Original Research Article

Prevalence and cardiovascular risk factors associated with obesity/overweight in adult patients living with HIV/AIDS: Case of the Makokou Outpatient Treatment Center, Ogooué-Ivindo, East Central Gabon

Abstract

Background: Designed to fight HIV/AIDS, antiretroviral drugs (ARVs) may be responsible for certain cardiometabolic abnormalities in people living with HIV (PLHIV). To this end, the present study evaluates the prevalence and impact of obesity/overweight on the development of cardiovascular risk factors in patients at the outpatient treatment center (CTA) of Makokou, in the Ogooué-Ivindo region, in east-central Gabon.

Materials and Methods: This is a cross-sectional and descriptive study, based on a retrospective analysis of the records of patients followed at the HIV/AIDS outpatient treatment center of Makokou from December 2015 to December 2020. A structured questionnaire was used to collect data such as age, gender, socio-economic level, daily habits such as alcohol consumption, tobacco consumption, and physical exercise. Other epidemiological parameters such as body mass index (BMI), and CD4 count were measured.

Results: A total of 165 people living with HIV (PLHIV), the majority of whom were aged 40 years and above (83.6%). treated with antiretrovirals, from December 2016 to December 2021, were collected for this study. With a sex ratio (F/H) of 3.58, women (78.2%) were in the majority compared to men. The mean age was 51 ± 13 years.

While 95.8% of the patients were from the different departments of the province of Ogooué-Ivindo, the remaining patients (4.8%) were from other provinces such as Estuaire, Haut-Ogooué or Ogooué-Lolo. Civil servants represented 21%. The self-employed represented 29%, and the unemployed represented 50%. Only 34% of the participants in the study, the majority of whom were women, engaged in regular physical activity. 5.4% of the patients, mostly men, were active smokers. 34%, especially women, consumed alcohol. 20% of the PLHIV had a medical history of type 2 diabetes mellitus or hypertension (HTA), and the majority were female. 5.4% of the declared hypertensives were on treatment. 7.8% of the hypertensive patients were discovered in consultation. The remainder were normotensive (86.8%). A significant difference in hypertension was observed in patients aged 40 years and over (p=0.0004). The data revealed a positive correlation index (r=0.19) between BMI and hypertension. All the therapeutic combinations with which the patients were treated contained NRTIs, of which the most used were tenofovir disoproxil (TDF) 66.67% and lamivudine (3TC) 33.33% and finally the most used NRTI was Efavirenz (EFV) 76.36%. After 5 years of treatment, 89 PLHIV (53.93%), had CD4 count ≥ 500 cells/mm^3. 53 PLHIV (32%) had CD4 count ranging from 200 - 499 mm^3 and thus moderate immune deficiency and with CD4 count < 200 /mm^3, 23 PLHIV (14%) had severe immune deficiency. HIV-infected patients under 40 years of age had a mean CD4 count of 412 cells/mm^3, which was lower than that of patients 40 years of age and older, which was 556 cells/mm^3 (p=0.01). It was noted that after 5 years, treatment with ARVs was significantly associated with an increase in BMI among PLHIV, (P<0.0015). It was indicated that the increase or decrease of CD4 count in PLHIV, depended on BMI, after 5 years of ARV treatment.

Conclusion This study confirms the existence of an increase in overweight and obesity in people living with HIV/AIDS under antiretroviral treatment. It also shows that obesity had an impact on the development of certain cardiovascular risk factors in these people, which require careful vigilance of the health personnel on their weight gain, due to lipidic parameters such as cholesterol, HDL, Triglycerides.

Keywords: Prevalence; cardiovascular; obesity/overweight; HIV/AIDS; Makokou; Gabon

I. INTRODUCTION

Discovered in the 1980s, HIV is still a pandemic that can affect any person, regardless of gender, age, ethnicity or even culture. Now considered a chronic inflammatory disease due to its morbidity and mortality, HIV is a real public health problem in the world [1]. Since the development of antiretroviral therapies, there has been a real decrease in the incidence of opportunistic diseases and an increase in life expectancy among people living with HIV (PLHIV) [2, 3]. However, despite the improvement in their living conditions, antiretroviral drugs are said to be the cause of new causes of death [4, 5]. Studies have shown a direct involvement of antiretrovirals in abnormalities that may favor the development of certain so-called "cardio-metabolic" diseases [6, 7]. Thus, certain molecules have shown the capacity to promote an imbalance in energy metabolism, leading to weight gain for some. This is the case of protease inhibitors (PI) and non-nucleoside reverse transcriptase inhibitors (NNRTI) [8].

