Metabolic Syndrome: What is the difference between the two definitions IDF and NCEP ATP III in Morocco? Case of the population of Marrakech

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Abstract. The purpose of this study was to determine the frequency of metabolic syndrome according to the two definitions: NCEP-ATP III and IDF 2005 and to analyze their differences in a population in Marrakech, Morocco. The study was carried out at Ibn Zohr hospital in Marrakech. The body mass index (BMI) was calculated to assess the degree of obesity of each subject. The blood parameters were measured by an appropriate biochemistry automaton. The diagnosis of metabolic syndrome was made according to the definitions of NCEP-ATP III and IDF 2005. All statistical analyzes were performed using SPSS software. A total of 300 subjects participated in the study, including 57.3% of women and 42.7% of men, with a sex ratio of 0.74. The mean age of our population was 51.6 ± 13.42 years. According to NCEP-ATP III, 79 of the participants (26.3%) had the metabolic syndrome, with a predominance of women: 60 women (20.0%) and 19 men (6.3%); according to the IDF, 139 or (46.3%) of the participants had MS, in which 31.0% were women and 15.3% were men. Waist circumference and hyperglycemia were the two predominant criteria according to both definitions. The study showed that all criteria were statistically associated with the presence of MS. The metabolic syndrome is common in our population regardless of the definition criteria used. The implementation of prevention strategies and the encouragement of a healthy lifestyle will minimize serious health problems in Marrakech city.

1. Introduction

The metabolic syndrome (MS) is the cause of several health problems such as Type 2 Diabetes and cardiovascular disease [1]. Obesity and a sedentary lifestyle are the two primary etiological factors [2]. Further efforts are needed to promote a healthy lifestyle with increased physical activity and reduced obesity [3]. People with metabolic syndrome need to be identified early to reduce their cardiovascular risk factors [4].

Today, there is disagreement about the criteria for diagnosing metabolic syndrome and different definitions are used to determine the presence of metabolic syndrome in a population. The International Diabetes Federation (IDF), the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) and the World Health Organization (WHO) have their own definition of metabolic syndrome [1, 5].

In Morocco, there are few studies comparing the different definitions that exist. Therefore, through our study, we sought to determine the frequency of metabolic syndrome according to the two definitions of NCEP-ATP III and IDF 2005 and to analyze their difference.

2. Material and Methods

The present study consists in an epidemiological study carried out on a population from Marrakech city in the south-west of Morocco, extending from March to July 2018 on a total of 300 subjects, including 42.7% of men and 57.3% of women, aged 18 years and over.

The first step was to obtain an authorization from the Ministry of Health signed by the regional delegate of the

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Ministry of Health, the director of the hospital and the head of the laboratory, to carry out the study at the Ibn Zohr hospital of Marrakech (Note de service Régionale N°735). The subjects recruited were people who came to the hospital for a medical check-up. With the nurses, we explained the purpose of our study to the patients, and then, they volunteered and signed the consent form. Anthropometric measurements were taken in a room reserved for them. The privacy of the subjects was respected while interviewing them. Thus, the ethics are therefore allocated to the regional delegation of the Ministry of Health, those that participated in the survey will benefit from the orientation and the ministry will take charge of their treatment in case there are any pathology(s) upon completion of the survey, this will make our study ethically acceptable.

Inclusion criteria

- People aged 18 years and over
- Both males and females
- People resident exclusively in Marrakech

Exclusion criteria

- Pregnant women
- Breastfeeding women
- People with thyroid pathologies
- Nonresidents in the city of Marrakech.

The weight in kilograms was measured using a SECA mechanical scale, with an accuracy of 0.5 Kg. The size is measured by the measuring board. The BMI was calculated to assess the degree of obesity of each subject. Waist circumference was measured using a navel tape measure. Blood pressure was recorded in the position sitting after 15 minutes of rest, at two intervals of 5 minutes. These measurements were made using a standard mercury sphygmomanometer on the right arm and the average of the two measurements was recorded for comparison.

