Evaluation Of Prevalence Of Metabolic Syndrome In Adult Subjects In University Settings: The Case Of The Ecole Normale Supérieure Of Libreville/Gabon

Hourfil-Gabin NTOUGOU ASSOUMOU[1], PhD, Armelle NTSAME AFFANE[1], PhD, Noreen Orianna KOUMBA MADINGOU[2], Doctorant

1. Ecole Normale Supérieure, BP: 17009, LBV / Gabon.
2. Laboratoire de Pharmacologie, Institut de Pharmacologie et de Médecine Traditionnelle (IPHAMETRA), CENAREST, BP: Gabon

Corresponding author: Hourfil-Gabin NTOUGOU ASSOUMOU, PhD. hourfil@gmail.com

***Abstract*—Background: Metabolic syndrome (MetS) is a current disease entity characterized by hyperglycemia, obesity, dyslipidemia hypertension.**

***Objective:* The aim of our study was to evaluate the prevalence of MetS and his associated risk factors in the Ecole Normale Superieure of Libreville.**

***Results:* Among the 479 subjects, 23 people had MetS according (4.83%) to NCEP ATP III criteria. The prevalence was higher in women with 65.22 % than men and increased with age.**

***Conclusions:* In spite of the numerous work and progress on the MetS, the latter stay misunderstood because of many controversies which surround him and its unknown physiopathology.**

Keywords—metabolic syndrome, cardiovascular disease, prevalence, adipose tissue.

Introduction

The number of people with diabetes in the world is estimated at more than 347 million according to the World Health Organization (WHO) [1]. And, the prevalence of diabetes is increasing in both developed countries with a rate of 40%, as in so-called "developing countries" especially in sub-Saharan Africa with 3.3 million Africans with diabetes. Like other countries of the continent, Gabon with 4.4% of the population reached is among the four most affected countries by this disease in Africa [1, 2].

However, many studies have shown that the association of diabetes with other metabolic abnormalities such as abdominal obesity, dyslipidemia, high blood pressure and many others, was a risk factor for cardiovascular disease. Indeed, this constellation of morphological, physiological and metabolic disorders is called metabolic syndrome (MetS) [3, 4, 5]. MetS is considered one of the world's leading health problems for the adult population in the 21st century [6]. Recent studies in several African populations reveal a prevalence ranging from 0 to 50% or more. In Nigeria the prevalence is 18%, in neighboring Cameroon it is 59%, while in Congo it is 18.9% [7, 8, 9].

On the other hand, cardiovascular diseases are the leading cause of death in industrialized countries and are constantly changing in so-called "emerging" countries [10]. Despite a lack of recent and accurate data, we nevertheless note that stroke is the first reason for admission to the neurology department of the Libreville Hospital Center [11]. The report on global nutrition indicates that in Gabon there is a rise in metabolic risk factors for non-communicable diseases with levels of 40% for blood pressure, 10% for blood glucose, 43% for blood cholesterol high. And, an increase in the prevalence of overweight and obesity with 44% of overweight adults and 15% of obese [12]. This would probably explain the current increase in the number of cases of cardiovascular accidents in this country.

Several factors may be responsible for this situation, namely: poor eating habits, alcoholism, sedentary lifestyle, health systems and many others. These factors are very prevalent in Gabon, hence the interest we must place in prevalence studies of cardiovascular diseases and other non-communicable diseases [13].

The MetS is a concept that arouses a lot of interest but also controversies in the scientific world. The main controversy surrounds its definition. Indeed, many definitions have been proposed certainly with criteria that come together but, there is still no common definition. The numerous publications published on the subject in recent years confirm this [14, 15, 16]. Thus, the fact that the syndrome is not yet defined as a disease does not prevent it from being important in distinguishing it from other diseases such as type 2 diabetes, obesity and many others. Moreover, it has been proven that in people with MetS, there is a double risk of having and dying from a cardiovascular event [17, 18, 19]. It is therefore necessary to multiply the studies that will better understand it and thus find the appropriate solutions to remedy it.

In addition, MetS studies have already been carried out in many African countries. One on the association between urbanization, physical activity and metabolic syndrome in adults of rural and urban populations in Cameroon [20]. Another on the prevalence of metabolic syndrome in a rural population of Ghana [21]. However, we are not aware of a study on metabolic syndrome in Gabon. It is therefore necessary in the case of Gabon to conduct studies on the subject to better prevent its occurrence and / or evolution and in parallel the diseases to which it exposes.

