cholesterol in Plasma, without use of the Preparative Ultracentrifuge. Clin Chem. 1972 Jun; 18(6):499-502. Google Scholar

16. Iroezindu M, Daniyam C. Lipid Profile of Anti-Retroviral Treatment-Naive HIV-Infected Patients in Jos, Nigeria. Ann Med Health Sci Res [Internet]. 2013[cited 2023 Jan 17]; 3(1):26-30.https://doi.org/10.4103/2141-9248.109468 . PubMed | Google Scholar

17. Shen Y, Wang J, Wang Z, Qi T, Song W, Tang Y, Liu L, Zhang R, Lu H. Prevalence of Dyslipidemia Among Antiretroviral-Naive HIV-Infected Individuals In China. Medicine[Internet]. 2015 Dec[cited 2023 Jan 17] ;94(48):e2201.https://doi.org/10.1097/MD.0000000000002201 . PubMed | Google Scholar

18. Manuthu EM, Joshi M, Lule G, Karari E. Prevalence of dyslipidemia and dysglycaemia in HIV infected patients. E Af Med Jrnl[Internet]. 2008 May 28[cited 2023 Jan 17]; 85(1):10-7. https://doi.org/10.4314/eamj.v85i1.9600 . Google Scholar

19. Armstrong C, Liu E, Okuma J, Spiegelman D, Guerino C, Njelekela M, Grinspoon S, Fawzi W, Hawkins C. Dyslipidemia in an hiv-positive antiretroviral treatment-naive population in dar es salaam, tanzania. JAIDS Journal of Acquired Immune Deficiency Syndromes[Internet]. 2011 Jun 1[cited 2023 Jan 17]; 57(2):141-5.https://doi.org/10.1097/QAI.0b013e318219a3d1 . PubMed | Google Scholar

20. Anyabolu EN. Low density lipoprotein cholesterol in a general out-patient population in a tertiary hospital in Southeast Nigeria: Associations and Implications. Clinical Medicine and Diagnostics[Internet]. 2017[cited 2023 Jan 23]; 7(1):8-17.https://doi.org/10.5923/j.cmd.20170701.02 .

21. Oguejiofor O, Onwukwe C, Odenigbo C. Dyslipidemia in Nigeria: Prevalence and Pattern. Ann Afr Med[Internet]. 2012 Oct 24[cited 2023 Jan 17]; 11(4):197-202.https://doi.org/10.4103/1596-3519.102846 . Google Scholar

22. Obirikorang C, Quaye L, Osei-Yeboah J, Odame E, Asare I. Prevalence of metabolic syndrome among HIV-infected patients in Ghana: A cross-sectional study. Niger Med J[Internet]. 2016[cited 2023 Jan 17]; 57(2):86-90. https://doi.org/10.4103/0300-1652.182082. PubMed | Google Scholar

23. Obirikorang C, Yeboah FA, Quaye L. Serum Lipid Profiling in Highly Active Antiretroviral Therapy-Naive HIV Positive Patients in Ghana; any potential risk? WebmedCentral INFECTIOUS DISEASES[Internet]. 2010[cited 2023 Jan 17]; 1(10).https://doi.org/10.9754/journal.wmc.2010.00987 . Google Scholar

24. Iffen S, Efobi H, Usoro A and Udonwa E. Lipid profile of HIV positive patients attending university of Calabar teaching hospital, Calabar, Nigeria. World J Med Sci[Internet]. 2010[cited 2023 Jan 23]; 5(4):89-93. Google Scholar

25. Calza L, Colangeli V, Manfredi R, Bon I, Re MC, Viale P. Clinical management of dyslipidaemia associated with combination antiretroviral therapy in HIV-infected patients. J Antimicrob Chemother[Internet]. 2016 Jun[cited 2023 Jan 13]; 71(6):1451-65. https://doi.org/10.1093/jac/dkv494. Google Scholar

| **Table 1**: Socio-demographic characteristics of treatment naïve HIV seropositive patients in Jos - Plateau State, 2019 | | |
|---|---|---|
| **Variable** | **Frequency (n=350)** | **Percent** |
| **Sex** | | |
| Male | 139 | 39.7 |
| Female | 211 | 60.3 |
| **Age (years)** | | |
| 15 – 24 | 37 | 10.6 |
| 25 – 34 | 115 | 32.8 |
| 35 – 44 | 121 | 34.6 |
| ≥ 45 | 77 | 22.0 |
| Mean age ±SD | 35.9 ± 10.2 | |
| **Level of Education** | | |
| Primary | 55 | 15.7 |
| Secondary | 204 | 58.3 |
| Tertiary | 91 | 26.0 |
| **Occupation** | | |
| Unemployed | 84 | 24.1 |
| Self employed | 157 | 44.9 |
| Privately employed | 45 | 12.9 |
| Government employed | 64 | 18.1 |
| **BMI ($Kg/m^2$)** | | |
| Underweight (<18.5) | 29 | 8.3 |
| Normal (18.5 to <25) | 222 | 63.4 |
| Overweight (25 to <30) | 85 | 24.3 |
| Obese (30 or above) | 14 | 4.0 |
| **CD4 Count** | | |
| <200 cells/μL | 82 | 23.4 |
| 200-499 cells/ μL | 192 | 54.9 |
| ≥500 cells/ μL | 76 | 21.7 |
| **Tobacco Smoking** | | |
| Yes | 26 | 7.4 |
| No | 324 | 92.6 |
| **Antihypertensive Drug** | | |
| Yes | 20 | 5.7 |
| No | 330 | 94.3 |
| **Alcohol Consumption** | | |
| Yes | 121 | 34.6 |
| No | 229 | 65.4 |
| BMI= Body Mass Index | | |

