Original Research Article

PREVALENCE OF OVERWEIGHT/OBESITY, COMORBIDITIES, AND ASSOCIATED FACTORS AMONG PERSONS LIVING WITH HIV/AIDS ON ART IN TWO TREATMENT CENTERS IN THE FAKO DIVISION, CAMEROON: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: The double burden of human immunodeficiency virus (HIV) with non-communicable disease is a public health problem in sub-Saharan Africa.A study was conducted among persons living with HIV/AIDS (PLWHA) on antiretroviral therapy (ART) to assess the prevalence of overweight/obesity, hypertension, and diabetes and their risk factors in two HIV treatment centers in the Fako division, Cameroon.

Methods: A hospital-based cross-sectional study was carried out at the Regional Hospitals of Buea and Limbe, in the Fako Division of the South West Region of Cameroon between June 1st, 2024 to August 31st, 2024. We included 464 persons living with HIV/AIDS. Sociodemographic and clinical data were collected using a questionnaire.A 24-hour dietary diversity was assessed using a questionnaire. Blood glucose level, blood pressure, and anthropometric data were recorded to determine the prevalence of diabetes, hypertension and overweight/obesity. A chi-square test was used to test association between categorical variables and a multiple logistic regression model was fitted to identify factors that were independently associated with overweight/obesity, hypertension and diabetes. Data was analyzed using SPSS version 25.0.

Results: The study comprised 464 adults aged 18 to 78 yearswith a mean age of 48.80 ± 11.67 years. The prevalence of overweight/obesity, hypertension, and diabetes among the participants were 62.5%, 25%, and 14% respectively. Factors significantly associated with overweight/obesity were females (aOR: 2.36; CI: (1.48-3.78); p=0.001), age group (50- 65 years) (aOR: 2.41; CI: (1.13-5.17); p=0.024), persons lacking HIV-related symptoms (aOR:3.36; CI:(1.49-7.56); p=0.003) and those who do not smoke. Hypertension was significantly associated withthe study site of the participants while diabetes was significantly associated withthe duration of ART and marital status.

Conclusion: There is a high burden of overweight/obesity, hypertension, and diabetes in PLWHA in two treatment centers in Fako Division. The expansion of HIV treatment programs must prioritize the initiation and strengthening of interventions aimed at minimizing preventable comorbidities and reducing the risks of non-communicable diseases (NCDs).

Keywords:*Diabetes, HIV/AIDS, hypertension, overweight/obesity, persons living with HIV/AIDS*

1. INTRODUCTION

HIV infection is a globally recognized health issue, characterized by the invasion of the Human Immunodeficiency Virus(HIV), leading to the development of AIDS[1]. HIV has claimed about 42.3 million lives to date with an estimate of 39.9 million people living with HIV at the end of 2023, 65% of whom are in the WHO African Region[2]. The advent of antiretroviral therapy (ART) has drastically reduced the number of deaths and AIDS-defining events among HIV-infected people, including wasting syndrome. However, there has been a gradual transition to overweight/obesity, a medical condition in which excess body fat has accumulated to the extent that it may adversely affect health[3]. In 2022, 43% of adults aged

18 years and over were overweight and 16% were living with obesity[4]. This has significant consequences in terms of both health and economic burden [5].

The use of potent antiretrovirals has led to increased survival for people living with HIV/AIDS (PLWHA) [6]. Nevertheless, as a chronic disease that is incurable with ART, HIV is associated with a substantial burden, including the requirement for lifelong treatment and the risk of treatment resistance[7], as there are concerns regarding the metabolic side effects and cardiovascular disorders that have surfaced because of the treatment. Metabolic side effects include insulin sensitivity (insulin resistance), dyslipidemia, hypertension, and abnormalities [8].

Studies have reported an increased risk of Non-communicable Diseases (NCD) such as diabetes mellitus (DM), hypertension, and cardiovascular diseases among PLWHIV [9]. The coexistence of DM and hypertension in HIV-infected individuals may complicate the management of HIV infection, increasing the risk of morbidity and mortality of these individuals[9]. People living with HIV infection have 3 sources of risk of developing NCDs: from HIV infection itself; effects of the ART; and, from the risk associated with increasing age[10].The prevalence of diabetes among PLWH on ART was 11.4% in Duguma *et al*., study. More so, the prevalence of diabetic dyslipidemia in PLWH exposed on ART was 8.9%. Government workers (AOR: 0.17, 95% C.I=0.03– 0.85, P=0.031), long duration inART use (AOR: 11.06, 95% C.I:1.03– 18.67, P=0.047), hyper-triglyceridemia (AOR: 2.62,95% C.I:0.82, 8.39, P=0.005), low-density lipoprotein-cholesterol(LDL-C)< 130 mg/dl (AOR: 4.04, 95% C.I=1.33– 12.30, P=0.014), and obesity (AOR: 9.62, 95% C.I: 1.01– 91.52, P=0.049) were independent risk factors for diabetes mellitus in PLWHIV exposed to ART [11].

