

Research Article

# High Prevalence of Metabolic Syndrome Found in Yaounde Fitness Centers: A Cross-Sectional Study

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## Abstract

Metabolic syndrome (MetS) is a growing public health concern globally, characterized by a cluster of conditions that increase the risk of cardiovascular diseases and type 2 diabetes. In Cameroon, particularly in urban areas like Yaoundé, lifestyle changes and a growing sedentary population have contributed to the rise of this syndrome. This study aimed to assess the prevalence of metabolic syndrome among individuals frequenting fitness centers in the city of Yaounde. In order to achieve this objective, a cross-sectional study was conducted involving 483 participants, including 326 women and 157 men, aged between 20 and 70 years. Anthropometric measurements (height and weight) were taken to determine the participants' body mass index (BMI) according to the World Health Organization (WHO) classification. Waist circumference, blood pressure, and fasting blood glucose levels were also assessed to determine the prevalence of metabolic syndrome using the criteria of the International Diabetes Federation (IDF). The findings revealed that 47.80% of the participants were affected by metabolic syndrome. The prevalence was notably higher in women (36.23%) than in men (11.59%). Additionally, the age group between 41 and 60 years exhibited the highest prevalence at 22.77%. The results underscore the high prevalence of metabolic syndrome among individuals attending fitness centers in Yaounde, with middle-aged women being the most affected. These findings highlight the need for targeted interventions to manage and prevent metabolic syndrome in this population.

## Keywords

Metabolic Syndrome, Prevalence, Fitness Centers, Yaounde, Anthropometric Measurements, Cardiovascular Risk, Type 2 Diabetes

## 1. Introduction

Metabolic syndrome, which is characterised by a set of conditions such as abdominal obesity, hypertension, dyslipidaemia and hyperglycaemia, is associated with an increased risk of cardiovascular disease and type 2 diabetes [1, 2]. The prevalence of metabolic syndrome has been a

significant public health concern worldwide. According to the World Health Organization [3], metabolic syndrome affects an estimated 20-25% of the adult global population. The condition is closely linked to an increased risk of cardiovascular diseases and type 2 diabetes. Various studies

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have reported different prevalence rates based on diagnostic criteria, with some regions showing higher rates, particularly in developed countries and urban areas of developing nations. In the United States of America, the prevalence has been found to be higher than in other regions, with estimates ranging from 12.5% to 31.4% depending on the diagnostic criteria applied [4]. In France, MetS prevalence is lower compared to the U.S., though it is rising. A study reported a prevalence of approximately 22% in the general population [5]. Data from Sub-Saharan Africa reveal varying prevalence rates, ranging from 17.5% to 34% in some urban populations [6, 7].

The prevalence of metabolic syndrome (MetS) in Cameroon is a growing concern, influenced by urbanization, lifestyle changes, and demographic factors. Research indicates significant variations in MetS prevalence across different populations and regions within the country. A study in the Littoral region found that MetS prevalence was highest in urban areas (37.2%), followed closely by rural (36.8%) and semi-urban (25.9%) settings. This disparity is attributed to lower physical activity levels in urban populations, where 54.5% reported low activity levels compared to 16.9% in rural areas [8]. Among secondary school students in Douala, the prevalence of MetS was reported at 27.4%, with a notable gender difference: 33.7% in females versus 11.1% in males [8]. Moreover, a study conducted in the Dschang Health District revealed that the prevalence of metabolic syndrome among adult men was alarmingly high (31.97% in the rural area and 48.60% in the urban area), attributed to shifts in dietary habits and physical activity patterns that accompany urbanization [9]. Given this situation, it is crucial to establish reliable epidemiological databases on the prevalence of metabolic syndrome in Cameroon to better understand the extent of the problem and guide public health policies. The aim of this study is to assess the prevalence of metabolic syndrome among individuals frequenting fitness centers in the city of Yaounde.

