Research Article

Nutritional Assessment of HIV/AIDS patients in Centre Region of Cameroon: A pilot study

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Abstract

Optimal nutrition is critical to minimize the susceptibility to opportunistic infections and HIV/AIDS progression. We assessed the nutritional status of people with HIV/AIDS living in Centre Region of Cameroon to help filling the knowledge gap in adult patients care. Cross-sectional analysis of 82 adults patients between 21 and 39 years old with an undetectable viral load at Saint Martin de Porrès Hospital in Yaounde was conducted. Body weight, height, waist and hip circumferences were measured for anthropometric variables. Plasma and serum total proteins, albumin, globulin, CD_4 count were determined in blood samples. Patients provided 7-day food records for nutrients intakes. 56.1% of participants had received nutritional counselling. Undernutrition represented 8.5%. Obesity (11%) was concerning only women. Abdominal obesity was high (60.8%). Food consumption score was acceptable for 97.5%. Food diversity score was average for 51.9%. Participants had higher daily consumption of proteins (74.03[51-97.87] g) and carbohydrates (261.96 ± 107.38 g). Daily fats intake (70.31 ± 29.42 g) was normal for women. Total energy was lower (2012 ± 773.82 kcal) than needed. Plasma proteins (70.37 ± 9.70 g/L), serum proteins (70.24 ± 9.90 g/L), albumin (39.23 ± 9.58 g/L), globulins (31.00 ± 11.72 g/L), CD_4 T cells (475.50 [273.75-692.00]/µL) were normal. Our findings

suggest that, although the participants maintained a normal weight, their food intake was not enough adequate for nutrients needs. This could contribute to worsening HIV/AIDS progression. There is a need for development of effective strategies to improve nutritional status of people with HIV/AIDS, using locally available foods.

Keywords: Nutritional status; HIV/AIDS; Adults; Cameroon

1. Introduction

The expansion of the availability of antiretroviral therapy (ART) in Cameroon has revolutionized the treatment of patients affected with human immunodeficiency virus (HIV) infection and acquired immune deficiency syndrome (AIDS), and led to the decline in HIV transmission [1]. Once a fatal infection, HIV is considered nowadays as a chronic, manageable condition [2]. HIV infection not only impairs the immune system, but it also affects the nutritional status by increasing energy requirements, reducing food intake, and adversely affecting nutrients absorption and metabolism [3,4]. Therefore, nutritional care of persons living with HIV/AIDS (PLWHA) is an essential component of comprehensive HIV medical management in addition to ongoing ART [5-7]. With good adherence to ART and appropriate nutrition, PLWHA have a life expectancy comparable with that in the general population [8-10]. Several studies have shown that maintaining an optimal nutritional status of PLWHA - eating the correct amounts of macronutrients and micronutrients- is crucial to: (1) maximize ART absorption and tolerance; (2) improve the functioning of the immune system; (3) help better manage symptoms; and (4) reduce the burden of disease and enhance their overall health and quality of life [11-16]. Therefore, attention is increasingly being given to the examination of nutritional status among PLWHA, as part of HIV strategic plans.

The staple foods of Cameroon vary from region to region and depend on climate, urbanization, household income, nutritional education, health, gender, and age group [17,18]. Despite the presence of restaurants, which offer a variety of international cuisines (e.g. French, Italian, Chinese, Asian, Middle Eastern, etc.) and international fast-food chains in urban areas, Cameroonian meal patterns are still heavily guided by traditional food practices rather than individual nutritional needs. In general, starchy foods (e.g. corns; cassava, Manihot utilissima; yam, Dioscorea sp.; cocoyam, Xanthosoma sp.; potatoes; plantains; unripe bananas; and rice) dominate in Cameroonian dishes and are served with sauces, which usually contain leafy vegetables, legumes and seeds with meat or fish added, depending on affordability, availability and cultural habits [19,20]. Meal frequency varies between twice or thrice per day, depending mainly on the affordability [17,19].

To our knowledge, the nutritional condition of PLWHA has not been studied in Cameroon context in general and in the Centre Region of Cameroon in particular. Therefore, this study was carried to assess nutritional status of PLWHA in the Centre Region of Cameroon. The outcome of this study would be the evidence to inform the improvement of nutrition counselling resources for HIV-infected patients tailored to the local diet context.

2. Materials and Methods

2.1 Study site

This cross-sectional study was conducted between July and October 2018 at the Saint Martin de Porres Dominican Hospital located in Mvog Betsi, one of the

suburbs of Yaounde, the capital of Cameroon [21]. Established in 2007, this modern general hospital is operated by the religious Dominican sisters and is supported by national and international organizations. It has been offering several medical services and programs, including a unit for HIV testing and pre- and post test counseling, HIV care and support, ART and prevention to the communities of Centre Region of Cameroon. During this study, the HIV unit was providing care and treatment counselling to 1,443 HIV-positive patients. This hospital is renowned in the country for his high-quality medical care and efficient staff.

2.2 Ethical Clearance and Consent to Participate

Prior to starting this research study, ethical approval was obtained from the authorities of the hospital and the Regional Ethics Committee for Human Health Research of the Cameroon Centre Region (Reference Number 0519/CRERSHC/2018). A note containing key informations regarding the study was giving everyday to the patients coming for their follow-up. They were asked to participate in the study with the assurance that participation is completely voluntary, and that it can be denied or discontinue at any time. All the volunteer individuals who were eligible to participate signed an informed consent form prior to enrollment. For the protection of the participants, anonymity and confidentiality were preserved by assigning a code to each participant.