Hypertension, poses a significant public health concern in both developing and developed countries. It is an NCD that is a strong predictor of cardiovascular disease (CVD), premature death, kidney failure, coronary heart attack, stroke, and other health problems [12]. Hypertension, commonly known as high blood pressure, refers to the persistent elevation of arterial blood pressure within the body. Hypertension causes approximately 7.5 million deaths annually, leading to a total of 57 million disability-adjusted life years (DALYs) worldwide. It represents approximately 12.8% of the total of all deaths [13].A study conducted in Rwanda showed that the prevalence of hypertension was 24.7%, which means that roughly 1 in 4 PLWH were hypertensive [14], in Benin 14.2% of the respondents were hypertensive with 3.1% newly diagnosed and 11.1% known with hypertension[15].In Mbuthia *et al.,* study, age >40 years, male sex, history of alcohol consumption, and being overweight/obese were significantly associated with hypertension [16].

Being overweight is a risk factor for cardiovascular and other diseases.Several studies have described increasing proportions of overweight and obesity in people living with HIV/AIDS in Sub-Saharan Africa SSA [17]. Another study in south Africa found the prevalence of overweight as 26.2% and obesity as 46.4% [18]. A study conducted by Simo *et a*l., showed that the prevalence of overweight, obesity, and overweight and obesity were 31.1%, 18.9%, and 50.1%, respectively [19].In a study conducted by Belete *et al*., overweight/obesity was significantly associated to sex, being male, duration on ART (took for ≥5 years), and ART drug regime [20].

Few studies have been conducted to determine the magnitude of obesity/overweight, hypertension and diabetes and their associated factors among persons living with HIV/AIDS on ART in the Fako division. This study was therefore carried out to assess the prevalence of overweight/obesity, hypertension and diabetes and their associated factors among adult HIV/AIDS persons on ART in two treatment centers in the Fako Division. This will generate evidence-based data which will inform a public health intervention to improve the health status of PLWHA.

2. MATERIAL AND METHODS

2.1 Study design and settings

A hospital-based cross-sectional study was conducted at the HIV care and treatment centers in Buea and Limbe Regional Hospitals in Fako Division from June 1 to August 31, 2024. These centers have the highest number of PLWHA in the region.

2.3 Study population and sampling

Participants were HIV-positive adults (male and female) aged 18 to 78 years attending health centers for routine health education and drug refills. Exclusion criteria included PLWHA who are critically ill, pregnant women and patients who did not give their consent and those absent during the study period. A total of 464 participants were recruited consecutively as they consented during follow-ups(figure1).

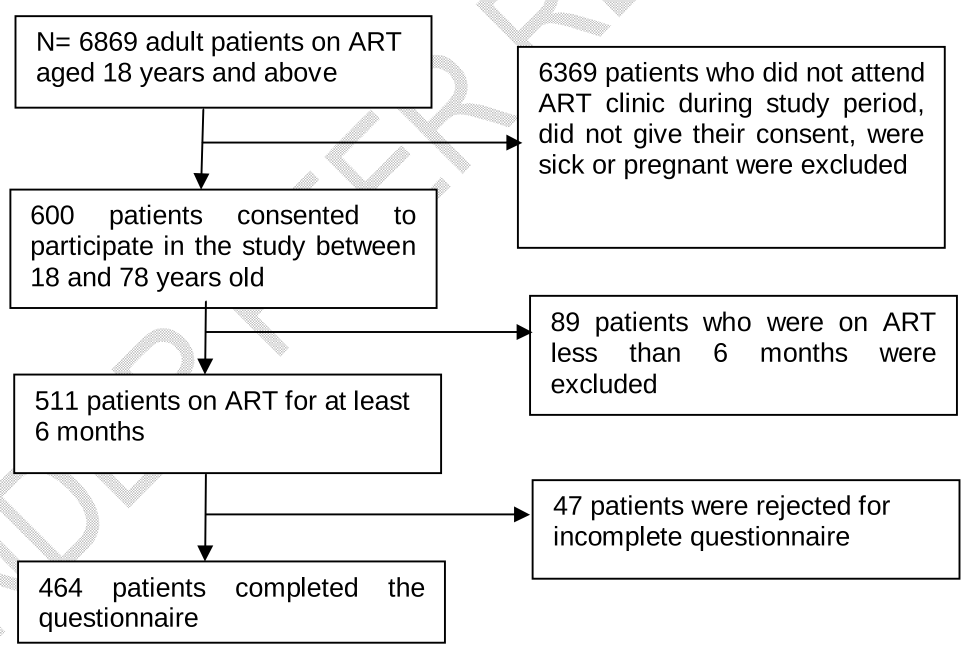

Figure 1: Flow chart of patients included in the study

2.4 Data collection

Demographic, clinical, dietary, and anthropometric data were collected via structured questionnaires from June to August 2024. Clinical data were obtained from treatment registers, while dietary diversity was assessed using a 24-hour dietary diversity questionnaire.

2.4.1 Anthropometric measurements

Body weight and height were measured using calibrated equipment. Height was measured barefoot to the nearest 0.1 cm with a portable stadiometer (HR-200, Tanita), and weight to 0.01 kg with a manual weighing scale (Mettler Toledo, India). BMI was calculated as weight (kg) divided by height squared (m^2). Participants were categorized by WHO BMI classifications: normal weight (18.5–24.9), overweight (25.0–29.9), and obese (≥30.0) [21].