## 2. Materials and Methods

### 2.1. Participants

This study is cross-sectional in nature and was carried out in fitness clubs in the Mfoundi department (Yaounde) during the period from 10 May to 15 June 2023. The study targeted nine (09) fitness centres in the city of Yaounde. A total of 483 participants, including 326 women and 157 men aged between 20 and 70, were selected for the study. The participants were recruited based on their regular attendance at these fitness centers, ensuring a diverse representation of individuals engaging in physical activity. The fitness centers included in the study offered a variety of physical activity programs, including aerobic exercises, strength training, and flexibility exercises. Before participating, all individuals provided written informed consent, adhering to ethical

guidelines outlined in the Helsinki Declaration. The study was ethically approved by the local ethics committee in charge of human health, operating under the Ministry of Public Health of Cameroon. The approval was granted under the reference number N°0637/L/RA/DSP/BFP/YDE on May 4, 2023. Participants were assured of their confidentiality and the voluntary nature of their involvement throughout the study.

### 2.2. Measurements

#### 2.2.1. Anthropometry

Body Mass Index (BMI) was calculated as body weight in kilograms divided by height in meters squared ( $\text{kg/m}^2$ ). Body weight and body height were recorded with participants dressed in light clothing, after overnight fasting, without shoes and having washed their feet with an alcoholic disinfectant. Body weight was measured with a bio-impedance meter scale Tanita BC-532 (Tanita Corp., Tokyo, Japan). Body height was measured using a precision stadiometer (Seca 220, Seca) to the nearest 0.1 cm.

#### 2.2.2. Waist Circumference

Waist circumference was measured using a tape measure placed perpendicular to the longitudinal axis of the body. The tape measure must pass slightly above the iliac crest of the participant who is standing with his legs together. The reading in cm was taken at the navel.

#### 2.2.3. Haemodynamic Parameters

A Chinese-made CK-W133 automatic electric wrist blood pressure monitor was used to measure systolic (SBP) and diastolic (DBP) blood pressure. After at least 30 minutes' rest, the electric sphygmomanometer was placed on the participant's left arm. The values for SBP and DPB (in mmHg) were read directly from the dials on the monitor.

#### 2.2.4. Blood Glucose Levels

Each participant's blood sugar was assessed using strips and a glucometer (Accu-CHEK® Active meter). Blood was sampled from finger-tip five minute after the end of the bleep test. Each strip is provided with a reagent zone containing reagents. Applying blood to this reactive area will cause a chemical reaction resulting in a change in colour of the test area. The Accu-CHEK® Active meter will detect this colour change and use the group-specific information on the code chip to convert the result corresponding to the colour obtained into a numerical value.

#### 2.2.5. Prevalence of Metabolic Syndrome

Metabolic syndrome was defined using the criteria of the International Diabetes Federation [10]. Subjects were considered to have metabolic syndrome if they had at least three of the following criteria:  $\text{BMI} > 25 \text{ kg/m}^2$ , waist

circumference greater than or equal to 94 cm, elevated fasting blood glucose >110 mg/dl, arterial hypertension (SBP > 130 mmHg and/or DBP > 85 mmHg).

### 2.2.6. Statistical Analyses

Data were analysed using SPSS version 21 software. Continuous variables were presented as mean  $\pm$  standard deviation and ordinal and nominal variables were presented as percentages. The Chi-square test was used to determine the link between the sociodemographic parameters and metabolic status of participants. Differences were considered significant at  $p < 0.05$ .

## 3. Results

Table 1 shows the distribution of participants according to their metabolic status. The data in this table show that participants with metabolic syndrome represented 47.80% of the total number of participants, while those with normal metabolic status represented 52.20%.

The distribution of participants according to metabolic status and gender is shown in Table 2. Analysis of the data in this table shows that 36.23% of participants with metabolic syndrome were women, while 11.59% were men. The chi-square test performed on this table showed a significant link ( $X^2=13.778$ ;  $ddl=1$  and  $p<0.001$ ) between gender and metabolic status. In fact, women are significantly ( $p<0.01$ ) more exposed to metabolic syndrome than men in these fitness centres/clubs/courses.

Table 3 shows the distribution of participants by metabolic status and by fitness centre. Analysis of the data in this table shows that the sports course on the Corniche Ouest has the highest number of participants with metabolic syndrome, with a prevalence of 8.28%. Next in order: the Olympic club (8.07%), the Omnisport course (7.04%), the Biyemassi

complex (6.00%). Achropole club (5.80%), Condor fitness (5.38%), NIYS fitness (3.73%), Ekounou fitness (2.48%) and SMN Gym (1.03%). The chi-square test performed on this table showed no significant association ( $X^2=9.246$ ;  $ddl=8$  and  $p=0.322$ ) between membership of a gym/club/parcours and the metabolic status of the participants in this study.