In addition to the consumption of tobacco and alcohol, a sedentary lifestyle and immune deficiency, implicated in the development of certain cardiovascular and metabolic diseases, the development of certain risk factors such as weight gain or obesity in patients under antiretroviral treatment is defined by the increase in body mass index (BMI) [9]. Despite the incrimination of the treatment, HIV is directly involved in a metabolic disorder that leads to dyslipidemia with a high elevation of triglycerides at an advanced stage of the disease [10]. All this disorder orchestrated by the virus itself and the antiretroviral treatment make PLHIV, potential targets at risk for cardio-metabolic diseases. To this effect, the scarcity of studies conducted in this context in Gabon, are the crucible of the lack of data in this regard. Therefore, this study aims to evaluate the prevalence and cardiovascular risk factors associated with obesity/overweight among PLHIV followed at the Makokou Outpatient Treatment Center (CTA-KL) in North-eastern Gabon.

II. PATIENTS AND METHOD

II.1 Type and setting of the study

This is a cross-sectional and descriptive study, based on a retrospective analysis of the records of patients followed at the Makokou HIV/AIDS outpatient treatment center from December 2016 to December 2021. The study population consisted of adult individuals living with HIV and treated with antiretroviral drugs for 5 years.

II.2 Inclusion and exclusion criteria

All other patients were included in this study, except those lost to follow-up, those with missing biological or socioeconomic and demographic data necessary for the study. Data on viral load were not available for all patients for technical reasons, so this parameter was removed from this study.

II.3 Data collection from the medical records of the HIV patients in the study

This consisted in collecting epidemiological parameters such as age, sex, socio-economic level, biological parameters and daily habits such as alcohol consumption, smoking, physical exercise, recorded during the last appointment of the PLHIV, for his or her therapeutic follow-up assessment (TMA). The Body Mass Index (BMI) was considered normal for a value ranging from 18.5 to 24.9 kg/m². The individual was lean for BMI < 18.5 kg/m²; overweight if BMI varied between 25 and 29.9 kg/m² and obese if BMI ≥ 30 kg/m². Severe immune deficiency was defined as CD4 < 200 /mm^3, moderate deficiency as CD4 ranging from 200 - 499 mm^3 and good immunity if CD4 ≥ 500 mm^3.

II.4. Data processing

The collected data were processed in an Excel 2016 database and the statistical analysis was performed using the R software.The tests used were Spearman's rank correlation, exact binomial test, Studen's test, One-factor Anova. The threshold of significance was 5%.

II.5. Ethical considerations

Ethical authorization for data collection was obtained through an administrative agreement from the Director of the Makokou HIV/AIDS Outpatient Treatment Center (CTA).

III. RESULTS

III.1 Socio-demographic characteristics of the PLHIV in the study

A total of 165 patients were recruited for this study, with a sex ratio F/M = 3.58, there was a predominance of women, 129 (78.2%) for 36 (21.8%) men. The mean age was 51 ± 13 years, with patients aged 40 years and over being the most represented (83.6%). With a minimum age of 19 years and a maximum age of 82 years, the patients came from the different departments of the Ogooué-Ivindo province, our study site, and from certain neighbouring provinces. 53.9% of the patients came from Makokou (Ivindo), which is the chief town of the province, 32.3% from Mékambo (Zadié), 7.8% from Boué (Lopé), 1.2% from Ovan (Mvoung), and the remainder, including 4.8%, came from other provinces such as Estuaire, Haut-Ogooué or Ogooué-Lolo. Divided into 3 groups, the population of this study was composed of civil servants who represented 21%, the private sector, made up of self-employed people such as traders, farmers, represented 29%, and the unemployed, made up of the unemployed, pupils or students, represented 50%. Only 34% of the participants in the study, the majority of whom were women, were engaged in regular physical activity defined as work in the fields and on forestry sites. While 5.4% of the patients, mostly men, were active smokers, 34% of the patients consumed alcohol, mostly women. Table 1

Table 1: Socio-demographic characteristics of the PLHIV in the study

Parameters	Number	Percentage (%)
Gender		
Male	36	21.8
Female	129	78.2
Age		
< 40 ans	27	16.4
≥ 40 ans	138	83.6
Departments		
Ivindo	89	53.9
Zadié	53	32.3
Lopé	13	7.8
Mvoung	2	1.2
Others	8	4.8
Professional category		
Civil servants	35	21
Self-employed	48	29
Unemployed	82	50