2.4.2 Blood pressure

Blood pressure was measured following standard guidelines after a 10-minute rest. Three readings were taken using an electronic monitor (Arm style, China). The cuff was positioned at heart level, and participants were seated with their back supported and forearm on a table. Hypertension was defined as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg [22].

2.4.3 Blood glucose level

Diabetes mellitus (DM) was diagnosed using a plasma glucose meter (No code easy use, China). A fasting blood glucose test required at least eight hours of fasting, while random blood sugar tests identified diabetes at ≥200 mg/dL [23,24].

2.4.4 Dietary diversity

Minimum dietary diversity was assessed using FAO guidelines as an indicator of nutrient adequacy using a 24-hour dietary diversity questionnaire [25].

2.5 Data analysis

Data entered into Kobo Collect were analyzed with SPSS version 25.0. Descriptive statistics summarized demographics and outcomes. A chi-square test was used to test association between categorical variables and a multiple logistic regression model was fitted to identify factors that were independently associated with overweight/obesity, hypertension and diabetes. $p < 0.05$ was considered significant.

3. RESULTS

3.1 Demographic characteristics of the study participants

Participants ranged in age from 18 to 78, with a mean age of 48.80 ± 11.67 years. Most participants, 202 (43.5%), were aged 34–49 years. Females accounted for 369 (79.5%), and 215 (46.3%) had a primary education level (Table 1).

Table 1: Demographic characteristics of study participants

Variable	Categories	Frequency (n)	Percentage (%)
Age group(years)	18-33	44	9.5
	34-49	202	43.5
	50-65	185	39.9
	>65	33	7.1

	Total	464	100
Gender	Female	369	79.5
	Male	95	20.5
	Total	464	100
Marital status	Divorced	12	2.6
	Married	197	42.5
	Single	158	34.1
	Widow(er)	97	20.9
	Total	464	100
Religion	Christian	458	98.7
	Muslim	6	1.3
	Total	464	100
Level of education	No formal education	13	2.8
	Primary	215	46.3
	Secondary	182	39.2
	Tertiary	54	11.6
	Total	464	100
Monthly income (Fcfa)	No income	41	8.8
	<25,000	157	33.8
	25,000-50,000	160	34.5
	50,001-75,000	49	10.6
	>75,000	57	12.3
	Total	464	100
Location	RHB	217	46.8
	RHL	247	53.2
	Total	464	100

***RHB= Regional Hospital Buea RHL= Regional Hospital Limbe**

3.2 Clinical and lifestyle characteristics of persons living with HIV/AIDS on ART in two treatment centers of the Fako Division

Majority of the participants, 428(92.2%) had been on ART for 3 years and above. About half of the participants, 243(52.4%) were in clinical stage 1 and most had undetectable viral load 398(87.1%). Majority of them did not have HIV-related symptoms, 435(93.8%), and were on first-line regimen 403(86.9%). More than half of the participants consume alcohol, 294(63.4%) as seen in table 2.

Table 2:Clinical and lifestyle characteristics of persons living with HIV/AIDS on ART in two treatment centers of the Fako Division

Variable	**Categories**	**Frequency (n)**	**Percentage (%)**
Duration on ART	3 years and above	428	92.2
	6 months to 3 years	36	7.8

	Total	464	100
Clinical stage of HIV/AIDS	Stage I	243	52.4
	Stage II	84	18.1
	Stage III	109	23.5
	Stage IV	28	6
	Total	464	100
Recently diagnosed with HIV advance disease	No	441	95
	Yes	23	5
	Total	464	100
Recent viral load (copies/ml)	> 40 copies/ml ≤1000copies/ml	52	11.4
	≥ 1000copies/ml(unsuppressed)	7	1.5
	Undetectable	398	87.1
	Total	457	100
Have HIV/AIDS-related symptoms	No	435	93.8
	Yes	29	6.3
	Total	464	100
Treatment Regimen	1st line	403	86.9
	2nd line	61	13.1
	Total	464	100
Depressed	No	427	92
	Yes	37	8
	Total	464	100
Disclosed HIV/AIDS status	No	44	9.5
	Yes	420	90.5
	Total	464	100
Attended HIV-related counselling session	No	18	3.9
	Yes	446	96.1
	Total	464	100
Consume alcohol	No	170	36.6
	Yes	294	63.4
	Total	464	100
Smoke	No	452	97.4
	Yes	12	2.6
	Total	463	100

3.3 Prevalence of overweight/obesity, diabetes, and hypertensionamong persons living with HIV/AIDS on ART in two treatment centers of the Fako Division

3.3.1 Prevalence of overweight/obesity based on BMI (body mass index) among PLWHA

More than half of the participants were overweight or obese, with an overall prevalence of 290(62.5%). Only 11 (2.4%) of the participants were underweight (Figure 1).