For each fasting subject (12 to 14 hours of fasting), we took a vial of venous blood. Blood samples were taken from 8:00 to 10:30 in the morning and were taken by the hospital nurses. Then the blood parameters were measured by a suitable biochemistry automaton after 10 min of centrifugation. The biological analyses were performed by the laboratory technicians under the supervision of the regional director of the Marrakech region. We were satisfied with the results gathered from the hospital registry. Diagnosis of metabolic syndrome as defined by the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) requires the combination of at least three of the five following criteria: waist circumference in women ≥ 88 cm and in men ≥ 102 cm, hypertriglyceridemia ≥ 1.5 g / L, HDL cholesterol < 0.50 g / L in women and < 0.40 g / L in men, blood pressure ≥ 130/85 mmHg, fasting blood glucose ≥ 1.1 g / L (or being on medication for the above abnormalities) [6]. The diagnosis of metabolic syndrome according to IDF 2005 focuses on abdominal obesity as a required factor [7] plus two of the other four criteria which are essentially identical to those cited by NCEP-ATP III. The biological and clinical analyses of the subjects were retrieved from the clinical measurement database at Ibn Zohr Hospital. These analyses concerning the targeted people are the subject of our study.

Statistical Analysis

We used SPSS (Statistical Package for Social Sciences) version 23.0 to perform statistical analyses. Quantitative variables were described using means and standard deviation; categorical variables were described using numbers and percentages. We used the Chi-square X^2 test to assess the association between two categorical variables. The test is considered significant when the p-value is less than 0.05.

3. Results

The study included 300 individuals of which 42.7% were men and 57.3% women, the average age of our population is 51.6 ± 13.42 years; the anthropometric,

clinical and biological characteristics of the population are described in the table 1.

Table 1: Anthropometric, clinical and biological characteristics of the studied population

Variables	Average	SD	Min	Max
Weight	74,06	13,2	39,3	114,9
Height	163,7	11,2	145	190
BMI	27,7	4,9	14,5	42,4
W C	97,83	11,04	70	126,0
Systolic BP	12,8	2,15	7,0	21,0
Diastolic BP	7,1	1,04	5,0	12,0
Glycemia	1,42	0,66	0,80	5,53
TG	1,33	0,82	0,46	10,50
HDL-C	0,54	0,15	0,27	1,56

BMI: Body Mass Index; BP: Blood Pressure; TG: Triglycerides; HDL-C: HDL-Cholesterol; SD: Standard Deviation; Min: Minimum; Max: Maximum; WC: Waist Circumference.

Metabolic syndrome was diagnosed in 79 (26.3%) and 139 (46.3%) participants using the NCEP and IDF definition criteria respectively. Frequency of metabolic syndrome in males and females was 6.3% and 20.0% for the NCEP-ATP III criteria, and 15.3% and 31.0% for the IDF criteria respectively (table 2).

Table 2: Determination of MS frequency according to NCEPT ATP III and IDF definitions

MS+	NCEP-ATP III (%) n = 79	IDF (2005) (%) n = 139
Women	20,0	31,0
Men	6,3	15,3
Total	26,3	46,3

MS+: Presence of Metabolic Syndrome

Table 3 presents the number of subjects with associated pathologies according to the presence or absence of the metabolic syndrome according to NCEP ATP III definition. High waist circumference was the most dominant criterion with 77 cases among the 79 with MS.

Table 3: Study of associated pathologies according to the presence or absence of metabolic syndrome according to NCEP-ATP III

NCEP-ATP III	MS+ n = 79	MS- n = 221	P
TG ↑	41	43	<0,001
TG Normal	38	178	
HDL-C ↓	55	48	<0,001
HDL-C Normal	24	173	
BP ↑	59	66	<0,001
BP Normal	20	155	
Gly ↑	73	119	<0,001
Gly Normal	6	102	
WC ↑	77	161	<0,001
WC Normal	2	60	

TG ↑: Hypertriglyceridemia; HDL-C ↓: Low HDL-Cholesterol; BP ↑: High Blood Pressure; Gly ↑: Hyperglycemia; WC ↑: High waist circumference; MS +: Presence of Metabolic Syndrome; MS-: Absence of Metabolic Syndrome.

