International Journal of Research in Medical Sciences
Njongang VN et al. Int J Res Med Sci. 2020 Oct;8(10):3481-3487
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20204220

Original Research Article

Prevalence and components of metabolic syndrome in HIV-infected patients at the Tiko Central Clinic and Cottage Hospital in Cameroon

Vigny N. Njongang[1,3]*, Assob J. C. Nguedia[1,2], Ojong E. Walter[1]

[1]Department of Medical Laboratory Sciences, [2]Department of Biomedical Sciences, University of Buea, Buea, Cameroon
[3]Department of Medical Laboratory Sciences, Maflekumen Higher Institute of Health Sciences Tiko, Tiko, Cameroon

Received: 02 August 2020
Accepted: 05 September 2020

***Correspondence:**
Vigny N. Njongang,
E-mail: N.Vigny64@gmail.com

ABSTRACT

Background: HAART and HIV related metabolic syndrome (MS) is associated with increased cardiovascular risk in aging HIV patients. This study was aimed at comparing the prevalence of MS between HIV-infected patients on HAART and apparently healthy HIV-uninfected individuals and identifying key MS components in these groups of subjects.
Methods: This was a hospital-based case-control study. The cases were HIV sero-positive individuals on HAART for at least 6 months and controls were HIV sero-negative individuals.
Results: 74/135 (54.8%) participants were females amongst which 53/75 (70.7%) and 21/60 (35%) were in the test and control groups respectively. The prevalence of MS was insignificantly higher in HIV-infected patients on HAART than in control subjects according to the IDF (22.7% versus 20%, p=0.834) and NCEP ATP III criteria (18.7% versus 18.3%, p=1.000) respectively. The most prevalent components of MS in HIV-infected patients on HAART were low HDL-c (100%), abdominal obesity (IDF: 68%, ATP III: 32%), and hypertension (28%). Multivariate analysis of MS components in HIV-infected patients on HAART revealed that hypertension (OR: 15.996, 95% CI: 3.385-75.585; p≤0.001) and high blood glucose (OR: 10.760, 95% CI: 1.642-70.505; p=0.013) were associated with MS. Significantly more HIV-infected females were seen with abdominal obesity than HIV-infected males (86.8% versus 4.5%, p≤0.001).
Conclusions: Abdominal obesity is a driving component of MS in HIV-infected patients particularly among females and hypertension is a prevalent and predictor component of MS among HIV patients.

Keywords: Cardiovascular disease, Components, HAART, HIV, Metabolic syndrome, Prevalence

INTRODUCTION

Highly active anti-retroviral therapy (HAART) used by human immunodeficiency virus (HIV) patients since the mid-1990's has led to a significant drop in HIV related mortality.[1] Nevertheless, metabolic disorders (hypertriglyceridaemia, reduced HDL cholesterol, abdominal obesity, hypertension, and insulin resistance) jointly termed metabolic syndrome is linked to HIV and HAART and associated with elevated cardiovascular disease risk in these patients as they age.[2]

A systematic review and meta-analysis study conducted in South Africa by Olamide and associates recently demonstrated that the prevalence of metabolic syndrome in sub-Saharan Africa is 12% for HIV-uninfected individuals and 21.5% for HIV infected subjects and this difference is statistically significant.[3] This study further mentioned that most studies in Africa have reported hypertension and high triglycerides as common components of metabolic syndrome among HIV-infected patients.[3] Kim et al in another systematic review and meta-analysis study conducted in Africa in 2016 revealed

that significantly more ART users had metabolic syndrome than non-ART users among HIV-infected individuals.[4] Recent studies conducted out of Africa have reported that the driving components of metabolic syndrome in HIV patients on HAART are low HDL cholesterol and high triglycerides.[5,6] In contrast, central obesity and high triglycerides were reported by Alfred et al in Kenya though the finding of Agete et al in Ethiopia is in support of findings reported out of Africa.[7,8]

In Cameroon, HAART coverage has drastically risen from 26 % in 2013 to 55% in 2018.[9,10] However, limited information on the prevalence and most common components of metabolic syndrome in HIV-infected patients exists in Africa especially in Cameroon. The aim of this study was to compare the prevalence of metabolic syndrome between HIV-infected patients on HAART and HIV-uninfected individuals and identify the key components of metabolic syndrome in both groups of subjects attending the Tiko Central Clinic and Cottage Hospital in Cameroon. This study shall provide information on the most prevalent components of metabolic syndrome in HAART-experienced HIV patients and HIV-uninfected individuals in Cameroon in an attempt to reduce the rising burden of metabolic syndrome particularly in HIV sero-positive patients on HAART.

