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Comparison and Concordance of Two Metabolic Syndrome Definitions in Cameroon

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Abstract

Background: They are two commonly metabolic syndrome (MetS) definition used for studies. This study was performed to determine the MetS prevalence of according to International Diabetes Federation (IDF) 2005 and National Cholesterol Education Program Adult Treatment Panel III (NCEP/ATP III) 2001 definitions in a Cameroon population and to determine the concordance between the two definitions.

Methods: A total of 1519 overweight or obese adults aged ≥ 18 years (1193 women and 326 men), selected randomly in Yaoundé were analyzed. Blood samples were analyzed, blood pressure and waist circumference assessed, data on lifestyle, medication, chronic disorders, and socio-demographic characteristics collected. Kappa test was done to examine the agreement between the definitions.

Results: The mean age of the group was 34.87 ± 10.97 years for men and for women 36.9 ± 11.28 years. The prevalence of MetS using (NCEP/ATP III) and IDF definitions was 13.0% and 19.5% respectively. The agreement rate between the IDF and (NCEP/ATP III) was good (Kappa=0.72). The subjects defined only with (NCEP/ATP III) and not IDF had lower body mass index, waist circumference but higher triglycerides levels than those defined by both (NCEP/ATP III) and IDF.

Conclusion: MetS is still uncommon in Cameroon using either (NCEP/ATP III), or IDF definition. The agreement between the two definitions was good especially in women. The limitation of IDF definition for detecting leaner but metabolically abnormal subject is a reality. There is a crucial need to set up recommended values of waist and hip circumference in Africans.

Keywords: Metabolic syndrome; Comparison; Concordance; Cameroon

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Introduction

The metabolic syndrome (MetS) is a constellation of several cardiovascular risk factors such as glucose intolerance, central obesity, dyslipidemia and hypertension [1]. It is associated with an increased risk for the development of type 2 diabetes [2,3], cardiovascular disease (CVD) [4] and mortality due to coronary heart disease (CHD) [5,6]. Many studies revealed that MetS is a leading course of coronary heart disease [7]. Therefore, it is important to identify subjects with MetS earlier. One report suggests that amongst the five commongly used MetS definitions [8-12], three of them are applicable in overweight or obese Cameroonian [13]. This study aimed to determine MetS prevalence concordance according the definitions proposed by the International Diabetes Federation (IDF) [14] and the National Cholesterol Education Program Adult Treatment Panel III (NCEP) [15].

Materials and Methods

Ethics

The cross-sectional study was approved by the Education Planning Commission of Fouda Medical Foundation. Women were recruited through free multiple chronic diseases campaign from January 2014 to March 2016. Admission to the study was based solely on voluntary participation of women. The study

volunteers were therefore referred at the Medical Foundation Andre Marie Fouda, Yaounde Cameroon. Females were excluded from the study if they were pregnant or lactating. All participants in the study provided verbal informed consent. All measurements and questionnaire were in accordance with the Helsinki Declaration (1983 version).

Questionnaires

The questionnaires set comprised socio-demography, health status on hypertension, diabetes, dyslipidaemia and current medication.

Anthropometry

The anthropometric measurements were taken by the same lab workers. The height was measured with a stadiometer to the nearest millimetre (Siber Hegner, Zurich, Switzerland). Body weight and body fat were determined in 12-h fasted participants (with very light clothing on) using a Jocca TM scale. The ratio between the weight (Kg) to height (m) was used to evaluate body mass index (BMI). Waist and hip circumferences were taken with the subject in a standing position, to the nearest millimetre, using a non-stretchable tape measure.

Physiological measurements

Systolic and diastolic blood pressures were measured in a resting position on three different visits (day 1, 7 and 10) using a mercury sphygmomanometer. An appropriate adult cuff was applied 2 to 3 cm above the antecubital fossa of the right arm. Blood pressure was measured to the nearest 2 mm Hg, reading the calibration below the meniscus. Systolic and diastolic blood pressures were read at the 1st and 5th Korotkoff phases, respectively. The mean of the 3 blood pressure values obtained from the 3 visits was taken as the participant's true blood pressure.

