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Original Research Article

Dyslipidaemia among antiretroviral therapy-experienced adolescents and young people living with HIV in Lagos, Nigeria

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The use of highly active antiretroviral therapy (HAART) in the treatment of Human immunodeficiency virus (HIV) infection has shifted the illness's dynamics from acute to chronic disease. This chronic condition has been linked to the emergence of metabolic and morphologic risk factors that predispose to Non-Communicable Diseases (NCDs), which has a detrimental effect on HIV progress. A cross-sectional study of HIV-positive adolescents and young people (AYLHIV) visiting an HIV treatment centre in Lagos, Nigeria. Sociodemographic information and antiretroviral treatment history were gathered. Anthropometric measures and blood pressure readings were obtained, and the results were presented as age and gender-adjusted z scores. Fasting triglycerides and high-density lipoprotein-cholesterol (HDL-c) levels were also measured. Dyslipidaemia was defined as a low level of High-Density Lipoprotein-cholesterol (HDL-c) and/or hypertriglyceridaemia in the individuals. The relationship between dyslipidaemia and other variables was investigated using univariate and logistic regression statistics in SPSS version 23, with statistical significance set at P 0.05. The participants' mean (standard deviation) age was 15.4 (±3.2) years. Dyslipidaemia, low HDL-c, and hypertriglyceridaemia were all present in 44.7 percent, 32.6 percent, and 19.9 percent of the population, respectively. The use of a protease inhibitor-based regimen and an ART duration of 8 years were statistically significant predictors of dyslipidaemia and hypertriglyceridaemia. Obesity and hypertension were also found as risk factors for dyslipidaemia. However, only the use of a PI-based regimen and the use of ART for a long period of time (> 8 years) were statistically significant (p≤0.05). Dyslipidaemia in HIV-infected adolescents and young people is linked to protease inhibitor-based ART and a lengthy duration of treatment. There is a need for regular lipid profile assessment in HIV treatment to decrease the risk of cardiovascular disease (CVD) and is consequences.

Keywords: Dyslipidaemia, HIV, Adolescents, young people, Nigeria

INTRODUCTION

Globally, Human Immunodeficiency Virus (HIV) infection remains a challenging public health issue especially in low- and middle-income countries (LMIC), where the prevalence and incidence of the infection is high (UNICEF; UNAIDS 2018). Worldwide, the burden of people living with HIV [PLHIV] is 36.9 million with about 1.8 million being

adolescents [10-19 years] (AVERT, 2019). Sub-Saharan Africa accounts for over two-thirds of the global population and approximately 85% of the adolescents living with the disease (Mahy and UNAIDS 2017; UNAIDS, 2018; UNICEF Data 2019). Nigeria has the second-highest burden of the global HIV epidemic and one of the highest incidences of new infections in sub-Saharan Africa, with 240,000 adolescents living with HIV as at 2016 (AVERT, 2019). Recent trends of the infection depict positive outcomes and increasing survival of PLHIV, transforming the disease from an acute to a chronic lifelong disease (NACA 2017; UNAIDS 2018). These outcomes are a result of the readily available and easily accessible highly active antiretroviral therapy (HAART) (UNAIDS 2018; UNICEF Data 2019).

The increased survival of PLHIV is associated with non-communicable diseases [NCDs] co-morbidities such as chronic obstructive lung diseases, diabetes mellitus, hypertension, cardiovascular disorders, oncological diseases, and neurological disorders among others (Hasse et al., 2011; Guaraldi et al., 2015; WHO 2015). These NCDs are propelled by diverse factors including aging, lifestyles (unwholesome diets, tobacco smoking, and a lack of physical activity), and metabolic risk factors (raised blood pressure, overweight/obesity, high blood sugar, and dyslipidaemia). Consequently, as children and adolescents living with HIV survive to adulthood, they could be further challenged by the development of NCDs leading to a poor outcome, if measures are not in place to combat them (Mutimura et al., 2008; CDC, 2013; WHO, 2019).