METHODS

Study duration, setting, and sampling technique

This study was conducted over a four-month period, from March to June 2016, at the treatment center of people living with HIV/AIDS, at the Tiko Central Clinic and Cottage Hospital. Over 1500 patients receive their treatment at this center. The patients attend the clinic once a month for clinical evaluation and refill of anti-retroviral therapy (ART). A consecutive sampling technique was employed to recruit eligible participants. The goals of the study, research procedure, risks and benefits of this research were explained to the study participants and only consenting individuals were included in the study.

Ethical considerations

Ethical approval was obtained from the Faculty of Health Sciences Institutional Review Board (FHSIRB) of the University of Buea, Cameroon (reference number: 2014-02-0514). Administrative authorizations were obtained from the following authorities: regional delegate of public health in Buea, district medical officer in Tiko, director of human resource in Limbe, and from the chief medical officer in Tiko.

Inclusion and exclusion criteria

The study population included all adult HIV sero-positive and HIV sero-negative persons attending the Tiko Central Clinic and Cottage Hospital for routine health assessment. We included all people living with HIV/AIDS PLWHA aged at least 25 years and excluded patients on highly active anti-retroviral therapy (HAART) for less than 6 months including defaulters of treatment regimen, pregnant and lactating women, those with documented hypertension, diabetes and dyslipidaemia before commencing HAART and those with any acute illness that required medical/surgical treatment or admission. HAART was defined as the use of ≥2 nucleoside reverse transcriptase inhibitors (NRTIs) and at least one non-nucleoside reverse transcriptase inhibitor (NNRTI); or ≥2 NRTIs and at least one protease inhibitor (PI).

Administration of questionnaires

A structured questionnaire was used to collect socio-demographic data from the participants while their medical records were accessed to obtain clinical information such as their recent CD4+ T cell count, HIV status, type and duration of HAART regimen. Following a 10 minute resting period, while a participant was seated, 2 blood pressure measurements (systolic and diastolic) were taken in the left arm with an interval of 3 minutes using a wrist digital blood pressure monitor LD-732A (Scian, Shanghai, China). The average blood pressure reading was calculated and used as the participants' actual blood pressure. Waist circumference (WC) was measured to the nearest 0.1 cm with patients wearing light clothing at the midpoint between the lowest rib and the iliac crest using an inelastic tape in light contact with but not compressing the skin. Hip circumference (HC) was also measured with an inelastic tape around the widest portion of the buttocks in light clothing to the nearest 0.1 cm. The waist-to-hip ratio was then calculated by dividing the WC by HC. The weight of each participant was measured using a Kinlee calibrated weighing scale (Healthometer, Florida, USA) in light clothing, with shoes off. Height was measured using a stadiometer to the nearest 0.1 cm.

Sample collection and analysis

Following this, 3 ml of venous blood was obtained, under strict aseptic conditions, after an overnight fast (8-12 hours). Fasting blood glucose was measured using the Accu Chek® Compact Plus glucometer (Roche Diagnostics GmbH, Mannheim, Germany) at the spot. Serum was then collected and stored in eppendorf tubes until analysis. Lipid profiles of the participants' sera were later measured in batches using a MINDARY spectrophotometer, a BA-88A semi-auto chemistry analyser with touch-screen and pop-up keypad (Mindray Bio-Medical Electronics, Shenzhen, China) according to the manufacturer's instruction. Triglycerides level was measured based on the Glycerol phosphate oxidase method. HDL-C level was measured based on the Chemical precipitation technique in the presence of phosphotungstic acid and Mg^{2+} ions.