It is with this in mind that we decided to evaluate the metabolic syndrome within the Ecole Normale Supérieure of Libreville.

Thus, throughout this work, we will first address the generalities around the metabolic syndrome, then the concept of metabolic syndrome, then we will discuss the experimental part which will be followed by a discussion and a conclusion.

Material and methods

The study took place at the Ecole Normale Supérieure during the period from January to March. The population consisted of 476 male and female individuals aged between 20 and 70 and belonging to the higher education sector (teachers, students or administrative staff). The few criteria for inclusion were based on adulthood (> 18 years old), volunteering, belonging to higher education and being in apparent good health.

Prior to the measurement of anthropometric and biological parameters, we collected information on the identity of the participants (surname, first name, gender, status, and establishment, date of birth, place of residence, department, telephone and many others).

Measurement of anthropometric parameters

The first parameter was the weight that was measured using a graduated scale. For the measure of the latter, the individual first had to get rid of objects that could give a wrong result such as shoes, phone and many others. Then he had to climb on the scales, his arms extended parallel to his body, his head raised.

After gaining weight, we measured the height using a graduated height in cm. So, the off-duty subject had to climb on the board, always with his arms around his body, his head up and his feet together. To measure the size, we slid the latch of the board to the highest point of the head.

These first two parameters will allow us to determine the Body Mass Index (BMI), using the formula: BMI = weight in kg / height in m^2. Afterwards, using a tape measure graduated in centimeters, we evaluated the waist and the hip.

Waist circumference was measured midway between the anterior superior iliac crest and the last rib after a normal exhalation. Indeed, a high waist would translate a high visceral fat.

The hip circumference is the horizontal circumference of the body measured at the strongest point below the waist (usually at the height of the buttocks).

The waist-to-hip ratio is an indicator of the type of adiposity. In addition to BMI, it helps prevent cardiovascular disease. By measuring the adiposity, we can qualify if it is of the android or gynoid type.

Para-clinical and biological parameters measurement

The first para-clinical parameter we measured was blood pressure. This one allows to evaluate the pressure exerted by the blood on the walls of the arteries. It is constantly modified during a cardiac cycle and has two main phases. The systolic phase which corresponds to the highest pressure and the diastolic phase which corresponds to the lowest pressure. To measure the blood pressure we used a compact automatic sphygmomanometer operating on the principle of oxillometry. The subject was sitting properly, relaxed, comfortably at room temperature and should not have eaten, smoked or exercised 30 minutes before the measurement. The subject was sitting on a chair, his feet resting flat on the floor. He had to remove the tight clothing from his arm or roll up the sleeves to put the cuff. Then we introduced the inflation plug into the air intake, and passed the arm through the cuff loop. The arm was placed correctly positioned (ie) the lower edge of the cuff 1 or 2 cm above the elbow, the marker centered on the middle of the inner side of the arm and the closed fabric band energetically. Finally, we pressed the power button and waited for the monitor to inflate until the buzzer indicated the end of the measurement. After reading the measurement, we stopped the blood pressure monitor and removed the cuff.

The first biological parameter we measured was blood glucose. This was evaluated using an Accu-Chek Performa kit consisting of test strip tubes, a calibration chip, an Accu-Chek Performa reader, a multiclix cartridge of lancets. The principle of measurement is based on the action of the enzyme contained in the test strip. Indeed, this enzyme extracted from Acinetobacter calcoaceticus will convert blood glucose to gluconolactone. This will create a harmless DC current that the reader will use to evaluate blood sugar.

Wearing a glove is essential (safety measure) before carrying out a measurement. The test strip has been inserted into the reader respecting the direction of the arrows. After insertion we took the blood sample using the previously prepared lancing device. Then we put the drop of blood in contact with the end of the strip and after 5 seconds the result was displayed on the screen.

Metabolic Syndrome definitions

We used the definition of MetS proposed by the NCEP-ATP III[55]. which states that a diagnosis of MetS can be made when at least three of the following five characteristics are present; waist circumference >102 cm for men and >88 cm for women, triglyceride level = 1.69 mmol/l (150 mg/dl) if fasting, High Density Lipoprotein cholesterol level (HDL) <1.04 mmol/l (40 mg/dl) if male or <1.20 mmol/l (50 mg/dl) if female, blood pressure =130/85 mm Hg, fasting blood glucose level =6.1 mmol/l (110 mg/dl).