The distribution of participants according to metabolic status and age group is shown in Table 4. The data in this table showed that participants aged between 41 and 60 had the highest prevalence of metabolic syndrome (22.77%). The chi-square test carried out on this table showed a significant link ( $X^2=39.936$ ;  $ddl=2$  and  $p<0.001$ ) between the age groups and the metabolic status of the participants. Indeed, older people are significantly ( $p<0.001$ ) more exposed to metabolic syndrome than younger people in these fitness centres.

Table 5 shows the distribution of participants according to metabolic status and level of sporting activity. Analysis of the data in this table shows that participants practising physical and sports activities 3 to 4 times a week are the most numerous, with a prevalence of 20.91%. However, the chi-square test carried out on this table showed no significant link ( $X^2= 0.060$ ;  $ddl=2$  and  $p>0.971$ ) between the number of sessions of sport per week and the metabolic status of the participants.

**Table 1.** Distribution of participants according to metabolic status.

Metabolic status	Number (ni)	Frequency (%)
Normal Metabolic Status	252	52.20
Metabolic syndrome	231	47.80
Total	483	100.00

**Table 2.** Distribution of participants according to metabolic status and gender.

Gender	Metabolic status			Chi-square test
	Normal Metabolic Status	Metabolic Syndrome	Total	
Women	151 (31.26%)	175 (36.23%)	326 (67.49 %)	$X^2=13.778$ , $ddl=1$ , $p<0.001$
Men	101 (20.91%)	56 (11.59%)	157 (32.51%)	
Total	252 (51.17%)	231 (47.83%)	483 (100 %)	

**Table 3.** Distribution of participants according to metabolic status and affiliated centers.

Affiliated centers	Metabolic status			Chi-square test
	Normal Metabolic Status	Metabolic Syndrome	Total	
Corniche	52 (10.77%)	40 (8.28%)	92 (19.05 %)	X <sup>2</sup> =9.246, ddl=8, p=0.322
Olympique	32 (6.62%)	39 (8.07%)	71 (14.70 %)	
Achropole	36 (7.45%)	28 (5.80%)	64 (13.25 %)	
NIYS	15 (3.10%)	18 (3.73%)	33 (6.83 %)	
SMN Gym	10 (2.07%)	5 (1.03%)	15 (3.11 %)	
Ékounou	12 (2.48%)	12 (2.48%)	24 (4.97 %)	
Omnisport	47 (9.73%)	34 (7.04%)	81 (16.77 %)	
Condor	30 (6.21%)	26 (5.38%)	56 (11.59 %)	
Complexe Biyemassi	18 (3.73%)	29 (6.00%)	47 (9.73 %)	
Total	252 (51.17%)	231 (47.83%)	483 (100 %)	

**Table 4.** Distribution of participants according to metabolic status and age groups.

Age groups	Metabolic status			Chi-square test
	Normal Metabolic Status	Metabolic Syndrome	Total	
20 to 40 years	139 (28.78%)	89 (18.43%)	228 (47.20 %)	X <sup>2</sup> =39.936 ddl=2 p<0.001
41 to 60 years	52 (10.77%)	110 (22.77%)	162 (33.54 %)	
61 years and above	61 (12.63%)	32 (6.62%)	93 (19.26 %)	
Total	252 (51.17%)	231 (47.83%)	483 (100 %)	

**Table 5.** Distribution of participants according to metabolic status and level of sport practice.

Number of session per week	Statut métabolique			Chi-square test
	Normal Metabolic Status	Metabolic Syndrome	Total	
1 to 2 times	79 (16.36%)	71 (14.70%)	150 (31.06 %)	X <sup>2</sup> =0.060 ddl=2 p=0.971
3 to 4 times	111 (22.98%)	101 (20.91%)	212 (43.89 %)	
5 to 6 times	62 (12.84%)	59 (12.21%)	121 (25.05 %)	
Total	252 (51.17%)	231 (47.83%)	483 (100 %)	