Physical activities		
Yes	56	34
No	109	66
Smokers		
Yes	9	5.4
No	156	94.6
Alcohol		
Yes	56	34
No	109	66

III. 2. Medical history of the PLHIV in the study

Taking into account the medical history, 20% of the PLHIV in this study admitted to having had a medical history of type 2 diabetes mellitus or high blood pressure (HBP), the majority of whom were female. 5.4% of the PLHIV were declared hypertensive and on treatment. 7.8% of the patients with HBP were discovered during follow-up visits. The remainder were normal HBP (86.8%) Table 2.

Table 2: Medical history of the PLHIV in the study

Medical history	Numbers	Percentages (%)
Yes	33	20
No	132	80
Hight Blood pressure		
Known and treated HBP	9	5.4
HBP unknown	13	7.8
Normal HBP	143	86.8

III.3 Correlation between age and hypertension of PLHIV study Regardless of gender, there was a significant difference in the presence of high blood pressure, which was higher in PLWHIV aged 40 years and over, than in those under 40 years (p=0.0004). The data revealed a positive correlation index (r=0.19) between BMI and hypertension. Table 3

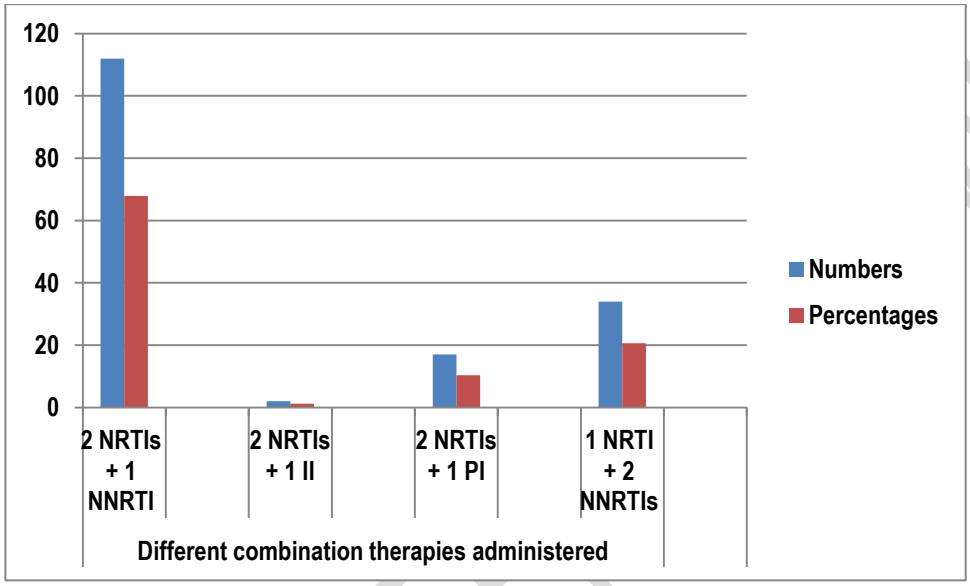
Table 3: Correlation between age and blood pressure in study patients.

Age groups	**Blood pressure** (HTA)	**Percentage (%)**	**p-value**
< 40 ans	27	16.36	
≥ 40 ans	138	83.64	p= 0.0004*

III.4. Therapeutic combinations used by study PLHIV

During the five years covering the time interval for this study, the different therapeutic combinations used to treat HIV patients consisted of Nucleoside Reverse Transcriptase Inhibitors (NRTI), Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTI), Protease Inhibitors (PI) and Integrase Inhibitors (II). These different first-line combination therapies were composed of : 2 NRTI + 1 NNRTI n=112 (67.88%), 2 NRTI + 1 II n=2 (1.21%), 2 NRTI + 1 PI n=17(10.30%) and 1 NRTI + 2 NNRTI n=34 (20.61%). It can be seen that all the combinations contained NRTIs, the most used of which were tenofovir disoproxil (TDF) with 66.67% and lamivudine (3TC) with 33.33% and finally the most used NNRTI was Efavirenz (EFV) with 76.36%. Figure 1

Figure 1: Different therapeutic combinations administered to PLHIV during the study



III.5. Distribution of the CD4 count after 5 years of treatment of the PLHIV in the study