2.3 Study Participants

HIV-positive patients receiving care and the antiretroviral combination therapy that included Tenofovir, Lamivudine, and Efavirenz since at least 24 weeks prior to study initiation at the Saint Martin de Porres Dominican Hospital of Mvog-Betsi, were randomly selected for participation. They were living in the Centre Region of Cameroon. Eligibility criteria for this study were as follows: (1) to be at least 21 years of age or older; (2) to be enrolled on Tenofovir-Lamivudine-Efavirenz antiretroviral therapy for at least 24 weeks; (3) to be asymptomatic with an undetectable viral load (< 40 copies per milliliter of blood); (4) to not be affected by nutrient-related diseases and conditions necessitating special diets (e.g., cardiovascular disease, hypertension, cancer, and diabetes mellitus); (5) to live in the Centre Region of Cameroon for at least six months.

2.4 Data Collection

2.4.1. Questionnaire Participants were required to complete an in-person interview questionnaire designed by us at the start of the study to determine their sociodemographic characteristics, including gender, age, area of residence, religion, marital status, employment status, estimated average monthly income, their clinical history of HIV and their perception of nutritional counselling, including knowledges about type of HIV, number of months on ART, HIV status of the partner, nutritional counselling.

2.4.2. Anthropometric measurements Height, body weight, waist and hip circumference were measured with standard procedure, during the in-person interview. Anthropometric indices, body mass index (BMI) and waist-hip ratio (WHR), were determined. BMI (kg/m^2) was calculated as a proxy nutritional status by dividing body weight (kg) by the square of the height (m^2). It was classified into four categories, according to the conventional classification of the World Health Organization: underweight (BMI $\leq$ 18.5 kg/m^2), normal weight (18.5 > BMI $\geq$ 24.9 kg/m^2), overweight (25 > BMI $\geq$ 29.9 kg/m^2) and obese (BMI $\geq$30 kg/m^2) [22]. Abdominal obesity was assessed by calculating the

WHR as waist circumference (cm) divided by hip circumference (cm). The cut-off value of abdominal obesity was considered as WHR > 0.85 for women and WHR > 0.90 for men [23].

2.4.3. Dietary intake Dietary frequency and diversity were assessed, using food consumption score (FCS) questionnaire and food diversity score (FDS) questionnaire, as indicators of the nutrients adequacy of the diet of the participants [24]. The FCS was calculated using the frequency of consumption of seven food groups (cereals; legumes; vegetables and fruits; meat and fish; milk; sugar; and oil) that was consumed by each individual during the 7 days prior to the in-person interview questionnaire [25]. On the other hand, the FDS was estimated by simply counting each of the following nine food groups (starches; dark green leafy vegetables; fruits and other vegetables rich in vitamin A; other fruits and vegetables; organ meats; meat and fish; eggs; legumes, nuts and seeds; milk and dairy products) that each individual had reported on 24-hour dietary recalls [24]. Furthermore, participants were required to record all the foods and beverages consumption of 7 consecutive days in food diaries. They were asked to carry diary with them and to record foods as eaten in real-time, as well as the location, time, whether or not during special occasions (e.g., birthdays, weddings, funerals, etc.). The food diaries were used for the determination of food consumption and average nutrients intakes to estimate global nutrients intakes [26]. Nutrient's composition of each food was determined using food composition tables [19,20,27] and total energy was calculated with the energy values of protein, 1g gives 4 kcal; lipids, 1 g gives 9 kcal; and carbohydrates, 1 g gives 4 kcal.

2.5 Laboratory Analysis

Blood specimens were collected on-site to obtain information about biochemical markers of nutrient status. For each participant, venous blood was obtained by venipuncture at the bend of the elbow, following standard procedures and protocols. Blood samples were taken into: (1) three 1.8 mg/ml ethylene-diamine-tetra-acetic acid (EDTA) tubes, one tube for the determination of plasma total proteins, albumin and globulins; one tube for CD_4 T cells count estimation, and the other one for viral load level; and (2) one 5 ml plain tube to capture serum total protein. The collected blood samples were transferred in insulated bags to maintain a suitable ambient temperature to: (1) the study site laboratory where total proteins [28] and albumin [29] were measured by conventional colorimetric method; and CD_4 T cells counts were determined using flow cytometry [30]; and (2) the laboratory of the Cameroonian Pasteur Centre where viral load levels were determined using reverse transcriptase polymerase chain reaction [31]. This viral load was done to exclude participants with a detectable result. Except for the blood samples dedicated to measurement of the viral load levels and CD_4 T cells counts, the blood specimens used for the measurement of blood biomarkers were centrifuged at 3500 rpm for 5 minutes at ambient temperature. After that, each sample was divided into two aliquots and placed in two separate tubes. The first tube had serum while the second tube had plasma. They were immediately analyzed for plasma total proteins (g/l), serum total proteins (g/l), albumin (g/l) and globulins (g/l).

2.6 Statistical analysis

Data were recorded in Microsoft® Office Excel 2013 software. Statistical analysis was conducted using the statistical software IBM SPSS Statistics version 21.0 (SPSS Inc., Chicago, IL, USA). The graphs were constructed using Microsoft® Office Excel 2013

software. The mean and standard deviation were used for the description of continuous variables. The categorical variables were described in terms of percentage. The comparison of the means of two quantitative variables between two groups was performed using Student's t-test after checking the hypothesis of normality of the sample. The qualitative variables were compared by Fisher's exact test. For all the tests used, differences were considered significant if p <0.05.

3. Results

3.1 Sociodemographic characteristics

Among 104 patients interested by the study, we included 82 adults according to eligibility criterias. Most of the participants were females (76.8%) with a sex ratio of 1:3. The majority of the participants were between 31 and 39 years old (65.9%) with mean age of 33.0 ± 4 years. Fifty-two (65.0%) were Catholic. Large part of the participants 55 (67.1%) were married or in concubinage (or common-law marriage i.e. cohabitation of a couple without legal or formal married but living together in a 'marriage-like' relationship and publicly referring to themselves as partners). Thirty-three (40.2%) were self-employed with an estimated monthly income between 50,001 and 100,000 CFA F (38.3%). Sociodemographic characteristics of the study individuals are shown in Table 1.