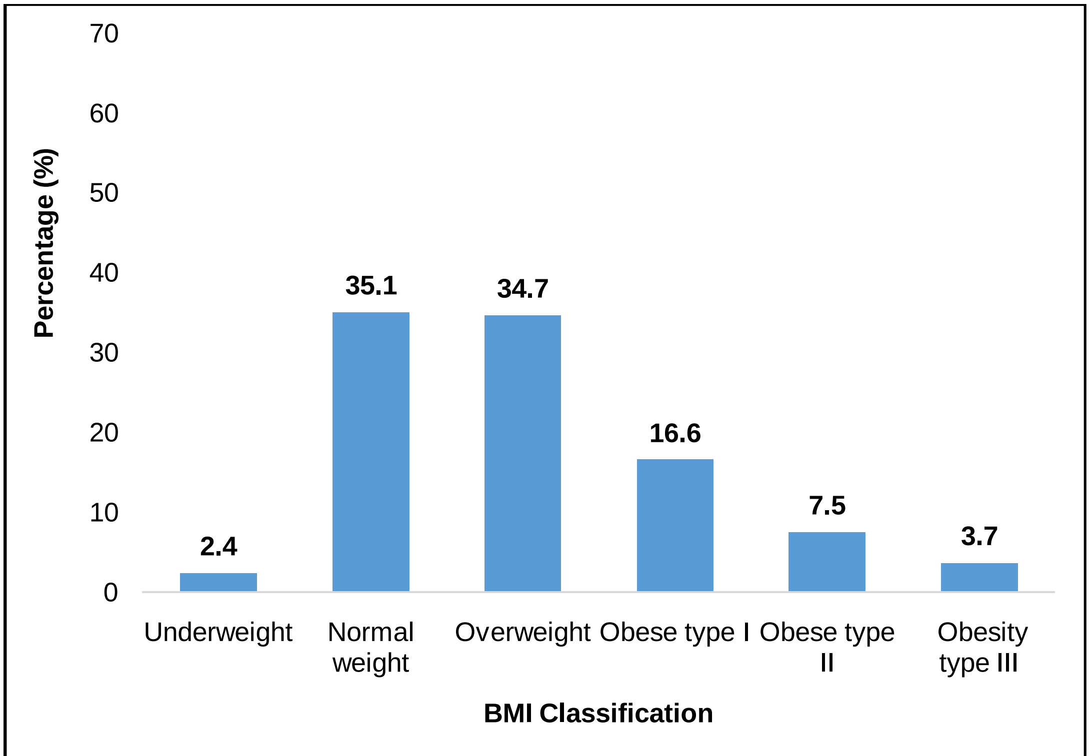

Figure 2:BMI classification of PLWHA in Fako Division

3.3.2 Prevalence of hypertension and diabetes among study participants

About one-quarter of the participants were hypertensive, 114(24.6%) and 65(14%) were diabetic in both treatment centres in Buea and Limbe Regional Hospitals, Fako Division (figure 2).

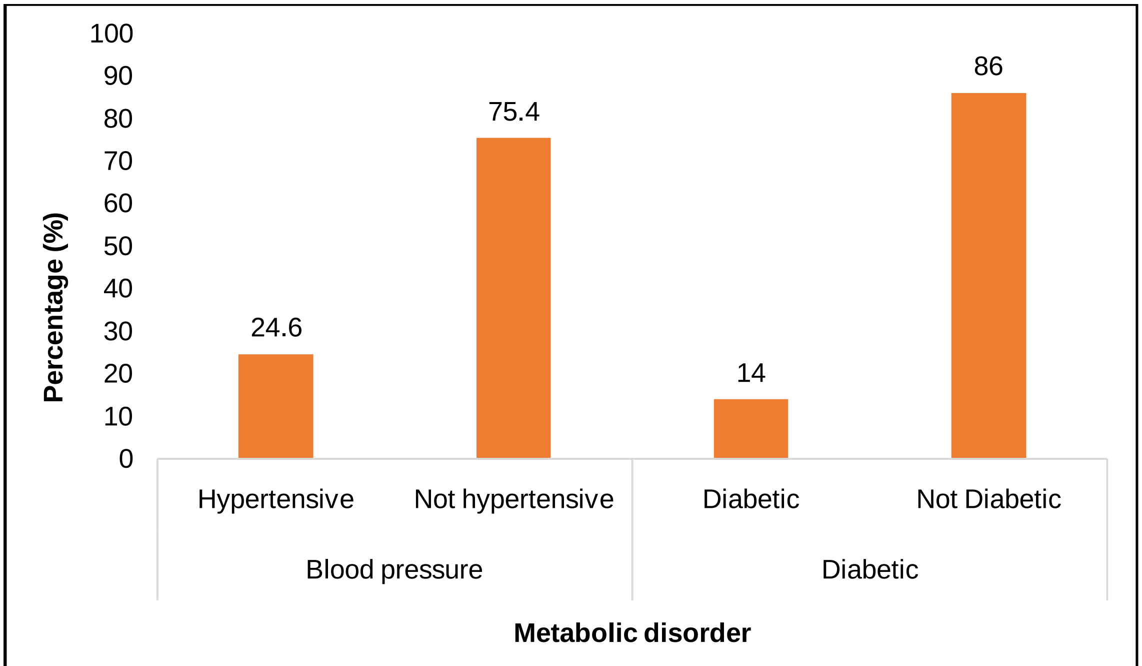

Figure 3: Prevalence of hypertension and diabetes among PLWHA in Fako Division

3.4 Factors associated with overweight/obesity

The factor associated with overweight/obesity was the gender ($\chi 2 = 11.67$, $p=0.001$) of the participants, with females 245(52.80%) being more overweight than males 45(9.7%) as seen in table 3.