Definition of operational terms

In accordance with the US National Cholesterol Education Program, Adult Treatment Panel III (NCEP-ATP III) guidelines, abnormal lipid profile was defined as TC ≥ 200 mg/dl, HDL-c <40 mg/dl, LDL-c ≥130 mg/dl, TG ≥150 mg/dl and TC/HDL-c ratio ≥5. Abdominal obesity was defined as WC >102 cm in men or WC >88 cm in women. Overweight was defined as body mass index (BMI) of 25-29.9 kg/m^2 and obesity, BMI of ≥30 kg/m^2. Hypertension was defined as SBP ≥140 mmHg and/or DBP ≥90 mmHg or current use of anti-hypertensive drug and diabetes was defined as FBS ≥126 mg/dL.[20] The following parameters were defined as follows: Physical inactivity (failure to engage in physical activities, recreation or work that lasted <30 minutes per day for <3 times in a week), abnormal WHR (>0.85 for females and >0.95 for males), insufficient fruit /vegetable consumption (failure to consume fruit or vegetable daily), alcohol excess (>7 local beers for men and >4 local beers and per week for women whereby 1 local beer =28 gm alcohol).

Metabolic syndrome was defined based on NCEP ATP III and IDF criteria. According to NCEP ATP III criteria, metabolic syndrome was defined as having ≥3 of the following criteria: I) Elevated fasting glucose: ≥100 mg/dl or diabetes mellitus; II) Elevated triglycerides: ≥150 mg/dl or treatment; III) Elevated waist circumference (abdominal obesity): ≥102 cm for men and ≥88 cm for women; IV) reduced HDL-c: <40 mg/dl in men and <50 mg/dl in women; V) Elevated blood pressure (Hypertension): SBP ≥130 mmHg or DBP ≥85 mmHg or treatment.[21] According to IDF criteria, metabolic syndrome was defined as having abdominal obesity (waist circumference of 80 cm in women and 94 cm in men or BMI ≥30 kg/m^2) in addition to at least two of the following components: I) Elevated fasting glucose: ≥100 mg/dl or diabetes mellitus; II) Elevated triglycerides: ≥150 mg/dl or treatment; III) reduced HDL-c: <40 mg/dl in men and <50 mg/dl in women or treatment; IV) Elevated blood pressure (hypertension): SBP ≥130 mmHg or DBP ≥85 mmHg or treatment.[19]

Statistical analysis

Data analysis was performed on SPSS version 21.0 (IBM Corporation, New York) using Chi-square (χ^2) test and multivariate logistic regression.

RESULTS

A total of 135 participants were recruited, 75 (55.6%) were HIV sero-positive amongst which 53 (70.7%) were females and 60 (44.4%) were HIV sero-negative amongst which 39 (65%) were males. The mean age was 42.04±9.61 years in the HIV sero-positive group and 39.00±11.3 years in the control group. The median duration on HAART was 42.0 (18-82) months (Table 1).

Table 1: Demographic characteristics of study population.

Parameter		HIV sero-positive group (n=75)	HIV sero-negative group (n=60)	Total (n=135)
Gender	Male	22 (29.3)	39 (65.0)	61 (45.2)
	Female	53 (70.7)	21 (35.0)	74 (54.8)
Age (years)	<40 years	34 (45.3)	39 (65.0)	73 (54.1)
	≥40 years	41 (54.7)	21 (35.0)	62 (45.9)
Occupation	Salary employed	43 (57.3)	45 (75.0)	88 (65.2)
	Self employed	22 (29.3)	12 (20.0)	34 (25.2)
	Unemployed	8 (10.7)	2 (3.3)	10 (7.4)
	Retired	2 (2.7)	1 (1.7)	3 (2.2)
Marital status	Married/Cohabitation	38 (50.7)	33 (55.0)	71 (52.6)
	Single	32 (42.7)	23 (38.3)	55 (40.7)
	Divorced	5 (6.7)	4 (6.7)	9 (6.7)
Level of education	No formal education	4 (5.3)	5 (8.3)	9 (6.7)
	Primary	39 (52.0)	28 (46.7)	67 (49.6)
	Secondary	28 (37.4)	18 (30.0)	46 (34.1)
	Tertiary	4 (5.3)	9 (15.0)	13 (9.6)
CD4+ T cell count* (cells/µl)	<250	17 (23.6)	-	-
	250-500	27 (37.5)	-	-
	>500	28 (38.9)	-	-
Duration of HIV infection (months)	Median (IQR)	63 (28-67)	-	-
Duration of HAART (months)	Median (IQR)	42 (18-82)	-	-
Type of HAART regimen	TDF+3TC+EFV	47 (62.7)	-	-

Continued.