## 4. Discussion

The aim of this study is to assess the prevalence of metabolic syndrome among individuals frequenting fitness

centers in the city of Yaounde. Several criteria were used to define the metabolic syndrome. The criterion used, which was that of the International Diabetes Federation, was used to assess the metabolic syndrome. The results of this study showed a prevalence of metabolic syndrome of 47.80% among individuals frequenting fitness centers in the city of

Yaounde. This finding is consistent with the growing body of literature suggesting that metabolic syndrome is a major public health concern, even in populations engaging in regular physical activity [11]. These results are also in line with those obtained in other regions of the world such as France [4], the United States of America [5], Nigeria [12], Ghana [13] and the Asian continent [14]. The same is true of the results obtained from studies conducted in Cameroon [2, 8, 9, 15]. Indeed, prevalence of metabolic syndrome in urban areas ranging from 37.2% to 48.60% have been reported in these studies. These figures bear witness to the epidemiological transition underway in Cameroon, where urbanisation and dietary changes are contributing to a rapid increase in metabolic syndrome, reinforcing the urgent need for targeted interventions to address metabolic syndrome in African populations.

The study found a significant gender disparity in the prevalence of metabolic syndrome, with women (36.23%) showing a higher prevalence than men (11.59%), which is statistically significant ( $X^2=13.778$ ;  $p<0.001$ ). This result is consistent with studies conducted in other African countries, where women are disproportionately affected by metabolic syndrome due to both biological and socio-cultural factors. Women are often more prone to obesity, particularly abdominal obesity, which is a key risk factor for metabolic syndrome [12, 16]. In Cameroon, several studies have highlighted that women are more likely to have higher waist-to-hip ratios and higher rates of hypertension, contributing to their higher risk of developing metabolic syndrome [17]. Moreover, hormonal changes related to pregnancy, menopause, and the use of hormonal contraceptives could further exacerbate women's vulnerability [18]. Furthermore, the higher risk among women in fitness centers could be due to other factors, including access to healthcare and socio-cultural roles, which may influence women's engagement in physical activity or dietary habits [19]. Addressing these gender differences in fitness centers programming and health interventions will be critical to tackling metabolic syndrome in Cameroon.

In terms of factors associated with metabolic syndrome, there were 184 obese patients suffering from metabolic syndrome, with a prevalence of 38.09%. 230 hypertensives suffering from metabolic syndrome, with a prevalence of 47.60%, and 356 diabetics suffering from metabolic syndrome, with a prevalence of 73.70%. These results are similar to those of Dandji et al. [9], who established a link between the evolution of the metabolic syndrome curve and associated factors such as sedentary lifestyle, arterial hypertension, overweight, high energy intake (high glycaemia), high lipid intake and LDL hypercholesterolaemia. The high prevalence of metabolic syndrome in people with diabetes can be explained by the fact that they are three to five times more likely to develop type 2 diabetes, and that hyperglycaemia itself is one of the components of metabolic syndrome.

The distribution of metabolic syndrome by age group shows that people in the 41-60 age range are significantly ( $p<0.001$ ) more exposed to metabolic syndrome, i.e. a prevalence of 22.77%, with a fall in the prevalence of metabolic syndrome from the age of 60 observed among the participants in our study (6.62%). Age is a well-known risk factor for metabolic syndrome, with older individuals more likely to experience the physiological changes associated with the syndrome, including insulin resistance, dyslipidaemia, and hypertension [20]. In sub-Saharan Africa, the prevalence of metabolic syndrome also tends to increase with age. A study in Yaounde found that individuals over 40 years old were significantly more likely to have metabolic syndrome than younger adults [21]. The increasing prevalence of obesity, coupled with reduced physical activity in older adults, may contribute to this trend [12]. The significant association between age and metabolic syndrome in this study ( $X^2=39.936$ ;  $p<0.001$ ) emphasizes the importance of addressing metabolic health concerns among middle-aged and older populations in Cameroon. These findings underscore the need for age-appropriate interventions that focus not only on physical activity but also on preventive measures such as dietary modifications and regular screening for risk factors [17].