Biochemical analyses of plasma

Fasting venous blood (5 ml) was collected from participants into heparinised tubes. After centrifugation (3000 × g) for 10 min, plasma collected was stored in aliquots at - 80°C, and analysed within one week. Total cholesterol and triglycerides in plasma were measured using previously described methods [16,17]. HDL-cholesterol was determined using a heparin manganese precipitation of Apo B-containing lipoproteins [18]. The Friedwald formula was used to calculate the concentration of LDL cholesterol [19]. Fasting blood glucose was determined using glucose test strips (Gluco plus).

Definition of metabolic syndrome

The MetS was defined according to the NCEP and IDF criterias. Subjects having three or more of the diagnostic criteria were defined as having MetS according to the NCEP/ATPIII report [15]. These criteria are: 1) Obesity: Waist Circumference >102 cm in men or >88 cm in women, 2) Hypertriglyceridemia: Triglycerides ≥ 150 mg/dl, 3) Low HDL-C, <40 mg/dl in men and <50 mg/dl in women, 4) Hypertension: known hypertensives or Blood Pressure ≥ 130/85 mmHg, and 5) Dysglycemia: known diabetes mellitus (DM) or fasting plasma glucose ≥ 1 10 mg/dl.

According to the IDF definition, someone has the metabolic syndrome if he or she has central adiposity plus two or more of the following four factors [8]: *1*) raised concentration of Triglycerides: 150 mg/dl (1.7 mmol/l) or specific treatment for this lipid abnormality; *2*) reduced concentration of H DL cholesterol: <40 mg/dl (1.03 mmol/l) in men and <50 mg/dl (1.29 mmol/l) in women or specific treatment for this lipid abnormality; *3*) raised blood pressure: systolic blood pressure 130 mmHg or diastolic blood pressure 85 mmHg or treatment of previously diagnosed hypertension; and *4*) raised fasting plasma glucose concentration 100 mg/dl (5.6 mmol/l) or previously diagnosed type 2 diabetes.

We divided the subjects with MetS into three groups: subjects identified as MetS with NCEP only Group 1 (n=5), with IDF only Group 2 (n=109) and with both IDF and NCEP Group 3 (n=192) respectively.

Statistical Analysis

Statistical analyses were done using STATA® 8.2 and SPSS 10.1. Descriptive statistics are presented as means ± standard deviations (SD). The categorical variables are given as percentages. Student's t-test and one-way ANOVA LSD post hoc test were used to compare means and test for significant differences in anthropometric and metabolic indices between the groups. Agreement analysis was performed to compare diagnosis criteria with the Kappa statistic test [20]. A p value <0.05 was considered statistically significant.

Results

The mean age of the studied population was 36.36 ± 11.33 years. Women (78.5%) were more represented than men (21.5%). 47.9% were overweight and 52.1% obese. The characteristics of the subjects are summarized in **Table 1**. Women were significantly older than men and had higher BMI, waist and hip circumference but lower total cholesterol levels than men. Other characteristics were not significantly different between the two groups.

Prevalence of Metabolic Syndrome

The prevalence of MetS according to the NCEP and IDF criteria was 13.0% and 19.8%; 14.5% and 21.4% in women, and 7.4% and 14.1% in men, respectively. The prevalence of MetS was significantly higher in women than in men using both definitions (P=0.000 for NCEP and p=0.001 for IDF).

The average age in these patients was 33.75 ± 6.99 years for patients diagnosed with NCEP criteria and 37.45 ± 10.56 years for individuals diagnosed with IDF. The IDF criteria detected more prevalence of MetS than the NCEP criteria **(Table 2).** Five subjects (0.3%) were diagnosed as having MetS by NCEP criteria and 109 patients (7%) by IDF criteria. and 192 patients (12.3%) of them presented MetS according to both criteria.