Parameter		HIV sero-positive group (n=75)	HIV sero-negative group (n=60)	Total (n=135)
	AZT+3TC+NVP	23 (30.6)	-	-
	AZT+3TC+EFV	2 (2.7)	-	-
	TDF+3TC+LPV+RTV	2 (2.7)	-	-
	TDF+3TC+NVP	1 (1.3)	-	-
Number of participants by HAART agent	3TC	75 (100.0)	-	-
	TDF	50 (66.7)	-	-
	EFV	49 (65.3)	-	-
	AZT	25 (33.3)	-	-
	NVP	24 (32.0)	-	-
	LPV+RTV	2 (2.7)	-	-

*CD4+ T cell count available only for 72 participants; *Number of participants by HAART agent (No.)
Abbreviations: HAART, Highly Active Antiretroviral therapy.

Table 2: Prevalence of metabolic syndrome in the study population based on HIV status.

Parameter	HIV uninfected (n=60) No. (%)	HIV infected (n=75) No. (%)	Total (n=135) No. (%)	χ^2	P value
Prevalence of MS (NCEP ATP III criteria)	11 (18.3)	14 (18.7)	25 (18.5)	0.002	1.000
Prevalence of MS (IDF criteria)	12 (20.0)	17 (22.7)	29 (21.5)	0.141	0.834

Abbreviations: MS, Metabolic Syndrome; IDF, International Diabetes Federation; NCEP, National Cholesterol Educational Panel.

The prevalence of metabolic syndrome was insignificantly higher in the HIV-infected patients on HAART than in the HIV-uninfected subjects according to the IDF (22.7% versus 20%, p=0.834) and NCEP ATP III criteria (18.7% versus 18.3%, p=1.000) respectively as shown in Table 2.

Table 3: Prevalence of metabolic syndrome components in the study population based on HIV status.

Metabolic syndrome components		HIV uninfected (n=60) No. (%)	HIV infected (n=75) No. (%)	Total (n=135) No. (%)	χ^2	P value
High TG		12 (20.0)	3 (4.0)	15 (11.1)	8.640	0.005
Abdominal obesity	IDF criteria	21 (35.0)	51 (68.0)	72 (53.3)	14.585	<0.001
	NCEP ATP III criteria	13 (21.7)	24 (32.0)	37 (27.4)	1.789	0.244
High blood glucose		7 (11.7)	11 (14.7)	18 (13.3)	0.260	0.800
Hypertension		34 (56.7)	21 (28.0)	55 (40.7)	11.346	0.001
Low HDL-c		42 (70.0)	75 (100)	117 (86.7)	25.962	<0.001

Abbreviations: TG, Triglyceride; HDL-c, High Density Lipoprotein cholesterol.

Table 4: Prevalence of metabolic syndrome components in HIV infected participants based on gender.

Metabolic Syndrome components	HIV-infected Males (n=22)	HIV-infected females (n=53)	Total (n=75)	χ^2	P value
High blood glucose	3 (13.6)	8 (15.1)	11 (14.7)	0.288	0.866
Hypertension	9 (40.9)	12 (22.6)	21 (28.0)	13.495	0.001
Low HDL-c	22 (100)	53 (100)	75 (100)	25.962	<0.001
High TG	2 (9.1)	1 (1.9)	3 (4.0)	9.457	0.009
Abdominal obesity (IDF criteria)	1 (4.5)	46 (86.8)	47 (62.7)	56.372	<0.001

Abbreviations: MS, Metabolic Syndrome; IDF, International Diabetes Federation; TG, Triglyceride; HDL-c, High Density Lipoprotein cholesterol.

The most prevalent components of metabolic syndrome in the HIV-infected participants were low HDL-c (100%), abdominal obesity (IDF: 68%, ATP III: 32%), and hypertension (28%). However, only low HDL-c (100% versus 70%, p≤0.001) and abdominal obesity (IDF: 68% versus 35%, p≤0.001) were significantly higher in the HIV-infected participants than in those without HIV respectively (Table 3).