Despite the overall high prevalence of metabolic syndrome in the fitness centers, the study found no significant association ( $X^2=9.246$ ;  $p=0.322$ ) between membership in a particular fitness center and metabolic status. This suggests that simply attending fitness centers may not be sufficient to prevent or manage metabolic syndrome, possibly due to differences in the intensity or type of physical activities offered, the participants' adherence to exercise routines, or other environmental and lifestyle factors. Similar results have been reported in other studies that show fitness centers membership alone is not always associated with improved metabolic health outcomes [15, 20]. The diversity of fitness programs and the varying levels of commitment among participants might explain why no clear association emerged. A study in Côte d'Ivoire also found that physical activity levels were not strongly correlated with metabolic syndrome prevalence among gym-goers, suggesting that additional factors such as diet, sleep, and stress management play an essential role in preventing metabolic syndrome [22]. Therefore, fitness centers should incorporate holistic health strategies, which not only emphasize exercise but also promote lifestyle modifications in areas like nutrition and stress reduction.

Although there was no significant association between fitness centers membership and metabolic syndrome, the distribution of prevalence rates across different centers is still worth noting. The Corniche Ouest sports course had the highest prevalence (8.28%), followed by the Olympic Club (8.07%) and others. This variation may reflect differences in the socio-economic status of the individuals attending these centers, as people from wealthier backgrounds often have access to better fitness facilities but may also experience higher levels of sedentary behaviour and dietary challenges



[18]. It is also possible that certain fitness centers attract individuals who are already at higher risk for metabolic syndrome, either due to personal health issues or lifestyle factors. It is noteworthy that the prevalence rates in the present study are somewhat higher compared to other studies in Cameroon, where urbanization, dietary transitions, and increasing sedentary lifestyles have contributed to the rise in metabolic syndrome [17]. This study underscores the need to address not only physical activity levels but also socio-economic and cultural factors that may affect health behaviours and metabolic outcomes in Cameroon.

## 5. Conclusion

This study demonstrates that metabolic syndrome is highly prevalent among fitness centers attendees in Yaounde, Cameroon, particularly among women and older adults. The lack of significant association between fitness centers membership and metabolic status highlights the importance of a comprehensive approach to health that includes exercise, diet, and lifestyle modifications. Future interventions should focus on promoting holistic health strategies that address the multi-dimensional nature of metabolic syndrome, especially in vulnerable groups such as women and older adults. Additionally, more targeted research is needed to explore the social and environmental factors that contribute to metabolic health in Cameroon and similar sub-Saharan African contexts.

## Abbreviations

MetS	Metabolic Syndrome
BMI	Body Mass Index
WHO	World Health Organization
IDF	International Diabetes Federation
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
LDL	Low Density Lipoprotein
NIYS	National Institute of Youth and Sports
SMN	South Mountain

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## Author Contributions

**Bonoy Lamou:** Formal Analysis, Software, Writing-original draft, Writing – review & editing

**Hamadou André:** Data curation, Investigation, Methodology, Supervision, Validation

**Adama Francois:** Conceptualization, Data curation

Formal Analysis, Investigation

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## Conflicts of Interest

The authors declare no conflicts of interest.

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## Biography



**Bonoy Lamou** is a sports and exercise physiologist. He completed his doctoral studies (PhD) from 2014 to 2019 at the University of Yaounde 1. Lecturer and head of Department of Physical Education, Health and Leisure at the University of Ngaoundere (Cameroon), he has been a permanent teacher at the National Institute of Youth and Sports of

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**Adama Francois** is a physical education and sports teacher serving secondary education in the city of Bertoua. A 2021 laureate of the National Institute of Youth and Sports in Yaounde (Cameroon), he is also a student in the Department of Physical Education, Health and Leisure at the University of Ngaoundere. His research work is in the field of sports physiology and physical exercise.

## Research Fields

**Bonoy Lamou:** sport physiology, pharmacology, chronic diseases, physical education, sport psychology, psychomotor learning

**André Hamadou:** physical education, chronic diseases, sport pharmacology, sports training, sport for all

**Adama Francois:** physical education, biomedical sciences, chronic diseases, sports training, sport physiology