Variables	Frequency (n=82)	Percentage
Gender		
Male	19	23.2%
Female	**63**	**76.8%**
Age		
21 - 30 years	28	34.1%
31 - 39 years	**54**	**65.9%**
Residence area		
Urban	**58**	**70.7%**
Peri-urban	24	29.3%
Marital status		
Married/concubinage	**55**	**67.1%**
Single	23	28.0%
Divorced/Separated	3	3.7%
Widow (er)	1	1.2%
Religion [a]		
Catholique	**52**	**65.0%**
Protestant	23	28.8%
Muslim	1	1.3%
Pentecotist/Jehovah's witness	4	5.0%
Profession		
Public employee	7	8.5%
Private employee	22	26.8%
Self-employee	**33**	**40.2%**
Unemployed	17	20.7%
Student	3	3.7%
Estimated monthly income [b] **(CFA francs)**		
< 25000	11	13.6%
25001 - 50000	27	33.3%
50001 - 100000	**31**	**38.3%**
100001 - 200000	8	9.9%
200001 - 300000	4	4.9%
> 300000	0	0.0%

[a]n = 80 [b]n = 81

Table 1: Socio-demographic characteristics

3.2 HIV medical history and perception of nutritional counselling

Table 2 below shows the HIV medical history and the perception of nutritional advices by the participants. Seventy-two (98.6%) of participants didn't know their type of HIV. The median of months on ARV therapy was 37.5 [18.0-51.25]. Fifty-six (68.3%) of participants had taken the therapy for 12-60 months. The majority of participants (62.2%) known their partners HIV status, for which 24 (52.2%) were negative. Between the positive partners, 18 (90.0%) were taking ART therapy. Forty-six (56.1%) participants said they have received nutritional counselling sometimes (45.7%) during their follow-up consultation. All participants found useful to receive nutritional advices (100.0%). Sixty-two (75.6%) participants were not taking their ARV therapy with meals, as an advice getting from the hospital (96.7%).

Variables	Frequency	Percentage
Type of VIH (n = 73)		
HIV 1	1	1.4%
Do not know	**72**	**98.6%**
Number of months on ARV therapy		
< 12	12	14.6%
12-60	**56**	**68.3%**
> 60	14	17.1%
Knowing partner status		
Yes	**46**	**62.2%**
No	28	37.8%
Partner HIV result (n = 46)		
Positive	21	45.7%
Negative	**24**	**52.2%**
Undetermined	1	2.2%
Partner on ARV (n = 20)		
Yes	**18**	**90.0%**
No	2	10.0%
Nutritional advices received in consultation		
Yes	**46**	**56.1%**
No	36	43.9%
Frequency of nutritional councelling[a]		
Sometimes	**21**	**45.7%**
Often	8	17.4%
Always	17	37.0%
Importance of nutritional councelling		
Yes	**82**	**100.0%**
No	0	0.0%
ARV with meals		
Always	5	6.1%
Sometimes	15	18.3%
Never	**62**	**75.6%**
If never, why? (n = 60)		
Eating early	2	3.3%
Advices from hospital	**58**	**96.7%**

[a]Sometimes: 1 consultation over 3; Often: 2 consultations over 3; Always: 3 consultations over 3.

Table 2: HIV medical history and perception of nutritional councelling

3.3 Anthropometric parameters

3.3.1. Body mass index

The average of BMI of study population was 24.56 ± 4.97 kg/m^2. The prevalence of underweight was 8.5%, whereas 45.1%; 35.4% and 11% of the participants were normal weight, overweight and obese respectively. Most participants with normal weight were men (47.4%) and aged between 21 and 30 (57.1%). Those falling into the obesity group were essentially women (14.3%) aged between 31 and 39 years (13%). Overweight condition was common in male (42.1%) and participants aged between 31 and 39 (37.0%). The lower prevalence of underweight were dominant in man (10.5%) and for 31 and 39 years old participants (11.1%). Figure 1 images the variation of BMI status (underweight, normal weight, overweight and obesity) of all participants. Figures 2 and 3 show the distribution of BMI per gender and per age group respectively.