The most prevalent components of metabolic syndrome in HIV sero-positive females were low HDL-c (100%), abdominal obesity (86.8%), and hypertension (22.6%). Nevertheless, significantly more HIV-infected females were seen with solely abdominal obesity than in HIV-infected males (86.8% versus 4.5%, p≤0.001). High blood glucose was more frequently detected in HIV infected females relative to HIV-uninfected males with no statistical significance (86.8% versus 4.5%, p=0.866)

Table 4. Multivariate analysis of the components of metabolic syndrome in HIV-infected patients on HAART revealed that hypertension and high blood glucose were the only components associated with metabolic syndrome. HIV patients with hypertension had a higher odds of metabolic syndrome (OR: 15.996, 95% CI: 3.385-75.585) compared to those with high blood glucose (OR: 10.760, 95% CI: 1.642-70.505) Table 5.

Table 5: Multivariate analysis of metabolic syndrome components in the HIV infected participants.

Metabolic syndrome components	HIV-infected Without MS (n=57)	HIV-infected With MS (n=18)	Total (n=75)	OR (95% CI)	P value
High blood glucose	3 (5.3)	8 (44.4)	11 (14.7)	10.760 (1.642-70.505)	0.013
Hypertension	9 (15.8)	12 (66.7)	21 (28.0)	15.996 (3.385-75.585)	<0.001
Low HDL-c	57 (100)	18 (100)	75 (100)	2.221 (2.221-2.221)	-
High TG	2 (3.5)	1 (5.6)	3 (4.0)	2.407 (0.094-61.780)	0.596
Abdominal obesity (IDF criteria)	33 (57.9)	18 (100)	51 (68.0)	65471356.87 (0.000-no value)	0.990

Abbreviations: MS, Metabolic Syndrome; IDF, International Diabetes Federation; TG, Triglyceride; HDL-c, High Density Lipoprotein cholesterol.

DISCUSSION

This study reveals an insignificantly higher prevalence of metabolic syndrome in HIV-infected patients on HAART than in HIV-uninfected persons. Moreover, it demonstrates that the most common components of metabolic syndrome in HIV sero-positive patients are low HDL-c, abdominal obesity and hypertension among which only hypertension is a predictor component. Lastly, it is highlighted in this research that more HIV-infected females have high blood glucose and abdominal obesity compared to HIV-infected males with a significant difference observed only for abdominal obesity.

The reported insignificantly higher prevalence of metabolic syndrome in the HIV-infected on HAART than in HIV sero-negative persons is in conformity with the findings (17/76-22.4% versus 14/70-20.0%) reported by Jyothi et al in India and inconsistent with the findings reported by: Herbert et al in Cameroon in 2014 who reported the prevalence of metabolic syndrome in ART exposed HIV patients, ART naïve HIV patients and sero-negative individuals, South African investigators in 2019 who reported the prevalence rates of metabolic syndrome and its components in HIV patients and HIV-uninfected subjects in a systematic review and meta-analysis study, and Paolo et al in 2007 in Italy who compared the prevalence of metabolic syndrome (MS) in HIV-positive patients with that from a sample of a general Italian population.[3,6,11,12] This could be due to the differences in sample size.