The prevalence rates of the individual components and number of items of MetS according to the two different criteria are listed in **Table 3.** Hypertension and abdominal obesity were the most common abnormality in men and in women abdominal obesity and Hypertension respectively for the two study definition. Abdominal obesity was markedly higher

Table 1 Characteristics of the studied population stratified by sex.

Clinical biological variables	Male (326)	Female (1193)	P-value
Age (years)	34.87 ± 10.97	36.82 ± 11.28	0.006*
BMI (kg/m²)	28.91 ± 3.15	30.20 ± 4.58	0.000*
Waist C (cm)	92.94 ± 11.66	94.50 ± 1 3.07	0.040*
Hip C (cm)	108.23 ± 10.70	112.65 ± 13.26	0.000*
Blood Pressure			
SBP (mmHg)	126.96 ± 22.66	126.20±20.76	0.586
DBP (mmHg)	85.17 ± 16.30	83.80 ± 15.44	0.178
Blood sample			
Gly (mg/dl)	92.46 ± 29.33	90.96 ± 24.89	0.401
Total-C (mg/dl)	153.25 ± 56.49	141.29 ± 47.62	0.001*
Trig (mg/dl)	101.03 ± 34.73	104.48 ± 38.61	0.122
HDL C(mg/dl)	45.30 ± 17.47	47.52 ± 17.91	0.054

Data are means ± standard errors of the mean, BMI=weight/stature.
t-test of the differences between means of men and women: P<0.05.

Table 2 Prevalence of the MetS components according to two definitions of MetS by gender.

Organization	326 Male	Female 1093	All
IDF			
Central obesity*	40.5	85.7	76.0
↑ BP	58.0	53.1	54.2
↑ blood glucose	32.2	28.4	29.2
↑ Triglycerides	9.8	10.8	10.6
↓ HDL	7.7	7.0	7.1
MetS prevalence	14.1	21.4	19.8
IDF items			
None	19.6	6.4	10.4
One	31.28	27.8	28.3
Two	33.0	44.2	41.2
NCEP/ATPIII			
Central obesity*	16.0	60.4	50.9
↑ BP	58.0	53.1	54.2
↑ blood glucose	19.3	19.7	19.6
↑ Triglycerides	9,8	10,8	10.6
↓ HDL	7.7	7.0	7.1
MetS prevalence	7.4	14.5	14 .0
NCEP/ATP III items			
None	27.8	16,1	19.7
One	42.8	33,2	34.8
Two	22.0	36,2	32.4

*Comparison by gender P<0.001

in women than men using both definitions (P<0.001). Our study results reveal an increasing number of patients from none of the components to two therefore it should be important to take preventive measures urgently.

Comparison of the concordance between both diagnostic criteria (Kappa statistic) was 0.72 (0.75 in women and 0.58 in men) which suggests a good concordance between the NCEP and the IDF diagnosis for MetS. The agreement between the definitions was poorer in men than in women and this might be related to the low frequency of abdominal obesity in men in the study comparatively to women. We evaluated the discrepancies in the diagnosis and we observed that the IDF criteria were more likely to diagnose MetS as positive as the NCEP criteria 7.1% was diagnosed with MetS using only IDF, and 0.32% was diagnosed with MetS using only NCEP criteria. This study showed

Table 3 Characteristics of subjects with IDF and or NCEP/ATPIII defined MetS.

	NCEP/ATPIII	IDF	NCEP/ATPIII + IDF
N	**5**	**109**	**192**
Age (years)	33.75 ± 6.99	37.45 ± 10.56	38.23 ± 11.72
BMI (kg/m^2) µ, $	29.00 ± 1.68	29.75 ± 4.64	31.86 ± 5.67
W C (cm) *, µ, $	77.753 ± 11.11	93.16 ± 10.30	103.51 ± 12.32
H C (cm) $	107.31 ± 5.90	111.53 ± 10.93	118.75 ± 12.09
Blood Pressure			
Sys pres (mmHg)	133.0 ± 14.78	136.26 ± 18.92	137.39 ± 22.33
Dias pres (mmHg)	98.40 ± 11.26	93.31 ± 16.03	91.79 ± 12.71
Blood Sample			
Glyceamia (mg/dl)	103.62 ± 18.40	109.45 ± 21.64	106.91 ± 30.66
Total C (mg/dl)	166.60 ± 93.49	148.57 ± 51.15	166.47 ± 61.42
Trigly (mg/dl) *, µ, $	188.20 ± 25.63	107.79 ± 41.50	133.39 ± 58.86
HDL-C (mg/dl)	44.0 ± 19.12	44.26 ± 18.06	43.39 ± 17.27