Dyslipidaemia is an important driver of NCDs. Several studies have reported an association between the use of ART among PLHIV, particularly Protease Inhibitor [PI]-based regimens, and impaired lipid metabolism profile (Feeney, 2011; UNICEF 2020). However, this might not be limited to the use of PI-based regimen only but a combination of multi-factorial related cascade of events involving race, gender, chronicity of HIV infection, duration/type of ART, immunologic changes, lifestyle behaviours, and pubertal changes among others (Mutimura et al., 2008; CDC, 2013; WHO, 2019).

Adolescents and young people are a growing population of people most affected with HIV. This “transitional age” is also associated with behaviours and practices that could promote the onset and rapid progression of dyslipidaemia and other metabolic disorders into life-threatening health challenges (LeBlanc and Janssen, 2010; Innes et al., 2016). The current study evaluates pattern and risk factors of dyslipidaemia among ART experienced adolescents living with HIV in a large treatment centre in Nigeria. The study findings will help put measures in place towards prevention and early detection and treatment of risk factors for NCDs, thus mitigating the short- and long-term complications.

MATERIALS AND METHODS

This was a prospective quantitative cross-sectional research of HIV positive adolescents and young people aged 10 to 24 years who attended the HIV Clinic at the Nigerian Institute of Medical Research's Clinical Sciences Department in Lagos, Nigeria, between July and October 2019. The clinic is situated in Nigeria's commercial capital and provides comprehensive HIV care and treatment to adults, adolescents, children, and pregnant women. On the second Saturday of each month, the clinic hosts an adolescent-friendly clinic, with about 400 AYLHIV patients presently under treatment. AYLHIV who had been taking antiretroviral medications for at least six months and agreed (consent/assent) to participate in the research were recruited. The research excluded AYLHIV with severe co-morbidities such as seizure disorders, sickle cell anaemia, or chronic hepatitis B infection, as well as those with acute sickness.

Information obtained from participants included socio-demographic characteristics (age, gender, education, occupation), clinical parameters (age at HIV diagnosis, duration on, and type of ART, and family history of hypertension and diabetes mellitus), physical examination findings (anthropometric measurements, blood pressure readings) and recent laboratory parameters (HIV RNA viral load and CD4 count within the 6 months of the study period). The anthropometric measurements (weight in kilograms, height in centimetres, waist circumference in centimetres) were obtained with the patient in light clothing and barefoot using the Seca combination weight and height meter ® and a medical tape. The body mass index (BMI), expressed in kilograms per square meter, was calculated from the weight and height measurements. Anthropometric measurements were expressed as age and sex-adjusted z scores based on WHO Growth Charts. Two blood pressure readings were obtained from the right arm twenty minutes apart, using an electronic sphygmomanometer (Omron M3 Intellisense™, Model: M3 (HEM-7131-E [Omron Healthcare Co. Ltd]) with the participant comfortably seated with the right arm placed at the level of the participant’s heart. The mean of the two readings was recorded as the participant’s blood pressure. If a high reading was obtained, a third measurement was conducted after another 20 minutes. The mean of the two closest readings was taken as the participant’s blood pressure. Point Hypertension was defined as a blood pressure reading of ≥ 95th percentile for age, sex, and height or readings above 130/80mmHg irrespective of participant’s age or gender.

Laboratory Parameters

After a 12-hour fast, approximately 6 ml of venous blood was collected from the antecubital fossa of each participant to determine their fasting lipid profiles [total cholesterol, triglycerides, high-density lipoprotein (HDL)-cholesterol, and low-density lipoprotein (LDL)-cholesterol using Roche C311 Clinical Chemistry autoanalyser. Hypertriglyceridaemia (TAG ≥ 110mg/dl) and/or low HDL-c (≤ 40mg/dl) were used to define dyslipidemia as these are

the two major predictive parameters for later development of cardiovascular disease.