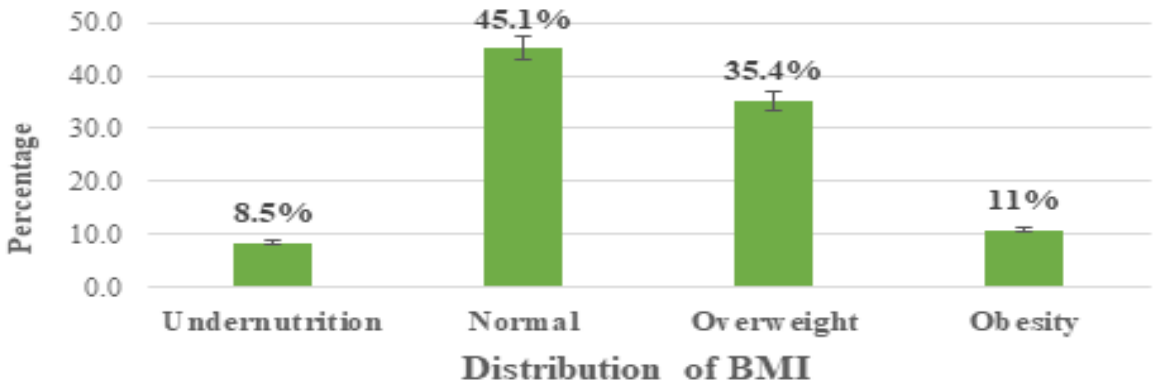

Figure 1: BMI distribution

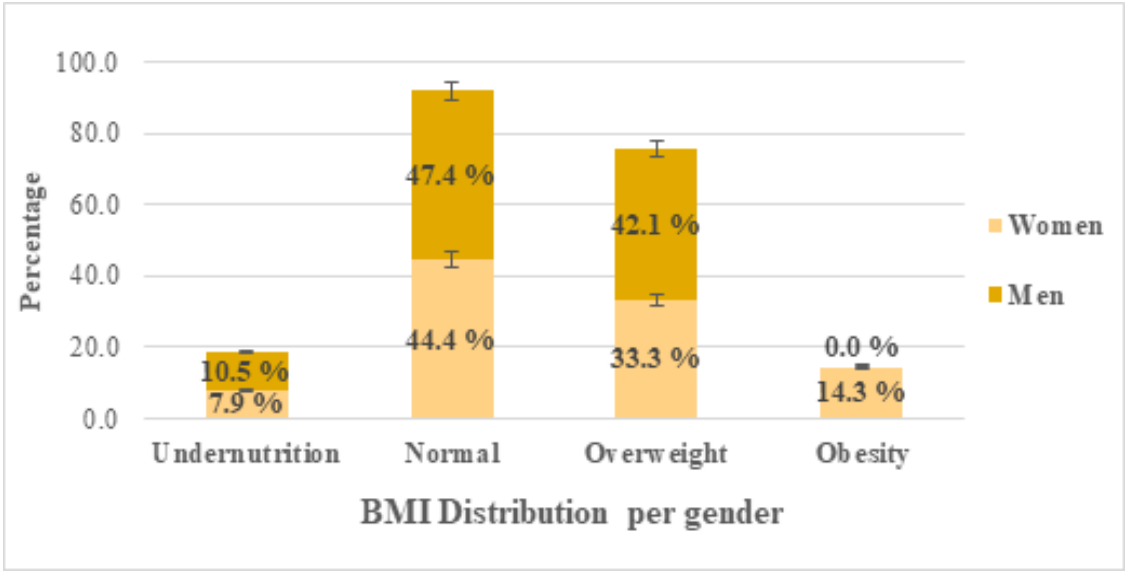

Figure 2: BMI distribution by gender

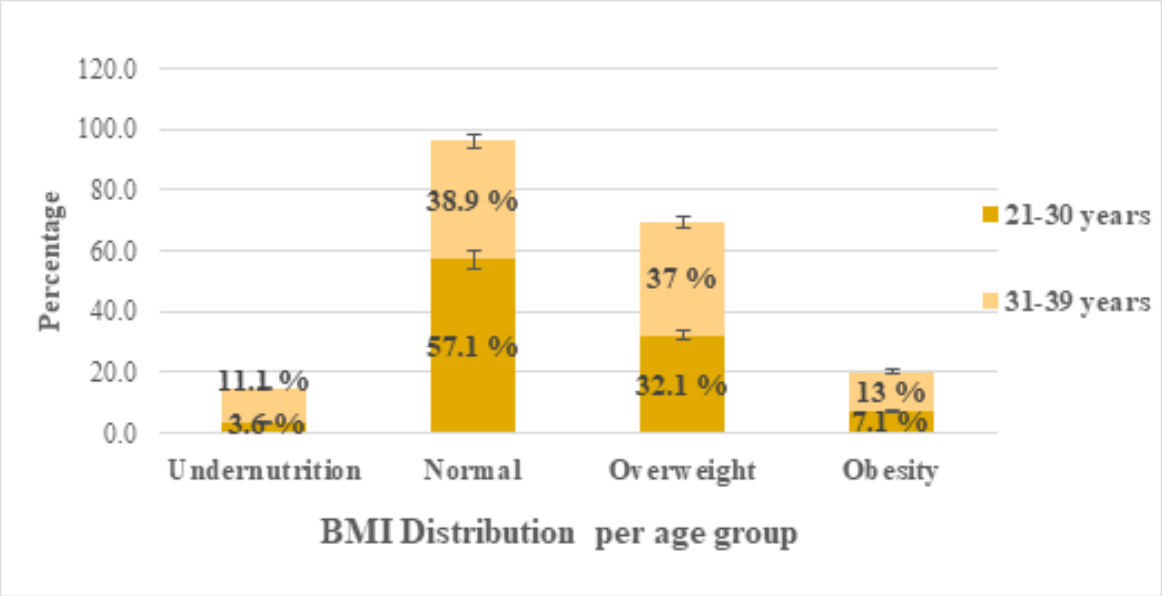

Figure 3: BMI distribution by age group

3.3.2. Waist-hip ratio

The WHR average was 0.89 ± 0.1 in study population. Figure 4 reveals the variation of WHR in the study population. Abdominal obesity was found in 48 (60.8%) of participants whereas 31 (39.2%) had normal morphotype. Figure 5 states that abdominal obesity was more present in men (82.4%) than in women (54.8%), with a statistical difference (p = 0.01). Figure 6 presents the variation of WHR by age group. Abdominal obesity was dominant in both age group, 55.6% for participants aged between 21 and 30 years old and 63.5% for those between 31 and 39 years old.