Speaking of severe immune deficiency for a CD4 rate < 200 /mm3, moderate deficiency for a CD4 rate ranging from 200 - 499 mm3 and good immunity if CD4 ≥ 500 mm3, after 5 years of treatment, 89 PLHIV of the study or 53.93%, had a CD4 rate ≥ 500 cells/mm3. 53 PLHIV or 32% had a CD4 rate ranging from 200 - 499 mm3 and thus a moderate immune deficiency and with a CD4 rate < 200 /mm3, 23 PvVIH or 14% had a severe immune deficiency. The HIV-infected patients in the study who were less than 40 years old had a mean CD4 count of 412 cells/mm^3 , which was lower than that of patients 40 years and older, which was 556 cells/mm3 (p=0.01). Table 4.

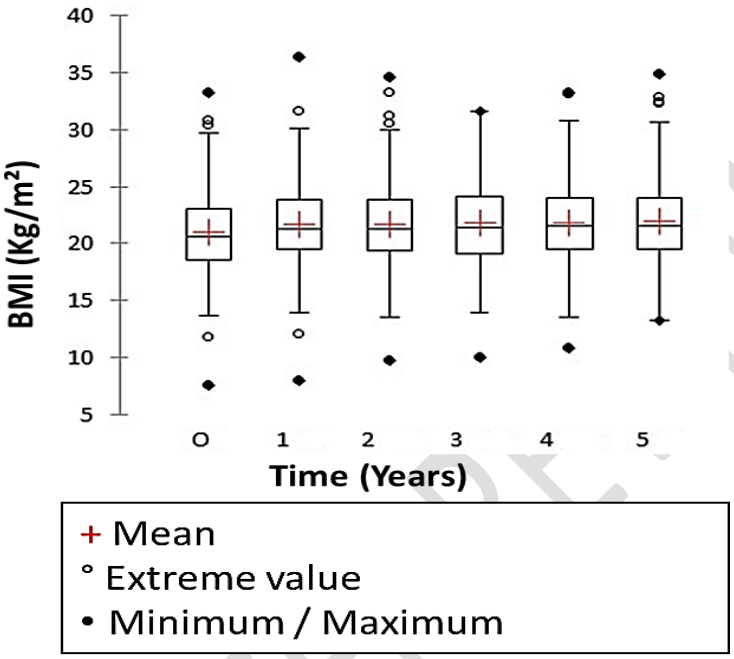
Table 4: Distribution of CD4 count after 5 years of antiretroviral treatment for HIV patients in the study

Age groups (years)	**CD4 rate after 5 years of treatment of study PLHIV**			
	< 200	200 -499	≥ 500	p-value
< 40	2	11	14	-
≥ 40	21	42	75	0,01
Total number of PLHIV	23	53	89	-

III.6. Evolution of the BMI of the patients, according to the weight taken at each check-up in the study PLWHIV.

Figure 2, represented by box plots, shows that thanks to a symmetry of BMI distribution around the median during the 5 years of follow-up of the PlwHIV, the median and the mean remained very close. While the maximum values of BMI tended to stabilize around 35 kg/m², the minimum values followed an increasing curve, thus indicating an increase in BMI of the PLWHIV observed, from the first (p=0.0001), until the fifth year of treatment.

Figure 2. Boxplots represent the distribution of BMI from case opening (OD) to year five of treatment



III.7. Prevalence of BMI between the opening of the file (OD) and after 5 years of antiretroviral treatment (ART).

The observation of the distribution of the PLWHIV in the study according to BMI levels showed that for a BMI lower than 18.5 kg/m², there were 30 PLWHIV at the opening of the file against only 25 after 5 years of treatment. For a BMI between 18.5 and 24.9 kg/m², there were 104 PLHIV at the beginning of the file compared to 93 PLHIV after 5 years of treatment. For a BMI value between 25 and 29.9 kg/m², there were 31 PLWHA at the opening of the file against 40 PLWHA after 5 years of treatment. Finally, for a BMI greater than or equal to 30 kg/m² considered as obese, there were none at the opening of the file (OD), but 5 years later, there were 7 PLWHA. It was noted that 71 or 43.03% of the PLWHIV in the study treated with antiretrovirals were overweight and 7 or 4.42% were obese. The analysis of the level of significance of the differences observed in the percentage of PLWHIV at the opening of the file (OD) and after 5 years of antiretroviral treatment (ART) according to BMI values was carried out using an exact binomial test, with a 95% confidence interval. The test was considered significant when p-value ≤ 0.05. We can see that after 5 years, treatment with ARV is significantly associated with an increase in BMI among PLWHIV with a BMI greater than or equal to 30 kg/m² (P<0.0015) Table 5.