Data Analysis

Data collected were recorded, validated, and analysed using the Statistical Package for Social Sciences (SPSS) software version 23. Descriptive and inferential statistics were applied in the course of the analysis. Descriptive statistics such as mean and standard deviation for normally distributed variables or median and interquartile range for skewed data were used to summarize continuous variables, while proportions were used to summarize categorical data. Logistic regression was done to determine the relationship between dyslipidaemia, and characteristics of study participants. Statistical significance was set a value of $p \leq 0.05$.

Ethical approval was obtained from the Institutional Review Board (IRB) of the Nigerian Institute of Medical Research, Lagos before the commencement of the study.

RESULTS

One hundred and forty-one adolescents and young people living with HIV [AYLHIV] participated in this study. The mean age was 15.4 (±3.2) years. The majority of participants were female (51.8%) and in secondary school (81.6%).

Most participants (97.4%) acquired HIV through vertical transmission and the mean age at HIV diagnosis was 6.1 (± 4.0) years. The majority of the participants were on non-Protease Inhibitor therapy (66.7%), had been on therapy for at least 8 years (64.5%), and had HIV RNA viral load less than 1000 copies/ml (81.6%) and CD4 count above 500 cells/μL (71.7%). Among the study participants, 19.9% and 6.4% had a positive family history of Hypertension and Diabetes mellitus respectively, while 38.3% and 61.7% had adequate and inadequate physical activity respectively.

The mean Total Cholesterol (TC), Tri-acylgylceride (TAG), High-Density Lipoprotein cholesterol (HDL-c) and Low-Density Lipoprotein-cholesterol (LDL-c) level were 140.7 (±37.9) mg/dL, 46.2 (±15.9) mg/dL, 77.1 (±27.5) mg/dL and 89.6 (±37.9) mg/dL respectively. The prevalence of dyslipidaemia was 44.7%. The most prevalent abnormal lipid profile (dyslipidaemia) was low HDL [32.6%], followed by Hypertriglyceridemia [19.9%] (Table 1).

Concerning clinical and lifestyle characteristics of participants associated with dyslipidaemia, long duration on ART (≥8years) (AOR 0.430; 95%CI= 0.186-0.996, p=0.049) and use of Protease Inhibitor based regimen (AOR 5.013; 95%CI= 2.059-12.203 p= <0.001) were significantly associated with dyslipidaemia. Although participants with inadequate physical activity (AOR 1.368; 95%CI=0.612-3.659), obesity (AOR 3.577; 95%CI= 0.271-46.730), and hypertension (AOR 2.714; 95%CI= 0.716-10.292) had higher odds of having dyslipidaemia, these were not significant Table 2.

Concerning clinical and lifestyle characteristics of the participants and hypertriglyceridaemia: The use of ART for >8years (AOR 0.200; 95%CI=0.066-0.608 p=0.005) and Protease Inhibitor based regimen (AOR 9.923; 95%CI= 2.963-33.231 p<0.001) were significantly associated with the hypertriglyceridaemia. The risk of developing hypertriglyceridaemia was higher among participants who were aged 15-24years (AOR 1.845; 95%CI= 0.595-5.718), obese (AOR 1.804; 95%CI= 0.090-36.152), and with viral load (>1000RNA copies/ul) (AOR 3.233; 95%CI= 0.796-13.139), although not statistically significant Table 3.

Table 4 depicts the association between low High-Density Lipoprotein (HDL-c) and participant characteristics. There was no statistically significant association between participant characteristics and low HDL-c. However, the risk of having a low HDL-c was higher among participants who were female (AOR 1.563; 95%CI= 0.704-3.467), on Protease Inhibitor based regimen (AOR 2.060; 95%CI= 0.877-4.842), obese (AOR 6.727; 95%CI= 0.518-87.406) and hypertensive (AOR 2.247; 95%CI= 0.617-8.182).

DISCUSSION

The use of Highly active antiretroviral therapy (HAART) has been beneficial in the management of HIV, saving countless lives especially adolescents and young people, who are living longer. This longevity has changed the dynamics of HIV infection, from an acute infection to chronic disease. This disease state is associated with a plausible onset of risk factors that will lead to various NCDs resulting in detrimental effects on the gains of HIV and the health indices of the global community. The risk factors include abnormal lipid levels, glucose metabolism, abnormalities in body fat distribution, and sustained increased blood pressure which are of public health concerns.