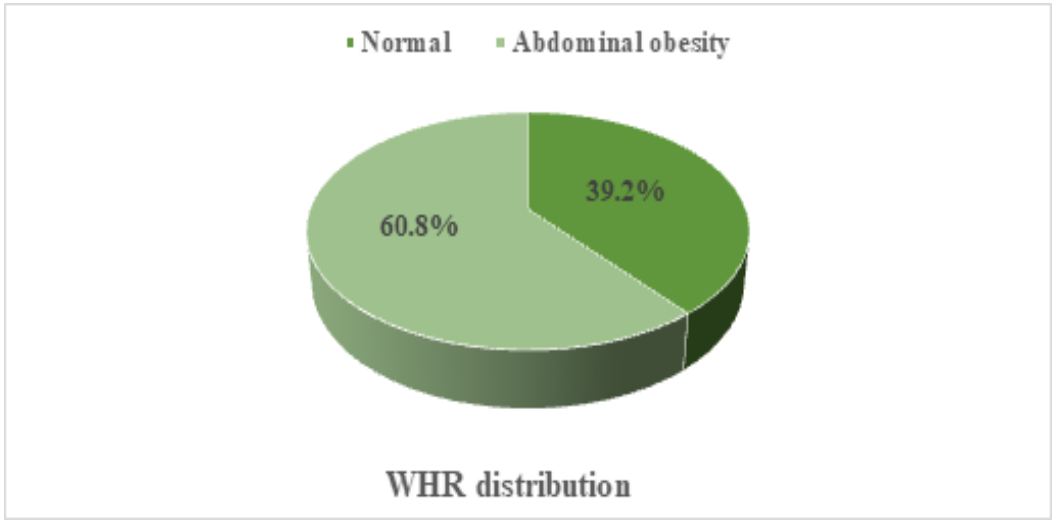

Figure 4: WHR variation of study population

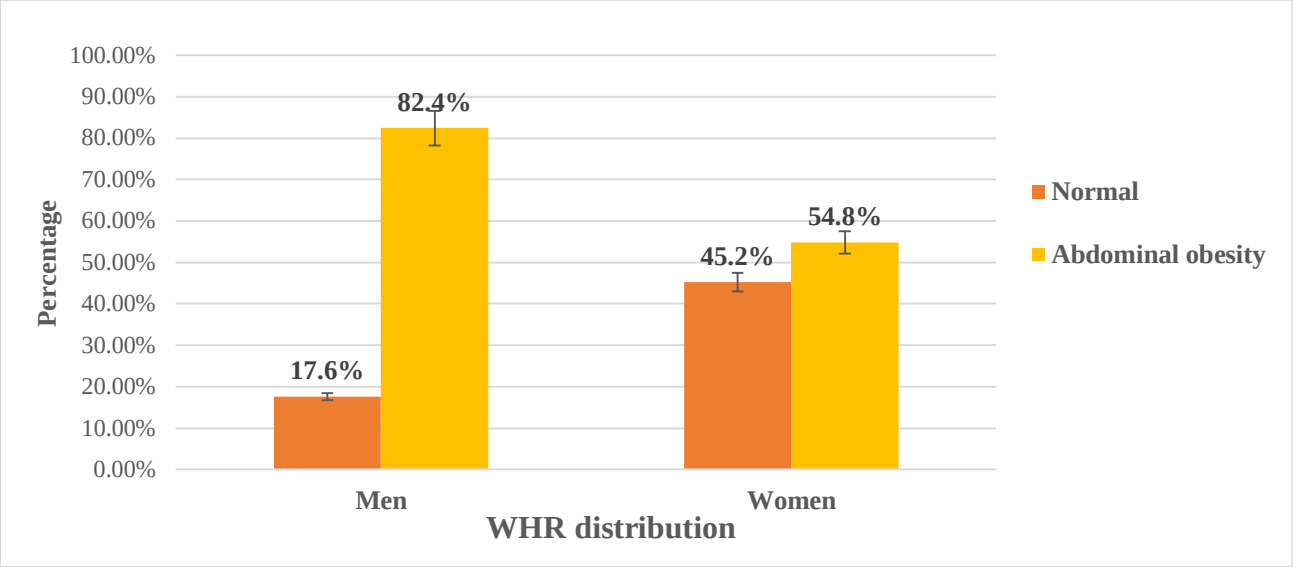

Figure 5: WHR distribution by gender

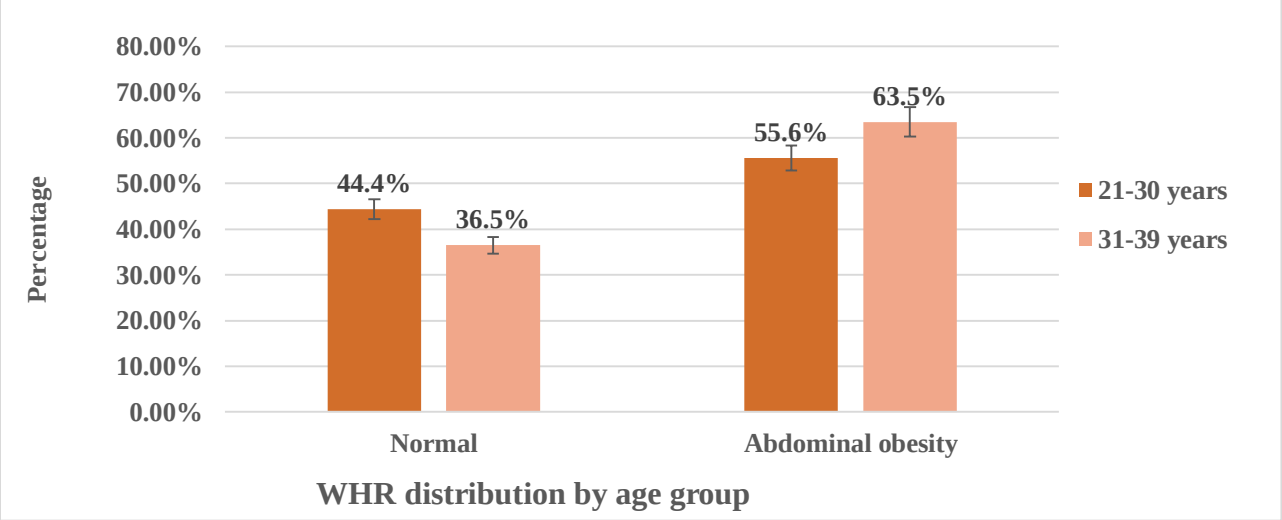

Figure 6: WHR distribution by age group

3.4 Dietary survey

3.4.1. Food consumption score

As our participants ate sugar and oil every day, we considered FCS less than 28 as poor, between 28.5 and 42 as borderline, and more than 42 as acceptable [25]. Figure 7 shows the distribution of FCS. Seventy-nine (97.5%) participants had an acceptable FCS whereas 2 (2.5%) had a borderline FCS. A poor FCS was not found in our study cohort.