Table 3: Association between obesity/overweight and demographic characteristics

Variable	Categories	n	Obesity/Overweight				Chi-square	P-value
			Yes	%	No	%		
Age group(years)	18-33	44	22	4.74	22	4.74	6.76	0.079
	34-49	202	131	28.23	71	15.30		
	50-65	185	121	26.08	64	13.79		
	>65	33	16	3.45	17	3.66		
	Total	464	290	62.50	174	37.50		
Gender	Female	369	245	52.80	124	26.72	**11.67**	**<0.001**
	Male	95	45	9.70	50	10.78		
	Total	464	290	62.50	174	37.50		
Level of education	No formal education	13	8	1.73	5	1.08	2.0	0.575
	Primary	215	129	27.86	86	18.57		
	Secondary	181	120	25.92	61	13.17		
	Tertiary	54	32	6.91	22	4.75		
	Total	463	289	62.42	174	37.58		
Average income(Fcfa)	No income	41	26	5.60	15	3.23	4.02	0.404
	<25,000	157	91	19.61	66	14.22		
	25,000-50,000	160	99	21.34	61	13.15		
	50,001-75,000	49	33	7.11	16	3.45		
	>75,000	57	41	8.84	16	3.45		
	Total	464	290	62.50	174	37.50		
Location	RHB	217	82	17.67	135	29.09	0.01	0.904
	RHL	247	92	19.83	155	33.41		
	Total	464	174	37.50	290	62.50		
Level of education	No formal education	13	5	1.08	8	1.72	2.07	0.547
	Primary	215	86	18.53	129	27.80		
	Secondary	182	61	13.15	121	26.08		
	Tertiary	54	22	4.74	32	6.90		
	Total	464	174	37.50	290	62.50		
Religion	Christian	458	171	36.85	287	61.85	0.41	0.524
	Muslim	6	3	0.65	3	0.65		
	Total	464	174	37.50	290	62.50		
Marital status	Divorced	12	4	0.86	8	1.72	5.74	0.121
	Married	197	68	14.66	129	27.80		
	Single	158	71	15.30	87	18.75		
	Widow(er)	97	31	6.68	66	14.22		
	Total	464	174	37.50	290	62.50		

***RHB= Regional Hospital Buea RHL= Regional Hospital Limbe**

The odds of those in the age group of 50 to 65 years old being overweight/obese were 2 times higher (aOR: 2.41; CI: (1.13-5.17); p=0.024) compared to those within the age group of 65 years and above. Also, the odds of a female being overweight/obese were 2.36 times higher compared to the male (aOR: 2.36; CI: (1.48-3.78); p=0.001) as seen in table 4.

Table 4: **Demographic factors independently associated with the prevalence of overweight/obesity**

Variable	Categories	Overweight/ Obese n (%)	Not Overweight/ Obese n (%)	AOR	95% CI		P-value
					Lower	Upper	
Age group (years)	18-33	22(4.74)	22(4.74)	1.17	0.47	2.92	0.735
	34-49	131(28.23)	71(15.30)	2.109	0.20	4.46	0.051
	50-65	121(26.08)	64(13.79)	2.41	1.13	5.17	**0.024**
	>65	16(3.45)	17(3.66)	1			
Gender	Female	245(52.08)	124(26.72)	2.36	1.48	3.78	**<0.001**
	Male	45(9.70)	50(10.78)	1			

There was no significant association between overweight/obesity and comorbidity.

Table 5 shows the association between overweight/obesity and clinical characteristics. One main clinical factor associated with overweight and obesity was the lack of HIV clinical symptoms (χ2=10.36, p=0.001). Persons living with HIV without any clinical symptoms were more likely to be obese/overweight.

Table 5: Association between overweight/obesity and clinical characteristics

Variable	Categories	n	Overweight/Obesity				Chi-square	P-value
			Yes	%	No	%		
Duration on ART	3 years and above	428	158	34.05	270	58.19	0.80	0.370
	6 months to 3 years	36	16	3.45	20	4.31		
	Total	464	174	37.50	290	62.50		
Clinical stage of HIV/AIDS	Stage I	243	85	18.32	158	34.05	4.27	0.233
	Stage II	84	29	6.25	55	11.85		
	Stage III	109	50	10.78	59	12.72		
	Stage IV	28	10	2.16	18	3.88		
	Total	464	174	37.50	290	62.50		
Diagnosed with HIV advance disease	No	441	161	34.70	280	60.34	3.74	0.053
	Yes	23	13	2.80	10	2.16		
	Total	464	174	37.50	290	62.50		
Recent viral load (copies/ml)	> 40 copies/ml≤1000copies/ml	52	22	4.74	30	6.47	1.00	0.661
	≥ 1000copies/ml	7	3	0.65	4	0.86		
	Undetectable	398	144	31.03	254	54.74		
	Total	457	169	36.42	288	62.07		
HIV/AIDS	No	435	155	33.41	280	60.34	10.36	**<0.001**