In this study, the mean age of the participants was 15.4(±3.2) years with 64.5% of the AYLHIV on HAART for at least 8 years and 66.7% on Non-Protease Inhibitor based therapy. 81.2% were virally suppressed with median (IQR) CD4 counts of 632 (481-857) cells/ml. The prevalence of dyslipidaemia, low HDL-c, and hypertriglyceridaemia were (44.7%), (32.6%), and (19.9%) respectively. The risk of dyslipidaemia, hypertriglyceridaemia, and low HDL-c) was higher among participants on ART for >8years, on PI-based regimen, obese and hypertensive. However, only the use of PI-based regimen and a long duration of ART(>8years) were statistically significant.

Dyslipidaemia patterns observed in this study; hypertriglyceridaemia, low HDL-c are distinctly atherogenic lipid profiles with associated long-term cardiovascular risk. This finding corroborates previous reports among people living with HIV irrespective of the age (Mandal et al., 2016; Ige et al., 2017; Nampijja et al., 2017). Furthermore, the dyslipidaemia in the current study is significantly associated with long duration of ART and use of Protease inhibitors, affirming the direct and indirect effect of HIV, long use of ART, and especially PI-based inhibitor on lipid

Table 1. Characteristics of Study Participants

Characteristics	Frequency (%)
Mean Age (± SD) in years	15.4 (± 3.2)
Age Groups (years):	
10 – 14	54 (38.3)
15 – 24	87 (61.7)
Sex:	
Female	73 (51.8)
Male	68 (48.2)
Educational Level:	
≤ Secondary	129 (91.5)
> Secondary	12 (8.5)
Family History of Hypertension:	
Yes	28 (19.9)
No	99 (70.2)
Unknown	14 (9.9)
Family history of Diabetes:	
Yes	9 (6.4)
No	118 (83.7)
Unknown	14 (9.9)
Physical Activity:	
Adequate	54 (38.3)
Inadequate	87 (61.7)
ART Type:	
Non PI-based	94 (66.7)
PI –Based	47 (33.3)
ART Duration (years):	
< 8	50 (35.5)
≥ 8	91 (64.5)
CD4 (cells/µl]:	
<500	36 (25.5)
≥500	105 (74.5)
Viral Load (copies/ml):	
<1000	115(81.6)
≥1000	26(18.4)
Obesity:	
No	138 (97.9)
Yes	3 (2.1)
Hypertension:	
No	128 (90.8)
Yes	13 (9.2)
Weight Z-score mean	-1.3 (±1.4)
Height Z-score mean	-1.1 (±1.4)
BMI Z-score mean	-0.8 (±1.3)
Lipids (Mean ± SD)	
TC-mg/dl	140.7 (±37.9)
HDL-c	46.2 (±15.9)
LDL-c	77.1 (±27.5)
TACG	89.6 (±37.9)

BMI- Body Mass Index, ART- Antiretroviral therapy, PI-Protease Inhibitor, TC-Total Cholesterol, HDL-c-High-Density Lipoprotein, LDL-c Low-Density Lipoprotein, TACG-Tri-acylgylceride

metabolism. Antiretroviral therapies; predominantly PI-based regimen induces dyslipidaemia, through different pathophysiologic mechanisms which include inhibition of lipogenesis, adipocyte differentiation, stimulation of lipolysis of the subcutaneous fats, increase, impaired uptake of remnant hepatic chylomicrons and VLDL and up-regulation of mRNA production in hepatic cells for key enzymes involved in the triglyceride biosynthetic pathway(Carr et al., 1998; Calza et al., 2003; Feeney, 2011).