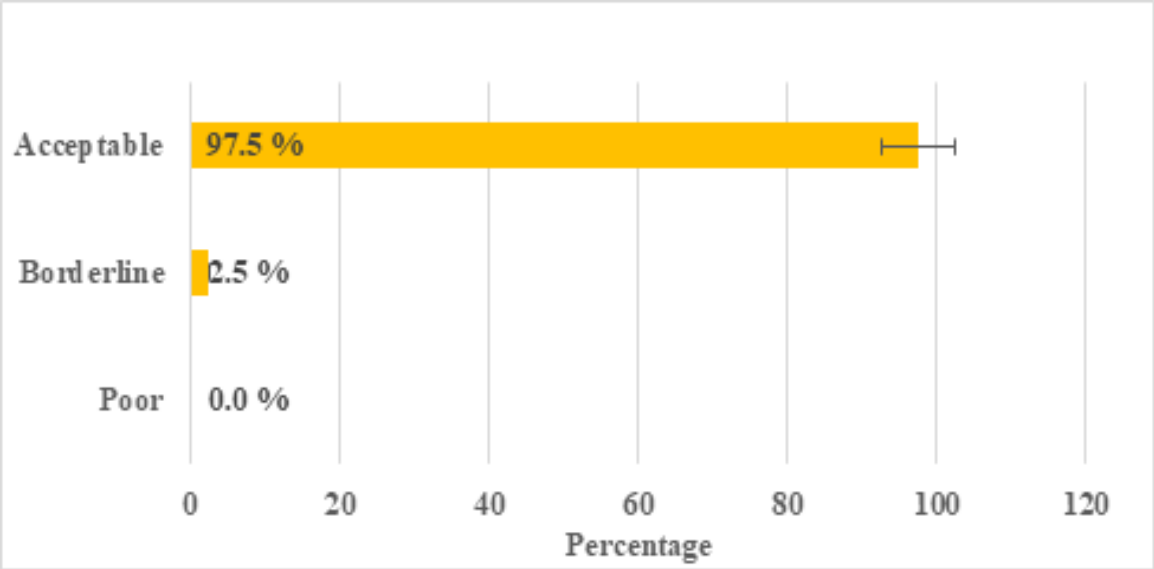

Figure 7: Food consumption score of study population

3.4.2. Food diversity score

We considered low any score less than or equal to 3, average between 4 and 5, and high, more than or equal to 6 [24]. Figure 8 presents the distribution of FDS. For 42 (51.9%) participants food diversity was average. Four (4.9%) had a high FDS whereas 35 (43.2%) had a low FDS. Figure 9 shows the variation of FDS by gender and age group. FDS was average for 34 (54.8%) women. It was also average for 15 (53.6%) participants aged between 21 and 30 years old and 27 (50.9%) participants between 31 to 39 years old. Men FDS was low for 9 (47.4%) of them. Starches (37.37%) and meat/fish (19.55%) were the two dominant groups of food items.