Table 5. Prevalence of BMI at baseline (OD) and 5 years after ART.

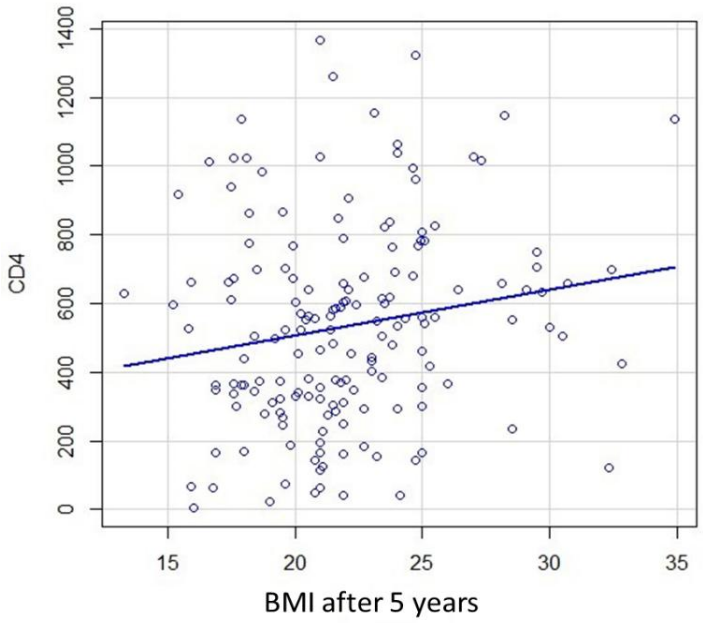
IMC (KG/M²)	OD	5 YEARS AFTER	TOTAL	BINOMIAL TEST		
				P(OD)	IC95%	p-value
< 18,5	30	25	55	0,54	[0,3 – 0,6]	0,5901
18,5 - 24,9	104	93	197	0.52	[0,4 – 0,68]	0.5024
25 - 29,9	31	40	71	0,43	[0,31 – 0,55]	0,3425

≥ 30	0	7	7	0	[0,37 – 0,44]	< 0,0015*
TOTAL	165	165	330	0 ,5	[0,44 – 0,55]	1
*** SIGNIFICATIVE TEST.**						

III.8. Correlation between CD4 count and BMI after 5 years of antiretroviral treatment

Figure 3 shows a significantly positive correlation between BMI and CD4 count of the HIV patients in this study. With a correlation coefficient r= 0.1 (p=0.02), there is a clumping of a cloud of points around the correlation line, indicating that the increase or decrease in CD4 count in HIV-infected individuals was dependent on BMI after 5 years of antiretroviral treatment.

Figure 3: Correlation between CD4 count and BMI after 5 years of antiretroviral treatment



IV. DISCUSSION

Socio-demographic characteristics of PLWHA in the study

The objective of this study was to evaluate the prevalence and cardiovascular risk factors associated with obesity/overweight in adult patients living with HIV/AIDS: the case of the Makokou Outpatient Treatment Center in east-central Gabon. The population of this study was predominantly female, with a sex ratio (F/H) of 3.58. This corroborates with studies conducted in Burkina Faso that indicated a sex ratio (F/H) of 3.6, as opposed to 0.8 found by other studies [11]. These data may be related to the large female population in our study area, but also to the current feminization of HIV/AIDS infection [12], due to the anatomy of the female genital tract, which is a more favorable environment for HIV infection than that of the male. Furthermore, if women are more likely to be

tested for HIV than men, it is because they are more willing to be tested; and above all, the establishment of a mandatory HIV sentinel surveillance for pregnant women, initiated within the framework of the Prevention of Mother-to-Child Transmission of HIV (PMTCT) in the world, contributes largely to the testing of a large number of women [13]. This category of young adults, the majority of whom are aged 40 and over (83.6%), explains the youthfulness of the study population, which is highly sexually active and often more affected by HIV/AIDS, but more aware of and more active in the therapeutic follow-up of the infection [12]. Consistent with work done elsewhere, half of the study population was unemployed, mostly sedentary and physically inactive (66%)[14]. 14] Although lower, this result is consistent with other studies that have shown that more than 90% of PLWH were sedentary [15].