Statistical analyses

Anthropometric and biological data were first compared between men and women using an unpaired student t-test, and then between the five criteria for MetS and the anthropometric, clinic and biologic parameters using unpaired t-Test of student. Anthropometric and biological data are presented as the mean ± standard deviation (SD). Results were considered as significant for p values less than 0.05. Statistics were performed using Statview 5 (SAS Institute Inc.) software.

Results

In the studied population, 476 individuals, we had 208 women, a percentage of 43.70% and 268 men or 56.30% whose age ranged between 20 and 70 years for an average of 33.24 ± 7.92 years. The most represented age group was between 20 and 30 years of age with 208 subjects, followed by 30 to 40 years with 180 subjects, then that of 40 to 50 with 67 and finally that of 50 to 70 with 15 topics. The population had an average body mass index of 25.09 ± 4.49 kg / m^2 with a maximum of 44.30 kg / m^2 and a minimum of 16.80 kg / m^2, four data were absent. The dominant abnormalities in the population were hyperglycemia with 202 (42.71%) subjects affected, overweight with 145 (30.53%) sufferers, excessive blood pressure, heart rate and waist circumference. The data describing the general characteristics of the population have been summarized in the two tables below.

Discussion

The objective of this study was to evaluate the prevalence of metabolic syndrome MetS in the Ecole Normale Superieure Libreville. Examination of the results reveals a low prevalence rate (4.83%) if we compare it to those found in Nigeria (62.5%), South Africa (26.5%) and Morocco (44%) [30,45, 46]. In fact, a study on the prevalence of MetS in a rural population in Ghana composed mainly of farmers, using the same definition as our study, found a prevalence of 15% [21]. Another on the employees of a university in Angola obtained a prevalence of 17.6% [47]. However, these results are, to our knowledge, the first data on MetS in Gabon cannot yet be extrapolated nationally because of the modesty of the sample.

It is also important to note that this prevalence may vary depending on the definition used. Indeed, the definition used plays a large role in the estimation of prevalence because, the threshold values are not the same for criteria such as waist circumference that varies according to sex and ethnicity. In addition, depending on the definitions, we have additional criteria and others are removed.

Of the 23 people with MetS, there were 15 women for every 8 men. The prevalence observed in women (65.22%) is then higher than in men. Many other studies have found a higher prevalence among women than men [21, 48]. This is certainly due to the fact that women are more sensitive to obesity because of many maternity as suggested by many works including those of Ndiaye on obesity in Africa [49]. The World Health Organization in Gabon in 2008, a high number of women overweight (52%) unlike men (37%), it is the same for obesity, 22% of women for 5% of 'men [12]. In our study, we had 51.47% of obese women.

However, other studies have found that the prevalence of MetS is higher in men than in women, as in the case of the DESIR study and the STANISLAS study [28, 32].

While socio-cultural, socio-economic, environmental factors and much more influence metabolic dysfunctions, the involvement of hormones no longer needs to be demonstrated [28]. This would lead to the different variations that we encounter depending on the genre.

The Ghana Rural Population Study and several other studies are consistent with the fact that the prevalence of MetS increases with age [21, 24, 50]. In addition, the most affected groups are those aged 40-60 and 60-69 years old. The results we obtained do not contradict this, because, we got the most people (7) reached in the age group of 40-50 years. The low prevalence in the 50-70 age group is due to the fact that we did not have enough people in this age group.

Certainly "obesity" and overweight were not taken into account to diagnose the MetS, but we noted fairly high prevalence of obesity (52.17%) and overweight (43.49%). This confirms the importance of obesity in the onset of MetS. Indeed, added to insulin resistance, obesity contributes to the occurrence of other criteria of MetS (hypertension, high level of bad cholesterol, lowering of good cholesterol and hyperglycemia) [45, 48,].

But also, alone, obesity increases the risk of cardiovascular disease. Numerous studies establish a positive correlation between obesity and MetS and suggest that most metabolic abnormalities are related to weight gain. Cardiovascular disease is becoming a scourge in Africa, especially in sub-Saharan Africa. They are considered the second leading cause of death in the world and constitute the main reason for admission to neurology services in Gabon [11]. High blood pressure seems to be the main criterion in the genesis of stroke. However, 28.63% of the population participating in the study were hypertensive, and the most affected age group was 30-40 years old. This suggests that a significant portion of the labor force is exposed to vascular events.