*Significant difference between subjects of group NCEP and IDF P<0.05. It: Significant difference between subjects of group NCEP and NCEP + IDF P<0.05. $: Significant difference between subjects of group IDF and NCEP + IDF P<0.05.

that subjects with MetS defined only by NCEP and not IDF had lower BMI, WC and higher triglycerides level compared to subjects defined with both NCEP and IDF. This consolidates the idea according to which IDF definition is not sufficient to detect some lean subjects with metabolic abnormalities like in these different studies [21-23].

Clinical parameters of the three groups are compared in **Table 4**. The five patients in Group 2 were had lower Body Mass Index, Waist Circumference and higher Triglycerides level than subjects in Group 3.

Discussion

This is the first study in Cameroon population to compare the prevalence of MetS according to NCEP/ATPIII and IDF and determine the concordance of these definitions. Of the total, less than one-fith had MetS and these two definitions showed good agreement except that some leaner women with metabolic abnormalities were undetected using IDF for diagnosis like in turkish 2008 study [24]. They were a significant higher prevalence of MetS in women than in men using both definitions. This corroborates with the data of the literature, which generally reveals significantly higher MetS rates in women [25-27]. This is due to the significant high prevalence of obesity in women comparatively to men such as Pasquet et al. report [28] demonstrated in Cameroon.

According to both definition, the most common abnormalities were abdominal obesity and hypertension in women and hypertension, abdominal obesity in men, respectively, and there is discordance with results of other studies [29,30]. The frequency of those two abnormalities can explain the increasing numbers of affected individuals from zero up to two altered individual components with a decrease from three components. Consequently our results reveal that less than one fifth of the studied population has MetS, this fact is important to increase awareness and take preventive steps on this issue. Our two definitions had a good agreement in identifying subjects with MetS in our population. Our results present lower agreement rates than the other studies [15, 31]. This can be explained by the absence of reference values for waist circumference in African population.

Our study confirmed the fact that subjects IDF definition has some limitations in detecting MetS in leaner patients since subjects defined only by ATPIII and not IDF had lower Body Mass Index, Waist Circumference and higher triglycerides level compared to subjects defined with both ATPIII and IDF. This work is in agreement with those of some recent studies also pointed out this finding [32,33].

Conclusion

To conclude, the prevalence of MetS is still low according to both definitions object of the study. One notes also agreement between ATPIII and IDF definitions was very good, especially in women. However it should be noted that IDF definition may miss some non-obese people with other metabolic abnormalities. MetS further studies in Africa population should be done with NCEP while waiting recommended values for waist circumference in Africa.

Table 4 Agreement between NCEP and IDF definitions in diagnosing MetS.

ALL (n =1519)		IDF definition			Kappa (K)
		Metabolic Syndrome			
	Met S	Present	Absent	Total	
NCEP definition	Present	1213	109	1322	0.72
	Absent	5	192	197	
	Total	1218	301	1519	
Men (n=326)		IDF definition			K
		Metabolic Syndrome			
	Met S	Present	Absent	Total	
NCEP definition	Present	278	24	302	0.58
	Absent	2	22	24	
	Total	280	46	326	
Women (n=1 193)		IDF definition			K
		Metabolic Syndrome			
	Met S	Present	Absent	Total	
NCEP definition	Present	935	85	1020	0.75
	Absent	3	170	173	
	Total	938	255	1193	

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