related symptoms	Yes	29	19	4.09	10	2.16		
	Total	464	174	37.50	290	62.50		
Treatment Regimen	1st line	403	150	32.33	253	54.53		
	2nd line	61	24	5.17	37	7.97	0.10	0.750
	Total	464	174	37.50	290	62.50		
Depressed	No	427	162	34.91	265	57.11		
	Yes	37	12	2.59	25	5.39	0.44	0.507
	Total	464	174	37.50	290	62.50		
Disclosed HIV/AIDS status	No	44	18	3.88	26	5.60		
	Yes	420	156	33.62	264	56.90	0.24	0.623
	Total	464	174	37.50	290	62.50		
Attended HIV related counselling session	No	18	5	1.08	13	2.80		
	Yes	446	169	36.42	277	59.70	0.76	0.385
	Total	464	174	37.50	290	62.50		
Comorbidity	Diabetes	51	22	4.74	29	6.25		
	Diabetes/Hypertension	14	5	1.08	9	1.94		
	Hypertension	100	28	6.03	72	15.52	5.34	0.145
	None	299	119	25.65	180	38.79		
	Total	464	174	37.50	290	62.50		

A multivariate analysis identified two clinical risk factors independently associated with overweight/obesity. These were persons without HIV/AIDS related symptoms and those who do not smoke. Those with no HIV/AIDS related symptoms[aOR:3.36; CI:(1.49-7.56); p=0.003)]were 3 times more likely to be overweight/obese compared to those with HIV/AIDS related symptoms. Study participants who were nonsmokers were 11 times more likely to be overweight (aOR:11.94; CI:(2.54-56.04); p=0.002) compared to those who smoked (Table 6).

Table 6: **Clinical factors independently associated with prevalence of overweight/obesity**

Variable	Category	Overweight/obese		AOR	95% CI		P-value
		Yes n(%)	No n(%)		Lower	Upper	
Recently diagnosed of HIV advance disease	No	30(6.47)	280(60.34)	2.17	0.91	5.19	0.083
	Yes	10(2.16)	13(2.80)	1			
HIV/AIDS related symptoms	No	280(60.34)	155(33.41)	3.36	1.49	7.56	**0.003**
	Yes	10(2.16)	19(4.09)	1			
Consume alcohol	No	92(19.83)	78(16.81)	0.53	0.36	0.79	**0.002**
	Yes	198(42.67)	96(20.69)	1			
Smoke	No	288(62.07)	164(35.34)	11.94	2.54	56.04	**0.002**
	Yes	2(0.43)	10(2.16)	1			

3.5 Factors associated to hypertension among PLWHA in Buea and Limbe Regional Hospitals

The only risk factor of hypertension identified was the study site. Participants on treatment at the RHB were 2.5 times more likely to be hypertensive (aOR:2.571; CI:(1.62-4.09); p<0.001)compared to those on treatment at RHL (Table 7).

Table 7: Demographic factors independently associated with the prevalence of hypertension

Variable	Categories	Hypertensive n (%)	Not hypertensive n (%)	AOR	95% CI		P-value
					Lower	Upper	
Age group (years)	18-33	2(0.43)	42(9.05)	0.034	0.01	0.17	**<0.001**
	34-49	32(6.90)	170(36.64)	0.19	0.08	0.43	**<0.001**
	50-65	65(14.01)	120(25.86)	0.562	0.26	1.23	0.148
	>65	15(3.23)	18(3.88)	1			
Gender	Female	84(18.10)	285(61.42)	0.589	0.34	1.01	0.055
	Male	30(6.47)	65(14.01)	1			
Location	RHB	66(14.22)	151(32.54)	2.571	1.62	4.09	**<0.001**
	RHL	48(10.34)	199(42.89)	1			

***RHB= Regional Hospital Buea   RHL= Regional Hospital Limbe**

There was no association between hypertension and clinical/lifestyle characteristics.

3.6Factors associated to diabetesin among persons living with HIV/AIDS on ART in two treatment centers of the Fako Division

Table 8 shows the association between diabetes and demographic characteristics. Following a bivariate analysis, marital status was found to be the only sociodemographic characteristic that was significantly associated to diabetes ($\chi 2$= 7.96, p=0.040).

Table 8: **Association between diabetes and demographic characteristics**

Variable	Categories	n	Diabetic				Chi-square	P-value
			Diabetic	%	Not Diabetic	%		
Age group (years)	18-33	44	4	0.86	40	8.62	4.50	0.211
	34-49	202	31	6.68	171	36.85		
	50-65	185	22	4.74	163	35.13		
	>65	33	8	1.72	25	5.39		
	Total	464	65	14.01	399	85.99		
Gender	Female	369	48	10.34	321	69.18	1.50	0.221
	Male	95	17	3.66	78	16.81		
	Total	464	65	14.01	399	85.99		
Monthly income (Fcfa)	No income	41	5	1.08	36	7.76	1.41	0.843
	<25,000	157	21	4.53	136	29.31		
	25,000-50,000	160	26	5.60	134	28.88		