| **Table 2:** Prevalence of dyslipidemia among treatment naïve HIV seropositive patients Jos - Plateau State, 2019 | | |
|---|---|---|
| **Variable** | **Frequency (n=350)** | **Percent** |
| **Hypercholesterolemia (TC > 5.2 mmol/L)** | 1 | 0.3 |
| **Hypertriglyceridemia (TG > 1.7 mmol/L)** | 217 | 62.0 |
| **Low HDL – C** | | |
| Men (< 0.9 mmol/L) | 41 | 29.5 |
| Women (< 1.0 mmol/L) | 99 | 46.9 |
| **High LDL – C (> 3.5 mmol/L)** | 1 | 0.3 |
| **Dyslipidaemia** | 275 | 78.6 |
| HDL-C= High-density lipoprotein, LDL-C= Low-density lipoprotein | | |

**Table 3:** Lipid profile pattern among treatment naïve HIV seropositive patients according to CD4+ cell category, Jos - Plateau State, 2019

| Variable | CD4 Count (%) | | | $\chi^2$ | P value |
|---|---|---|---|---|---|
| | <200 cells/µL | 200 – 499 cells/µL | <500 cells/µL | | |
| **Total Cholesterol** | | | | | |
| Normal | 76 (21.8) | 192 (55.0) | 81 (23.2 | 3.27 | 0.194 |
| High | 0 (0.0) | 0 (0.0) | 1 (1.2) | | |
| **Triglycerides** | | | | | |
| Normal | 41 (30.8) | 68 (51.1) | 24 (18.1) | 11.40 | 0.003* |
| High | 35 (16.1) | 124 (57.2) | 58 (26.7) | | |
| **HDL – C** | | | | | |
| Low | 33 (29.7) | 60 (54.1) | 18 (16.2) | 8.43 | 0.014* |
| Normal | 43 (17.9) | 132 (55.3) | 64 (26.8) | | |
| **LDL – C** | | | | | |
| Normal | 76 (21.8) | 192 (55.0) | 81 (23.2) | 3.27 | 0.19 |
| High | 0 (0.0) | 0 (0.0) | 1 (100.0) | | |

HDL-C= High-density lipoprotein, LDL-C= Low-density lipoprotein

*Statistically significant

**Table 4:** Factors of dyslipidemia among treatment naïve HIV seropositive patients, Jos - Plateau State, 2019

| Variable | Dyslipidaemia | | OR | 95% CI (Confidence interval) | P Value |
|---|---|---|---|---|---|
| | Yes n (%) | No n (%) | | | |
| **Age (years)** | | | | | |
| ≤ 35 | 134 (78.8) | 36 (21.2) | 1 | | |
| >35 | 141 (78.3) | 39(21.7) | 1.0 | 0.62 – 1.72 | 0.91 |
| **Sex** | | | | | |
| Female | 165 (78.2) | 46 (21.8) | 0.95 | 0.56 – 2.00 | 0.83 |
| Male | 110 (79.1) | 29 (20.9) | 1 | | |
| **Alcohol Consumption** | | | | | |
| Yes | 92 (76.0) | 29 (24.0) | 0.80 | 0.47 – 1.35 | 0.40 |
| No | 183 (79.9) | 46 (20.1) | 1 | | |
| **Smoking** | | | | | |
| Yes | 20 (71.4) | 8 (28.6) | 0.60 | 0.25 – 1.42 | 0.24 |
| No | 260 (80.7) | 62 (19.3) | 1 | | |
| **Antihypertensive** | | | | | |
| Yes | 18 (69.2) | 8 (30.8) | 0.53 | 0.22 – 1.28 | 0.15 |
| No | 262 (80.9) | 62 (19.1) | 1 | | |
| **BMI** | | | | | |
| Underweight | 23(79.3) | 6(20.7) | 1.03 | 0.40 – 2.67 | |
| Normal | 175(78.8) | 47(21.2) | 1 | | |
| Overweight | 67(78.8) | 18(21.2) | 1.00 | 0.54 – 1.84 | |
| Obese | 10(71.4) | 4(28.6) | 0.67 | 0.20 – 2.24 | |