In addition, the risk is higher in individuals with hyperglycemia, hypertension and obesity [47]. Our results underscore the importance that must be attached to cerebrovascular accidents. The most common pathologies and risk factors in the population were, in descending order, hyperglycemia (42.71%), overweight (30.53%), high blood pressure (28.63%), a high heart rate (27.37%) and a high waist circumference (26.05%).

But also, hyperglycemia occupies a significant place in the development of microscopic and vascular macro-complications [48]. However, this is the main anomaly present in the population we studied.

While we did not collect enough data on staff and teachers to make meaningful comparisons, at least we found that virtually all MetS participants were students. This is certainly due to school-related stress that is more felt by learners in addition to external pressures. Studies have already reported the involvement of stress in the pathophysiology of MetS [21]. Indeed, a prospective study conducted at the military training hospital Mohammed V in Morocco suggests that stress would promote obesity, and at the same time the MetS and its cardiovascular complications, by stimulating the activity of the corticotropic axis [28].

Many positive correlations have been found however, the one that has challenged us is the correlation between the systolic pressure and the diastolic pressure with $r = 0.782$ and $p < 0.0001$. The literature has already effectively reported the significant impact of the association between this correlation and age in the onset of MetS [21].

Like any human work, our study remains perfectible because, indeed, it presents limits. First, it would have been desirable to evaluate more parameters such as cholesterol and triglycerides to verify with other definitions whether variations in prevalence are important or not and to expand the size of the population.

As the pathophysiology of MetS is multifactorial, information on alcohol use, smoking, sporting activity, ethnicity and many others would surely have led to more relevant results and more accurate prevalence. In addition, Gabon is a country rich in ethnicity and the majority of the studies do not often take into account this ethnic diversity which nevertheless presents characteristics peculiar to each group. And again, poor eating habits, alcoholism and smoking are very prevalent, resulting from the socio-economic standard of living of most of the population.

Conclusions

This study involved 476 individuals from academia and was designed to evaluate metabolic syndrome MetS Using the NCEP-ATP III definition, we diagnosed the metabolic syndrome in 23 people, a prevalence of 4.83%.

The first lesson we learn from this study is that MetS remains a poorly understood pathological entity despite the many studies carried out on the subject. In addition, it concerns all classes of populations, all countries and increases the risk of cardiovascular and cerebrovascular diseases and other pathologies. It would therefore be necessary to agree on a single definition in order to better apprehend it.

Although low, this prevalence should still challenge the authorities and populations because of the high prevalence of other pathologies risk factors such as obesity, hyperglycemia, hypertension and many others. It would therefore be necessary to use the first means of struggle, prevention.

Many studies should still be carried out because many areas remain unexplored, for example the prevalence in children and adolescents. Much work in this direction has already been done in other countries. It would also be interesting to introduce criteria that were not used in this study as insulin resistance, hypertriglyceridemia to explore the maximum of definitions for better preventive efficacy.

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Tables

Table I: Comparison of the anthropometric and biological parameters of the population according to gender.

Variables	Gender		
	Men (n=268)	**Women (n=208)**	**p-value**
Weight (kg)	78.88 ± 12.98	67.17 ± 13.56	< 0.0001
Age (yrs)	34.26 ± 7.95	31.92 ± 7.72	0.001
SBP (mm Hg)	132.83 ± 19.36	122.84 ± 17.76	<0.0001
DBP (mm Hg)	81.53 ± 12.28	78.19 ± 12.47	0.004
HR (bpm)	72.02 ± 10.20	77.80 ± 10.73	<0.0001
TDT (cm)	86.99 ± 11.33	87.37 ± 11.73	ns
TDH (cm)	98.24 ± 8.50	98.88 ± 11.29	ns
BMI (kg/m^2)	24.69 ± 3.10	25.61 ± 5.02	0.023
Glycaemia (g/l)	0.92 ± 0.25	0.98 ± 0.28	0.04

Values are represented as means ± standard deviation. PAS: systolic blood pressure; PAD: diastolic blood pressure; HR: heart rate; TDT: waist circumference. TDH: hip size. BMI: body mass index; ns: not significant.

Table II: Prevalence of other pathologies in the population.

Variables	Gender	
	Men (56.30 %)	**Women (43.70 %)**
Overweight	39.47	46.86
Hyperglycaemia	11.57	44.71
Hyper WC	19.48	37.50
Hyper HR	37.08	17.79
Hyper SBP	13.86	7.21
Hyper SBP FC	12.31	16.83
Obesity	32.21	28.36

Hyper WC: high waist, Hyper FC: high heart rate, Hyper PAS: hypertensive, Hyper PAS, FC: systolic blood pressure and high heart rate.