The prevalence of dyslipidemia (44.7%), is within the prevalence range of 19.3% to 75% reported by previous studies (Piloya et al., 2012; Bwakura-Dangarembizi et al., 2015; Mandal et al., 2016; Ige et al., 2017; Nampijja et al., 2017; Viljoen et al., 2020). The variability in the prevalence

Table 2. Clinical and Laboratory Characteristics of Participants by Lipidaemia Status

Characteristics	Dyslipidemia N=63 (44.7%)	Without Dyslipidemia N=78 (55.3%)	Crude		Adjusted	
			OR (95% CI)	P value	OR (95% CI)	P value
Mean Age (± SD) in years	16.1 (±3.1)	14.9 (±3.2)		0.026		
Age group (years)						
10 – 14	20 (31.7)	34 (43.6)	0.60	0.150		
15 – 24	43 (68.3)	44 (56.4)	(0.30-1.20)			
Sex:						
Female	32(50.8)	41(52.6)	0.93	0.834		
Male	31(49.2)	37(47.4)	(0.48-1.81)			
Educational Level:						
≤ Secondary	58 (92.1)	71 (91.0)	1.14	0.826		
>Secondary	5 (7.9)	7 (9.0)	(0.34-3.79)			
Family history of HTN:						
Yes	7 (13.0)	21 (28.8)	0.37	0.034		
No	47 (87.0)	52 (71.2)	(0.14-0.95)			
Family history of DM:						
Yes	3 (5.7)	6 (8.1)	0.64	0.540		
No	50 (94.3)	68 (91.9)	(0.15-2.68)			
ART Type:						
PI-based	33 (52.4)	14 (17.9)	5.03	<0.001		
Non-PI-Based	30 (47.6)	64 (82.1)	(2.35-10.76)			
ART Duration (years):						
≥ 8	38 (60.3)	53 (67.9)	0.72	0.346		
< 8	25 (39.7)	25 (32.1)	(0.36-1.43)			
CD4 [cells/µl]:						
<500	21 (33.3)	15 (19.2)	2.1	0.056		
≥500	42 (66.7)	63 (80.8)	(0.97-4.53)			
VL (copies/ml:						
≥1000	13 (20.6)	13 (16.7)	1.3	0.546		
<1000	50 (79.4)	65 (83.3)	(0.55-3.05)			
Hypertension:						
Yes	8 (12.7)	5 (6.4)	2.12	0.199		
No	55 (87.3)	73 (93.6)	(0.66-6.85)			
BMI Z score mean	-0.9 (±1.2)	-0.8 (±1.3)		0.639		
Lipids (Mean ±SD)						
TC-mg/dl	149.9 (±32.4)	129.3 (±41.1)		0.001		
HDL-c	54.2 (±13.8)	36.3 (±12.3)		<0.0001		
LDL-c	84.0 (±24.7)	68.6 (±28.7)		0.005		
TACG	75.6 (±19.2)	106.9 (±47.2)		<0.0001		

OR: Odd Ratio, CI: Confidence interval, TC: Total Cholesterol, HDL-c: High density lipoprotein-cholesterol, LDL: Low density lipoprotein-cholesterol, TACG-Triacyglyceride

of dyslipidaemia could allude to the difference in study population, definition of dyslipidaemia; while some studies considered four lipids (total cholesterol, triglyceride, low-density lipoprotein, and high-density lipoprotein, others considered only two lipids (TG, HDL-c). Other plausible reasons for the variation could be due to the use of different national treatment guidelines, genetic differences in socio-demographic characteristics, and environmental factors.

In the current study prevalence of low HDL-c (32.6%) was higher compared to hypertriglyceridaemia (19.9%). The high prevalence of low HDL-c could be because most of the study participants were on non-PI based regimen, in a healthy state with nutritional status within normal limit, and virally suppressed with adequate immune recovery. This finding is in concordance with reports by (Ige et al., 2017) in Nigeria, (Nampijja et al., 2017) in Uganda, and (Innes et al. 2016) in South Africa. However, contrary report of higher prevalence of hypertriglyceridaemia was reported by (Okechukwu et al. 2017) in Nigeria, Viljoen et al in South Africa (Viljoen et al., 2020), (Tadesse et al., 2019) in Ethiopia, and (Blázquez et al., 2015) in Spain. The contrary report of a higher prevalence of hypertriglyceridaemia could be due to the severe disease state or poor immunological state of the study participants. In addition, the higher prevalence of triglycerides in the (Viljoen et al., 2020) work is attributed to its predominant population being on a PI-based regimen based on the South African National guidelines.