Our study demonstrated that low HDL-c, abdominal obesity and hypertension are the most prevalent components of metabolic syndrome in HIV-infected patients. This finding is in support of the findings revealed by Gibson et al in 2014 who estimated the prevalence and risk factors for metabolic syndrome (MetS) among HIV positive patients on antiretroviral therapy (ART) in Tanzania.[13] Conversely, our finding is not in line with findings estimated by: Henriette et al in Cameroon whose reports in 2014 on the prevalence of metabolic syndrome and its individual components among HIV-infected Cameroonians revealed that hypertriglyceridaemia, low HDL-c and abdominal obesity are the most prevalent components of metabolic syndrome; Alfred et al in 2018 in Kenya who reported central obesity, high triglycerides, and high blood glucose after assessing the prevalence and risk factors for MetS among ART-naive and ART-experienced HIV-infected adults without preexisting cardiometabolic disorders in Western Kenya; Girma et al in 2020 in Southern Ethiopia who revealed hypertension, high blood glucose and central obesity after estimating and evaluating the magnitude of MS among ART exposed and ART naïve HIV-infected patients; and Herbert and colleagues in Cameroon in 2014 who reported hyperglycaemia, abdominal obesity and low HDL-c for HIV patients on first line ART and low HDL-c, abdominal obesity, and hyperglycaemia for those on second line ART after estimating the prevalence of MS in Cameroonian HIV-infected subjects receiving different combinations of HAART as well as HIV patients who had never received antiretroviral drugs.[7,11,14,15] The observed differences might have stemmed from the following differences existing in our study: most HIV patients on HAART were exposed to efavirenz, shorter study duration, absence of HAART naïve HIV patients, smaller sample size, and younger HAART experienced HIV patients. Moreover, our finding is contradictory to findings reported out of

Africa: Alvarez et al in Latin America revealed high triglycerides, low HDL-cholesterol and high blood pressure (HBP); Laiz et al in Brazil reported low HDL-c, high triglycerides, and elevated waist-circumference; Paolo and colleagues in Italy reported high triglycerides, low HDL-c and hypertension; Sarita and associates in India revealed low HDL-c, high triglycerides, and high blood glucose.[12,26-18] The difference in race between HIV patients on HAART within and without Africa might account for the discordant findings.

The sample size of HIV patients on HAART in this study was limited due to a short study duration and small number of these patients who visited the HIV/AIDS treatment center daily. Capillary blood glucose was measured by point of care testing and the use of Accu Chek® Compact Plus glucometer at the spot (Point Of Care) for the determination of blood glucose could slightly affect the results especially at low glucose concentration. Despite these limitations, this study is the first in Cameroon (to the best of our knowledge) which shows that Abdominal obesity is a driving component of metabolic syndrome in HIV-infected patients particularly among females and hypertension is a prevalent and predictor component of metabolic syndrome among HIV patients on HAART.

CONCLUSION

Metabolic syndrome is insignificantly more common in persons living with HIV than in those without HIV. Abdominal obesity is a driving component of metabolic syndrome in HIV-infected patients on HAART particularly among females and hypertension is a prevalent and predictor component of metabolic syndrome in these patients. HIV patients on HAART should be screened for these metabolic syndrome components and treated accordingly in order to reduce the risk of developing a cardiovascular disease.

ACKNOWLEDGEMENTS

The authors appreciate the contributions made by the Chief Medical officer and laboratory staff at the Tiko Central Clinic and Cottage Hospital. We are also grateful for the collaboration of the HAART treated HIV infected and HIV sero-negative participants in Tiko Central Clinic and Cottage Hospital.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Faculty of Health Sciences Institutional Review Board (FHSIRB) of the University of Buea in Cameroon