Medical history of the PLWHIV in the study

In this study, only 33 PHAs or 20% admitted to a medical history of type 2 diabetes mellitus or hypertension, the majority of whom were female. Contrary to some studies that have reported prevalences two to three times higher in people living with HIV [16], this study shows that 13.2% of PLWHIV were hypertensive. This result is close to that of Djalloh et al who obtained 14.9% [17] and that of Mukeba-Tshialala et al who reported a prevalence of 11.5% [14].This could be explained by the presence of other co-infections, such as the Hepatitis C virus, especially in women, as reported in a Spanish study [18].

Correlation between age and high blood pressure (BP) in study PHAs

Although the prevalence of hypertension was high in this study, in contrast to a Spanish study that found that age was not a factor associated with hypertension in PLWHIV [18], a positive association between hypertension (AH) and age was observed. Thus, the age group of 40 years and older was the most at risk [15].

Anthropometric and biological data of PLWHIV in the study

The different first-line combination therapies used to treat the PLWHIV in this study consisted of : 2 NRTIs + 1 NNRTI (67.88%), 2 NRTIs + 1 PI (1.21%), 2 NRTIs + 1 PI (10.30%) and 1 NRTI + 2 NNRTIs (20.61%). These results are not far from those obtained elsewhere [11,13], For the different combinations, we see that all the combinations contained NRTIs, the most used of which were tenofovir disoproxil (TDF) with 66.67% and lamivudine (3TC) with 33.33% and finally the most used NNRTI was Efavirenz (EFV) with 76.36%.This corroborates with the fact that the choice of therapeutic combination is very important from the beginning of the treatment. This choice is often made on a case-by-case basis, with the particularities of each patient.

Distribution of CD4 count after 5 years of treatment in the study population

After 5 years of antiretroviral treatment, 89 PLWHIV in the study, or 53.93%, had a CD4 count ≤ 500 cells/mm3. This result is close to the study conducted by Pugliese et al which found a prevalence of 52% [19]. In this study, individuals 40 years and older had a higher average CD4 count than those under 40 years of age. This result is contrary to that obtained in a study that showed an inverse correlation between age and CD4 count[, justifying that young age favored rapid restoration of immunity due to preserved thymic function [20].

Evolution of the BMI of the patients, according to the weight taken at each check-up in the HIV patients in the study.

Similar to other studies, this study showed a significant increase in BMI during the first year of treatment [21], which continued to evolve this time, in a non-significant way until the fifth year. At the end of 5 years of treatment with antiretrovirals, the prevalence of overweight/obesity among the patients in this study was 18%. This result is identical to that obtained in a study conducted in the DRC among PLWHA [14], and could corroborate with the initial choice of the different therapeutic combinations

Distribution of BMI between the opening of the file (OD) and after 5 years of antiretroviral treatment (ART).

The analysis of the level of significance of the differences observed in the percentage of PLWHIV at the opening of the file (OD) and after 5 years of antiretroviral treatment (ART), according to the BMI values carried out using an exact binomial test, with a 95% confidence interval, and considered significant when p-value ≤ 0.05, showed that after 5 years, ART treatment was significantly associated with an increase in BMI in PLHIV with a BMI greater than or equal to 30 kg/m² (P<0.0015). These results are in agreement with those obtained from studies elsewhere, in which it has been indicated that, combinations of ARVs were more lipidogenic, and, this is the case of the INT+IP combination [22].

Correlation between CD4 count and BMI after 5 years of antiretroviral treatment

Contrary to the data obtained by Crum-Cianflone [23] who indicated that the increase in BMI could result in a decrease in CD4 replication rate, this study observed a positive correlation between BMI and CD4 rate, as reported by Womack and colleagues who showed an association between morbid obesity and a high CD4 rate[24].

V. CONCLUSION

The prevalence of obesity/overweight in patients living with HIV evolved to nearly 3% in 5 years of antiretroviral treatment. This was independent of age; however, it had an impact on the increase in blood pressure and the evolution of CD4 count. In addition to age beyond 40 years, weight gain was one of the most important cardiovascular risk factors in PLWHIV. This weight gain was very important from the first year of treatment and appeared to change slightly during follow-up. These results invite treating physicians and health care personnel, responsible for the follow-up of PLWHIV, to monitor the weight gain of PLWHIV to prevent the development of cardio-metabolic diseases related to HIV and antiretroviral drugs.

Data availability

Data supporting the conclusion are available upon request from the corresponding author.

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