However, the risk of developing dyslipidaemia was higher among participants with inadequate physical activity, obesity, and hypertension in the study further explains the multi-factorial cause of dyslipidaemia. The

Table 3. Characteristics of Participants by Level of Triglycerides((TG)

Characteristic	Abnormal TG (n = 28 [19.9%])	Normal TG (n=113 [80.1%])	Crude		Adjusted	
			OR (95% CI)	P value	OR (95% CI)	P value
Age group (years)						
10 – 14	11 (39.3)	43 (38.1)	1.05	0.904	1.85	0.289
15 – 24	17 (60.7)	70 (61.9)	(0.45-2.46)		(0.60-5.72)	
Sex:						
Female	17(60.7)	56 (49.6)	0.64	0.292	0.39	0.082
Male	11(39.3)	57 (50.4)	(0.274-1.48)		(0.14-1.13)	
Educational						
Secondary	27 (96.4)	102 (90.3)				
Tertiary	1 (3.6)	11 (9.7)	3.7981.182			
Physical Activity:						
Inadequate Adequate	15 (53.6)	72 (63.7)	0.657			
	13 (46.4)	41 (36.3)				
ART Type:						
PI –Based	18 (64.3)	29 (25.7)	5.214			
Non -PI based	10 (35.7)	84 (74.3)				
ART Duration (years):						
≥ 8	14 (50.0)	77 (68.1)	0.47	0.08	0.20	0.005
< 8	14 (50.0)	36 (31.9)	(0.20-1.08)		(0.07-0.61)	
CD4 (cells/µl):						
<500	10 (35.7)	26 (23.0)	0.54	0.171	0.46	0.17
≥500	18 (64.3)	87 (77.0)	(0.22-1.31)		(0.15-1.40)	
VL (copies/ml):						
≥1000	4 (14.3)	22 (19.5)	1.45	0.53	3.23	0.101
<1000	24 (85.7)	91 (80.5)	(0.46-4.61)		(0.80-13.14)	
Obesity:						
Yes	1 (3.6)	2 (1.8)	2.06	0.56	1.80	0.700
No	27 (96.4)	111 (98.2)	(0.18-23.51)		(0.09-36.15)	
Hypertension:						
Yes	2 (7.1)	11 (9.7)	0.71	0.67	1.03	
No	26 (92.9)	102 (90.3)	(0.15-3.42)			

OR: Odd Ratio, CI: Confidence interval, ART: Antiretroviral therapy

reduced physical activity potentiating dyslipidaemia is in concordance with previous works on the interplay between the degree of physical activity and dyslipidaemia (LeBlanc and Janssen, 2010; de Lima et al., 2019). In the current study, approximately one-third of study participants perform adequate physical exercise, there is, therefore, a need to motivate adolescents and young people to adopt positive behaviour and lifestyles such as physical exercise, healthy diet amongst other health-promoting measures that could help prevent or mitigate dyslipidaemia and its sequalae.

Furthermore, the risk of developing dyslipidaemia among obese and hypertensive participants in the study affirms the intersection between dyslipidaemia, obesity, and hypertension. This is in addition to the effect of the HIV infection and contribution of ART to metabolic and morphologic alterations that may increase the risk of metabolic and cardiovascular diseases (CVD). This aligns with previous works (Noubiap et al., 2017; Okechukwu et al., 2017; Song et al., 2019).