Table III: Comparison of anthropometric and biological parameters in individuals with and without metabolic syndrome.

Variables	**Metabolic Syndrome (MetS)**		
	(+) MetS	**(-) MetS**	**p-value**
Age (yrs)	39.83 ± 10.90	32.89 ± 7.60	< 0.0001
Weight (kg)	84.22 ± 13.32	69.66 ± 13.16	< 0.0001
SBP (mm Hg)	152.65 ± 15.32	127.19 ± 18.67	< 0.0001
DBP (mm Hg)	96.44 ± 10.36	79.22 ± 11.98	< 0.0001
FC (bpm)	78.96 ± 13.44	74.34 ± 10.63	0.05
TDT (cm)	101.91 ± 8.98	86.40 ± 11.09	< 0.0001
TDH (cm)	110.00 ± 7.34	98.04 ± 9.57	< 0.0001
BMI (kg/m^2)	30.60 ± 4.84	24.81 ± 4.29	< 0.0001
Glycaemia (g/l)	1.22 ± 0.63	0.93 ± 0.21	< 0.0001
N (%)	23 (4.83)	453 (95.17)	-

The values are represented as means ± standard deviation. SBP: systolic blood pressure; DBP: diastolic blood pressure; HR: heart rate; TDT: waist circumference; TDH: hip circumference; BMI: body mass index.

The correlation analysis shown in the table below showed a strong cause-and-effect relationship between body mass index and waist circumference, hip circumference and weight. It is the same between the weight and the turns of hip and size.

Table IV: Correlation matrix of the frequency of anthropometric and biological characteristics of the population.

Variables	Weight	Age	SBP	DBP	HR	TDT	TDH	BMI	Glycémia
Weight (kg)	1.000								
Age (yrs)	0.280*	1.000							
SBP (mm Hg)	0.377*	0.298*	1.000						
DBP (mm Hg)	0.407*	0.274*	0.782*	1.000					
HR (bpm)	-0.025	-0.015	0.088	0.146	1.000				
TDT (cm)	0.831*	0.426*	0 .352*	0.404*	0.030	1.000			
TDH (cm)	0.862*	0.337*	0.322*	0.372*	0.039	0.859*	1.000		
BMI (kg/m^2)	0.867*	0.288*	0.316*	0.374*	0.048	0.868*	0.875*	1.000	
Glycaemia (g/l)	0.045	0.048	-0.004	0.025	0.092	0.074	0.036	0.071	1.000

*SBP: systolic blood pressure: DBP: diastolic blood pressure: HR: heart rate. TDT: waistline. TDH: hip circumference. BMI: body mass index. * P <0.0001.*

Figure 8: *Representation of the different correlations. A: correlation between age and BMI. B: correlation between PAS and BMI. BMI: body mass index. SBP: systolic blood pressure.*

Figure

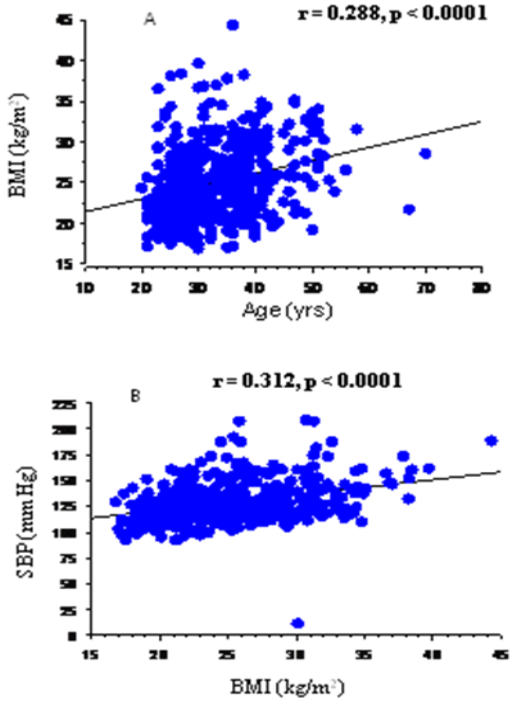

Figure 8: *Representation of the different correlations. A: correlation between age and BMI. B: correlation between PAS and BMI. BMI: body mass index. SBP: systolic blood pressure.*