REFERENCES

1. Sears S, Buendia JR, Odem S, Qobadi M, Wortley P, Mgbere O, et al. Metabolic syndrome among people living with HIV receiving medical care in Southern United States: prevalence and risk factors. AIDS Behav. 2019;23(11):2916-25.
2. Jules CNA, Vigny N, Vincent SV, John FT, Peter A, Eric AA. Evaluation of cardiovascular risk factors in HIV/AIDS patients attending the Tiko Central Clinic and Cottage hospital, Tiko, Cameroon. Cardiol Cardiovasc Res. 2019;2(3):1-7.
3. Olamide OT, Solange ZM, Benn S. Prevalence of metabolic syndrome among HIV-positive and HIV-negative populations in sub-Saharan Africa- a systematic review and meta-analysis. BMC Systemat Rev. 2019;8(4):1-17.
4. Kim AN, Nasheeta P, Edward JM, Andre PK. A meta-analysis of the metabolic syndrome prevalence in the global HIV-infected population. PloS One. 2016;11(3):1-27.
5. Mariana AR, Geyza NAA, Nathalia SG, Camila AC, Raissa DSS, Unai T. Metabolic disorders and cardiovascular risk in people living with HIV/AIDS without the use of antiretroviral therapy. Rev Soc Bras Med Trop. 2017;50(5):598-606.
6. Jyothi I, Swaroop N, Suresh S, Nisha G, Rewari BB, Anita S. Metabolic syndrome and cardiovascular disease risk assessment among human immunodeficiency virus-infected individuals on antiretroviral therapy. Indian J Sex Transm Dis. 2018;39(1):28-33.
7. Alfred O, Tecla MT, Nicholas K, Edmond KN, Jemima HK, Stephanie P, et al. Metabolic syndrome among antiretroviral therapy-naïve versus experienced HIV-infected patients without preexisting cardiometabolic disorders in Western Kenya. AIDS Patient Care STDs. 2018;32(6):215-22.
8. Agete TH, Demo YT. Influences of gender in metabolic syndrome and its components among people living with HIV virus using antiretroviral treatment in Hawassa, southern Ethiopia. BMC Res Notes. 2016;9(145):1-7.
9. UNAIDS. HIV/AIDS estimates in Cameroon, 2020. Available at: http://www. unaids.org/en/regions countries/countries/Cameroon. Accessed 20 May 2020.
10. Global AIDS response progress (GARP). National follow-up report on the policy declaration on HIV/AIDS Cameroon, 2014. Available at: http://www.unaids.org. Accessed 20 May 2020.
11. Herbert AM, Henry DM, Anthony TK, Omarine N, Theresia NK. Prevalence of metabolic syndrome in human immunodeficiency virus-infected patients from the South-West region of Cameroon, using the adult treatment panel III criteria. Diabetol Metab Syndr. 2014;6(92):1-7.
12. Paolo B, Cristina G, Elena R, Rita F, Elena R, Marzia F, et al. HIV and metabolic syndrome: A comparison with the general population. J Acquir Immune Defic Syndr. 2007;45(4):426-31.
13. Kagaruki GB, Kimaro GD, Mweya CN, Kilale AM, Mrisho RM, Shao AF, et al. Prevalence and risk factors of metabolic syndrome among individuals

living with HIV and receiving antiretroviral treatment in Tanzania. J Adv Med Med Res. 2015:1317-27.
14. Dimodi HT, Etame LS, Nguimkeng BS, Mbappe FE, Ndoe NE, Tchinda JN, et al. Prevalence of metabolic syndrome in HIV-infected Cameroonian patients. World J AIDS. 2014;4:85-92.
15. Bune GT, Yalew AW, Kumie A. The extents of metabolic syndrome among Antiretroviral Therapy exposed and ART naïve adult HIV patients in the Gedeo-zone, Southern-Ethiopia: a comparative cross-sectional study. Arch Public Health. 2020;78:1-10.
16. Alvarez C, Salazar R, Galindez J, Rangel F, Castaneda ML, Lopardo G, et al. Metabolic syndrome in HIV-infected patients receiving antiretroviral therapy in Latin America. Brazilian J Infect Dis. 2010;14(3):256-63.
17. Lauda LG, Mariath AB, Grillo LP. Metabolic syndrome and its components in HIV-infected individuals. Revista da Associação Médica Brasileira. 2011;57(2):182-6.
18. Bajaj S, Tyagi SK, Bhargava A. Metabolic syndrome in human immunodeficiency virus positive patients. Indian J Endocr Metab. 2013;17(1):117-20.
19. International Diabetes Federation. The IDF world consensus definition of the metabolic syndrome. Available at: https://www.idf.org/e-library/consensus-statements/60-idfconsensus-worldwide-definitionof-the-metabolic-syndrome. Accessed 25 May 2020.
20. American Heart association. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of high blood cholesterol in Adults (adult treatment panel III) Final report. Available at: http://circ.ahajournals.org/content/106/25/3143. Accessed 20 May 2020.
21. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, et al. Diagnosis and management of the metabolic syndrome Association/National Heart, Lung, and Blood Institute Scientific Statement. Circulation. 2005;112(17):2735-52.

Cite this article as: Njongang VN, Nguedia AJC, Walter OE. Prevalence and components of metabolic syndrome in HIV-infected patients at the Tiko Central Clinic and Cottage Hospital in Cameroon. Int J Res Med Sci 2020;8:3481-7.