In the current study, dyslipidaemia and hypertriglyceridaemia were significantly associated with long duration of ART and PI-based ART regimen. This could be related to the effect of prolonged use of ART and PI-based regimen in activating the pathway that increases the production of triglycerides. This finding is in concordance with previous studies (Ige et al. 2017; Nampijja et al., 2017; Okechukwu et al., 2017; Viljoen et al., 2020). Study participants who had not achieved viral suppression (≥1000 cells/ml) were likely to have hypertriglyceridaemia. This is similar to findings by previous works (Grunfeld et al., 1991; Kanjanavanit et al., 2011; Nampijja et al., 2017) which buttresses the ability of the HIV virus to initiate a systemic inflammatory response in an individual as a result of persistent infection leading to increased hepatic lipogenesis and eventual hypertriglyceridaemia. Furthermore, the risk of hypertriglyceridaemia in the older age group of study participants is in keeping with the understanding of the physiology of triglycerides levels, which increases with age (Greenfield et al., 1980). It is thus important to ensure close monitoring among the HIV-infected population considering the role HIV infection and the use of ART plays in potentiating further increase in triglyceride levels.

Table 4. Characteristics of Participants by Level of High Density Lipoprotein-cholesterol (HDL-c)

Characteristics	Normal HDL-c N=95 (67.4%)	Abnormal HDL-c N=46 (32.6%)	Crude			Adjusted		
			O.R.	C.I.	P value	O.R.	C.I.	P value
Age group:								
10 – 14	40(42.1)	14(30.4)	0.602	0.285-1.272	0.183	0.743	0.289-1.909	0.537
15 – 24	55(57.9)	32(69.6))						
Sex:								
Female	53(55.8)	20(43.5)	1.640	0.807-3.336	0.172	1.563	0.704-3.467	0.272
Male	42(44.2)	26(56.5)						
Educational Level:								
Primary	11(11.6)	3(6.5)			0.542			0.683
Secondary	77(81.1)	38(82.6)	1.810	0.476-6.872	0.384	0.612	0.111-3.360	0.572
Tertiary	7(7.4)	5(10.9)	2.619	0.471-14.577	0.272	1.010	0.113-9.000	0.993
Physical activity:								
Adequate	35(36.8)	19(41.3)	0.829	0.404-1.703	0.610	0.923	0.414-2.056	0.845
Inadequate	60(63.2)	27(58.7)						
ART Type:								
Non -PI based	70(73.7)	24(52.2)	2.567	1.228-5.364	0.012	2.060	0.877-4.842	0.097
PI –Based	25(26.3)	22(47.8)						
ART Duration (years):								
< 8	34(35.8)	16(34.8)	1.045	0.500-2.185	0.907	0.785	0.340-1.814	0.572
≥ 8	61(64.2)	30(65.2)						
CD4Count[cells/ml]:								
<500	20(21.1)	16(34.8)	0.500	0.229-1.093	0.082	0.519	0.212-1.270	0.151
≥500	75(78.9)	30(65.2)						
Viral Load [RNA copies/ul:								
<1000	80(84.2)	35(76.1)	0.597	0.249-1.429	0.246	0.657	0.237-1.817	0.418
≥1000	15(15.8)	11(23.9)						
Obesity:								
No	94(98.9)	44(95.7)	4.273	0.377-48.388	0.241	6.727	0.518-87.406	0.145
Yes	1(1.1)	2(4.3)						
Hypertension:			1.886	0.595-5.972	0.281	2.247	0.617-8.182	0.219
No	88(92.6)	40(87.0)						
Yes	7(7.4)	6(13.0)						

Conclusion

The prevalence of Dyslipidaemia in our study population is 44.7% with low HDL-c and hypertriglyceridaemia being the commonest forms. The long-term use of ART and PI-based regimen were significantly associated with dyslipidaemia. Other identified risk factors include obesity, hypertension, and high viral load. Routine evaluation of the lipid profile of adolescents and young people living with HIV is essential to reduce the risk of cardiovascular diseases and its complications.

Limitations

This is a cross-sectional study and so cannot fully establish temporality that are predictive limitations. Though the sample size was not large, the sample size calculation used the existing prevalence of dyslipidaemia in our setting. The study took place in one large HIV treatment center with over 20,000 patients; a multicenter study could increase the strength of the study.

Conflict of interest

The authors declare no competing interest.

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