	50,001-75,000	49	7	1.51	42	9.05		
	>75,000	57	6	1.29	51	10.99		
	Total	464	65	14.01	399	85.99		
Location	Buea Regional Hospital	217	27	5.82	190	40.95	0.83	0.362
	Limbe Regional Hospital	247	38	8.19	209	45.04		
	Total	464	65	14.01	399	85.99		
Level of education	No formal education	13	3	0.65	10	2.16	1.37	0.716
	Primary	215	30	6.47	185	39.87		
	Secondary	182	24	5.17	158	34.05		
	Tertiary	54	8	1.72	46	9.91		
	Total	464	65	14.01	399	85.99		
Religion	Christian	458	64	13.79	394	84.91	0.04	0.850
	Muslim	6	1	0.22	5	1.08		
	Total	464	65	14.01	399	85.99		
Marital status	Divorced	12	4	0.86	8	1.72	7.96	**0.040**
	Married	197	28	6.03	169	36.42		
	Single	158	15	3.23	143	30.82		
	Widow(er)	97	18	3.88	79	17.03		
	Total	464	65	14.01	399	85.99		

Table 9 shows the association between diabetes and clinical/lifestyle characteristics. Of all clinical the factors, the only factor found to have a statistically significant association with diabetes was the duration on ART ($\chi 2$= 3.914, p=0.048).

Table 9:Association between diabetes and clinical/lifestyle characteristics among PLWHA in Buea and Limbe Regional Hospitals

Variable	Categories	n	Diabetic				Chi-square	P-value
			Diabetic	%	Not Diabetic	%		
Duration on ART	3 years and above	428	56	12.07	372	80.17	3.914	**0.048**
	6 months to 3 years	36	9	1.94	27	5.82		
	Total	464	65	14.01	399	85.99		
Clinical stage of HIV/AIDS	Stage I	243	30	6.47	213	45.91	3.508	0.341
	Stage II	84	13	2.80	71	15.30		
	Stage III	109	20	4.31	89	19.18		
	Stage IV	28	2	0.43	26	5.60		
	Total	464	65	14.01	399	85.99		
Diagnosed of HIV	No	441	62	13.36	379	81.68	0.019	0.891
	Yes	23	3	0.65	20	4.31		

advance disease	Total	464	65	14.01	399	85.99		
Recent viral load (copies/ml)	> 40 copies/ml ≤1000copies/ml	52	9	1.94	43	9.27	1.861	0.263
	≥ 1000copies/ml	7	2	0.43	5	1.08		
	Undetectable	398	53	11.42	345	74.35		
	Total	457	64	13.79	393	84.70		
HIV/AIDS related symptoms	No	435	61	13.15	374	80.60	0.001	0.972
	Yes	29	4	0.86	25	5.39		
	Total	464	65	14.01	399	85.99		
Treatment Regimen	1st line	403	56	12.07	347	74.78	0.032	0.857
	2nd line	61	9	1.94	52	11.21		
	Total	464	65	14.01	399	85.99		
Depressed or anxious	No	427	60	12.93	367	79.09	0.008	0.928
	Yes	37	5	1.08	32	6.90		
	Total	464	65	14.01	399	85.99		
Disclosed HIV/AIDS status	No	44	7	1.51	37	7.97	0.146	0.703
	Yes	420	58	12.50	362	78.02		
	Total	464	65	14.01	399	85.99		
Attended HIV related counselling session	No	18	3	0.65	15	3.23	0.11	0.740
	Yes	446	62	13.36	384	82.76		
	Total	464	65	14.01	399	85.99		
Consume alcohol	No	170	27	5.82	143	30.82	0.782	0.377
	Yes	294	38	8.19	256	55.17		
	Total	464	65	14.04	399	86.18		
Smoke	No	452	64	13.79	388	83.62	0.329	0.566
	Yes	12	1	0.22	11	2.37		
	Total	464	65	14.01	399	85.99		

3.7 Magnitude of dietary diversity among PLWHA in Buea and Limbe Regional Hospitals

Figure 3presents the minimum dietary diversity of the study participants. 68 (15%) of participants had achieved a good minimum dietary diversity while 396 (85%) did not. The mean minimum dietary diversity score was 3.42 ±1.07.