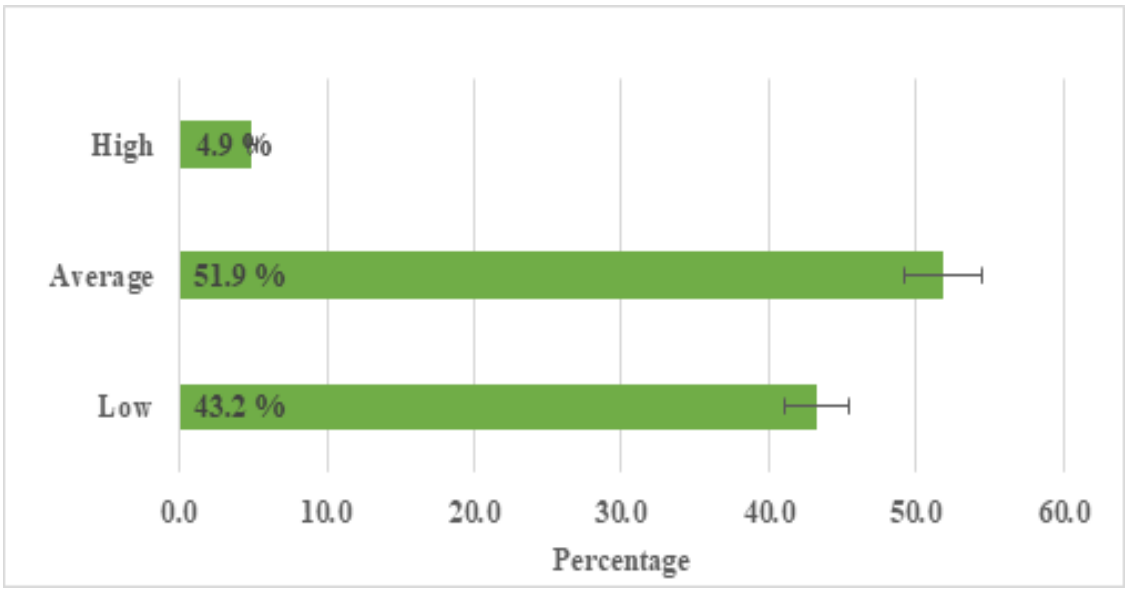

Figure 8: Food diversity score of study population

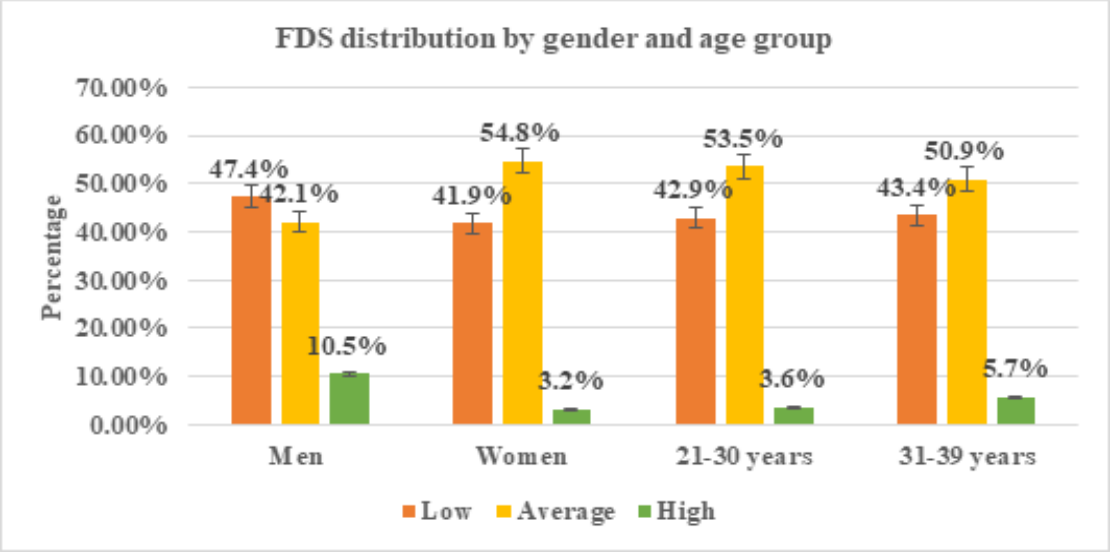

Figure 9: FDS distribution by gender and age group

3.4.3. Daily nutrients intake

Sixty-three food diaries were recovered, and 44 were included in the study after validation. Table 3 presents the means and median of macronutrients daily intake of participants. The median of protein (74.03 g) was higher than the daily required proteins. The mean of fats intake (70.31 g) was normal for women and low for men. The consumption of carbohydrates was two times (261.96 g) higher than the daily recommendation. Total energy was lower (2012 kcal) than needed in both men and women. These differences were not statistically significant for gender and age group. However we found a statistical difference between areas (urban versus peri-urban) for lipids (p = 0.01), carbohydrates (p = 0.03) and energy (p = 0.007).

Parameters	Mean ±SD/Median [Q25-Q75]	Normal range
Proteins (g)	**74.03 [51 - 97.87]**	M: 56 g/j; F: 46 g/day
Fats (g)	**70.31 ± 29.42**	M: 93g/j; F: 70g/day
Carbohydrates (g)	**261.96 ± 107.38**	130 g/day
Energy (kcal)	**2012.38 ± 773.82**	M: 2670-3420 kcal/day[a] F: 2400-2760 kcal/day[a]

M=Male F= Female [a]For PLHIV in Cameroon [32]

Table 3: Means and median of macronutrients daily intake

The recommended range are 11-15% for proteins, 35-40% for fats and 50-55% for carbohydrates per day [33]. Table 4 reveals the distribution of percentage of macronutrients and energy of participants. Most of them were consuming more than 15% of proteins (75%) and more than 55% of carbohydrates (88.6%) everyday. All

of them were eating less than 35% of lipids (100%) everyday, according to the food diaries. Daily energy intakes was low for 38 (86.4%) patients.

Parameters/Range	Frequency	Percentage
Proteins		
< 11%	3	6.8 %
11-15%	8	18.2 %
> 15%	**33**	**75.0 %**
Fats		
< 35%	**44**	**100.0%**
35 - 40%	0	0.0%
> 40%	0	0.0%
Carbohydrates		
< 50%	1	2.3 %
50 - 55%	4	9.1 %
> 55%	**39**	**88.6 %**
Energy		
Low	**38**	**86.4 %**
Insufficient	4	9.1 %
High	2	4.5 %

Table 4: Distribution of macronutrients and energy intake

3.5. Biochemical and immunological markers

Table 5 resumes the means or median of biochemical parameters and CD_4 T cells levels of participants. All markers were in normal range: 70.37 g/L for plasma total proteins; 70.24 g/L for serum total proteins; 39.23 g/L for albumin; 31 g/L for globulins and 475.50 /µL for CD_4 T cells. The difference between men and women was statistically significant (p = 0.008) for albumin level.

Parameters	Mean ±SD/Median [Q25-Q75] (n = 82)	Normal range
Plasma total proteins (g/L)	70.37 ± 9.70	66-87 g/L
Serum total proteins (g/L)	70.24 ± 9.90	64-83 g/L
Albumin (g/L)	39.23 ± 9.58	34-48 g/L
Globulins (g/L)	31.00 ± 11.72	30-35 g/L
CD_4 (per µL)	475.50 [273.75 - 692.00]	< 350/µL

Table 5: Means/median of biochemical and immunological markers

The normal range was 66 to 87 g/L for plasma total proteins; 64 to 83 g/L for serum total proteins; 34 to 83 g/L for albumin; 30 to 35 for globulins; and more or equal to 350 CD_4 T cells/µL. Table 6 states that most of participants had normal values of plasma total proteins (65.8%); serum total proteins (69.5%); albumin (58.5%); and CD_4 T cells (70.7%). Low globulins levels were dominant (51.2%) in the study population.