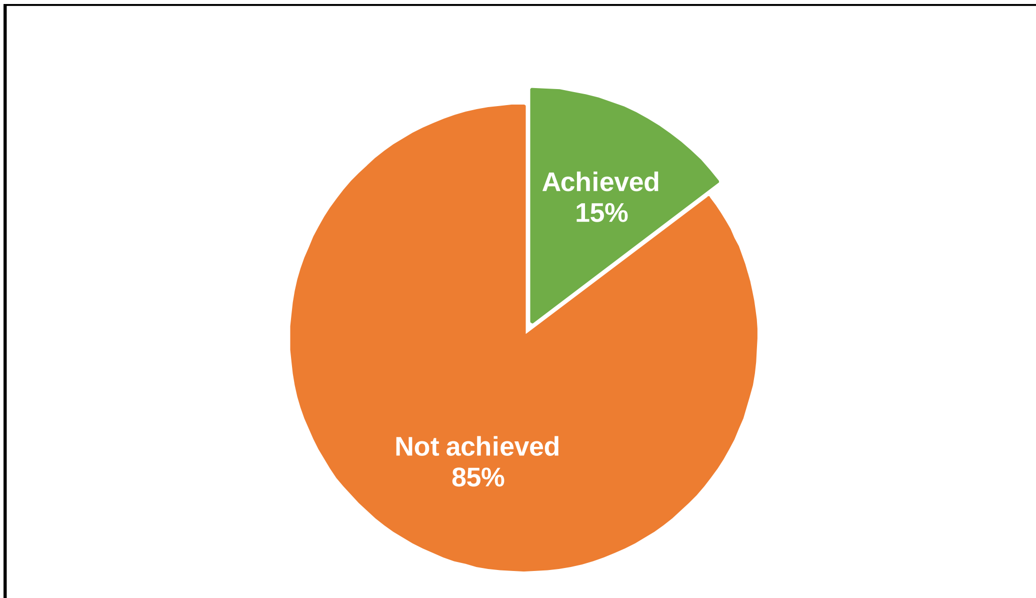

Figure 4: Minimum dietary diversity of PLWHA in Buea and Limbe Regional Hospitals, Fako Division

The most consumed food group was grains, white roots and tubers and plantains 458(98.9%)], followed by meat, poultry and fish 46(9.9%)]. The least consumed food group was other vitamin A-rich fruits and vegetables 33(7.1%) (table 10).

Table 10: Distribution of food groups consumed by study participants

Variable	Categories	Frequency (n)	Percentage (%)
Food groups	Grains, white roots and tubers, and plantains	458	98.9
	Other fruits	78	16.8
	Other vegetables	109	23.5
	Other vitamin A-rich fruits and vegetables	33	7.1
	Dark green leafy Vegetables	191	41.3
	Eggs	46	9.9
	Meat, poultry and fish	401	86.6
	Pulses (beans, peas and lentils)	95	20.5
	Milk and milk products	52	11.2
	Nuts and seeds	126	27.2
	Total	**1589**	**343.2**

4. DISCUSSION

This study found a 62.5% prevalence of overweight/obesity among participants, with only 2.4% underweight. This prevalence is comparable to findings by Crum-Cianflone *et al.* (2008) in the US, where 63% of PLWHA were overweight/obese [26]. Similar patterns have been observed in other studies highlighting rising obesity rates in PLWHA [27,28]. Contributing factors include ARV metabolic effects, increased social support, insulin resistance, and chronic inflammation [29,30]. However, this prevalence was higher than 13.5% reported in Ethiopia [31] and 46% in Uganda [32], potentially due to lifestyle changes, poor diets, and sedentary behaviour [33]. Additionally, stigma related to AIDS wasting syndrome may drive PLWHA to adopt high-calorie diets to gain weight and avoid discrimination [32].

Overweight/obesity was more common in females (52.8%) and participants aged 50–65 (26.08%). Females were 2.36 times more likely to be overweight/obese, consistent with findings in Ethiopia [34]. Contributing factors include decreased metabolism with age and higher global obesity rates in women [35]. In sub-Saharan Africa, men often seek care later, leading to more significant weight loss [36]. Participants aged 50–56 were twice as likely to be overweight/obese compared to those over 65, consistent with findings from Tanzania showing obesity peaks in the mid-50s before declining [37,38].

Clinical factors associated with overweight/obesity included the absence of HIV-related symptoms, and non-smoking. Asymptomatic participants were three times more likely to be overweight/obese, aligning with literature linking weight loss to HIV symptoms such as nausea, vomiting, and oral infections [39]. Non-smokers were 11 times more likely to be overweight compared to smokers. This was consistent with findings from the UK in the general population wherecurrent smokers were less likely to be obese than never-smokers and similar with findings done in Scotland, among PWHA where current smokers were less likely to be overweight and obese than never-smokers[40,41].The reason could be that smoking increases both HIV-related and non-related outcomes and has been shown to impact HIV disease progression[42].

Hypertension prevalence was 25%, consistent with estimates for Cameroon (23.8–25.4%) [43,44] but higher than 21.9% in sub-Saharan Africa [45] and lower than 38% in Bamenda [46]. Hypertension is linked to rising obesity rates and contributes to non-communicable disease burdens.

Diabetes prevalence was 14%, aligning with studies in PLWHA (14.9%) [23] and LMIC estimates (6.8%–26%) [47] but higher than the 5.8% in the general population prevalence in Cameroon [48]. Factors included longer ART duration and marital status. ART use beyond three years increased diabetes risk, as seen in Yaoundé studies [49].

CONCLUSION

The prevalence of overweight/obesity among PLWHA was high and influenced by gender, age, absence of HIV symptoms,and smoking status. Hypertension and diabetes were common, linked to age, location, ART duration, and marital status. These findings emphasize the need for interventions addressing non-communicable diseases in PLWHA.

CONSENT

All authors declare that written informed consent was obtained from the participants.

ETHICAL APPROVAL

This study was approved by the Institutional Review Board of the Faculty of Health Sciences, University of Buea (Ref. No. 2024/2459-03/UB/SG/IRB/FHS). Administrative clearance was obtained from the Regional Delegation of Public Health for the South West region, (Ref. No. P42/MINSANTE/SWR/RDPH/CB.PT/680/512) and written informed consent was obtained from the patients recruited into this study.

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Details of the AI usage are given below:

1.

2.

3.

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