Variables	Frequency (n = 82)	Percentage
Plasma total proteins		
< 66 g/L	26	31.7%

66 - 87 g/L	**54**	**65.8%**
> 87 g/L	2	2.5%
Serum total proteins		
< 64 g/L	18	22%
64 - 83 g/L	**57**	**69.5%**
> 83 g.L	7	8.5%
Albumin		
< 34 g/L	19	22%
34 - 48 g/L	**48**	**69.5%**
> 48 g/L	15	8.5%
Globulins		
< 30 g/L	**42**	**51.2%**
30 - 35 g/L	12	14.6%
> 35 g/L	28	34.2%
CD_4		
< 350/µL	24	29.3%
≥ 350/µL	**58**	**70.7%**

Table 6: Variation of biochemical and immunological markers

4. Discussion

Nutrition plays an important role in immunity and influences the ability of the immune system to respond to infections. It is therefore a key part of the management of HIV infection. The aim of this pilot study was to determine the nutritional status of persons living with HIV in the Centre Region of Cameroon. Our results show that all patients aren't receiving nutritional advices during their follow-up. All of them found useful to have a nutritional counselling. This suggest that the reinforcement of caregiver's implication on nutritional education of patients should be improve. Moreover, our study findings reveal that there is high burden of malnutrition for PLWHA, both undernutrition and overnutrition. Undernutrition affects approximatively 1 over 10 patients, whereas overweight touched around 4 over 10, and obesity, more than 1 patient over 10. We observe that women were more affected by obesity than men, and men were more affected by overweight than women. On the other hand, undernutrition was dominant in men compare to women, similar to the study carried out by Takarinda et al. in Zimbabwe [34]. The presence of undernutrition after at least 24 weeks of ARV therapy with an undetectable viral load might be due to the quality and quantity of food intake or physiological status of concerned participants. Overweight and obesity were more dominant in our study than undernutrition, despite the lower daily total energy. This result suggest that the issue concern the quality of food consumed by participants. Moreover, only women were obese in our study cohort, aged between 31 and 39 years old. The reason might be the quality of food items intake, but also the physiological composition of women for that age. Abdominal obesity was dominant in our study population. It is probably due to the high prevalence of obesity in our cohort. However, abdominal obesity might reflect metabolic syndrome, knowing that this syndrome affects 32.8% of PLWHA in Cameroon [35]. FCS was acceptable for the majority of participants. Meaning that there is a good accessibility to food for participants. However, FDS that reflect the quality of food was high for few of them, whereas more than a half had a moderated FDS. The study carried out by Mukabana & Masika in Kenya [36] revealed that more than a half of PLWHA had a moderated FDS, whereas 35.5% had a high FDS,

making the difference with our findings. Our results suggest that the diet of participants was not enough varied. Moreover, starches, which are rich in carbohydrates, were more consume by participants. This finding is similar to those of Tesfaw et al. in Ethiopia [37]. Starchy food was followed by meat and fish item. The reasons might be due to the study area, cultural habits, socio-economic status [18-20]. And this can explained the prevalence of overweight and obesity of this study population. The daily intake of proteins and carbohydrates were higher than the recommanded values. This finding is in line with the FDS of participants. The consumption of fats was lower than the daily recommandation. The reason might be one of the limits of food diaries, that is the report of the quantity of fats daily intake. Although this was not the objective of this study, the trend showed a significant difference between participants from urban areas and those from peri-urban areas about fats, carbohydrates and energy. An in-depth study in this direction might provide important informations. Despite macronutrients intake was not normal in majority of participants, we found that biochemical parameters (albumin, plasma and serum total proteins) were normal. This result suggest that because of their better immunologic status, nutrients are well metabolised. This might be due to ART, undetectable viral load, clinical status of participants. But, low globulins level was predominant in more than a half of participants. Knowing that serum globulins level is a good biomarker of inflammation and the immune status of the body [38], there is a need for PLWHA to have optimal globulins levels in their diet to improve their immune system and ability to defense against infections.

This study revealed some implications. Firstly, malnutrition, both undernutrition and overnutrition, are present amongst persons living with HIV in the Centre Region of Cameroon. Therfore, it is important to sensitize caregivers about it, to assess and well register anthropometrics parameters starting by the first visit to the health facilities and during individual follow-up. Secondly, overweight and obesity are some of risk factors for cadiovascular diseases. Our findings suggest that there is an urgent need to screen and manage systematically cardiovascular risks and diseases at every follow-up consultation of HIV patients in health care centers, especially overweight and obese patients, to reduce the morbidity and the mortality due to this category of illness. Thirdly, studies might be done to formulate globulins locally available food supplement for PLWHA to help to improve their immunological status.

The investigation into causal relationship between determinents and outcomes of nutritional status of our study population is limited because of the cross-sectional nature of this study. Then, further analytical studies might be done for better results and conclusions. Additionally, a more representative study of the Centre Region of Cameroon might refine the results. And, as key limitations, this study may be affected by some systematic errors, for example recall bias for self-reported components and measurement errors.

5. Conclusion

Our findings reveals that there is a double burden of undernutrition and over-nutrition in HIV population of Centre Region of Cameroon, with a high prevalence of overweight and obesity than undernutrition among these HIV patients taking ARV therapy for more than 24 weeks with an undetectable viral load. Women were concern by overweight and obesity, while men were concern by overweight. Nutritional counselling, nutritional assessment and screening of cardiovascular

diseases should be an important part of PLWHA routine follow-up, using available local foods.

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Conflicts of interest

There were no conflicts of interest between authors.

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