Table 4 shows the number of subjects with associated pathologies according to the presence or absence of metabolic syndrome according to the IDF definition. 100% of subjects with SM had an elevated waist circumference, while hypertriglyceridemia was the least present criteria.

Table 4: Study of associated pathologies according to the presence or absence of the metabolic syndrome according to IDF 2005

IDF	MS+ n = 139	MS- n = 161	P
TG ↑	61	23	<0,001
TG Normal	78	138	
HDL-C ↓	75	28	<0,001
HDL-C Normal	64	133	
BP ↑	88	37	<0,001
BP Normal	51	124	
Gly ↑	120	55	<0,001
Gly Normal	19	106	
WC ↑	139	99	<0,001
WC Normal	0	62	

TG ↑: Hypertriglyceridemia; HDL-C ↓: Low HDL-Cholesterol; BP ↑: High Blood Pressure; Gly ↑: Hyperglycemia; WC ↑: High waist circumference; MS +: Presence of Metabolic Syndrome; MS-: Absence of Metabolic Syndrome.

4. Discussion

This study aimed to assess the diagnosis of metabolic syndrome and determine its frequency, using the defining criteria of NCEP-ATP III and IDF, which are considered easy to use methods. The overall frequency of metabolic syndrome in our study was high regardless of the criteria used. The advanced age of our population and the overweight already installed can partly explain this high percentage.

According to NCEP-ATP III, 79 or 26.3% have MS and 161 or 46.3% were diagnosed according to IDF. These results differ from a study by Moy and Bulgiba [8], comparing the two definitions, NCEP-ATP III and IDF to diagnose MS among Malaysians in Kuala Lumpur; this difference can be explained by the difference of ethnicities. Our results also differ from a study by Ucar et *al.* [9] who used the same definition criteria and where the prevalence of MS according to NCEP-ATP III was 86.0% and according to IDF was 56.5% in a Turkish population undergoing hemodialysis; and another study by Kubrusly et *al.* [10] where the prevalence of MS according to the definitions of NCEP-ATP III and IDF were 41.7% and 42.6% respectively in a Brazilian population. This difference can be explained by the fact that all of the subjects had a chronic kidney disease, which is one of the risk factors for MS.

Using both definitions, women were the most affected by MS compared to men. (20.0% vs. 6.3%) using NCEP-ATP III and (31.0% vs. 15.3%) using IDF; our results are similar to those of a study conducted in Malaysia [11] which showed a higher prevalence of SM in women (50.5%) than in men (36.5%). Work may be the reason for this difference, as a large majority of our participants are housewives; a higher proportion of housewives were obese compared to other professional categories [12]. Contrary, in another study conducted in Singapore [13], men dominated whatever the definition used.

Based on the analysis of associated pathologies in subjects with MS and according to the NCEPT-ATP III and IDF definitions, high waist circumference and hyperglycemia were the two most dominant associated pathologies. We found a highly significant association between blood glucose variations and the presence of MS (P<0.001) based on both definitions; Rasic-Milutinovic et *al.* [14] also found a strong effect between hyperglycemia and the presence of MS.

We also found a positive and significant association between MS and dyslipidemia, assessed here by hypertriglyceridemia (P <0.001) and low HDL-C (P <0.001), Banerjee et *al.* [15] showed the importance of dyslipidemia, because in their study hypertriglyceridemia was a predictor of MS.

In the present study we found an association between High Blood Pressure and the presence of MS (P <0.001)

according to NCEPT-ATP III and IDF, our results are in accordance with those of a study conducted on 1655 people in Vitória in Brazil, where the prevalence of MS was 32.9% of which 71.0% had high blood pressure [16]. Kubrusly et *al.* [10] found no association between hypertension and MS neither by the definition of NCEPT-ATP III nor that of the IDF, (P = 0.6) and (P = 0.3) respectively.

Content of the discrepancies resulting from the diagnosis of MS, using the different criteria of its definitions, there was a meeting in 2009 between the major organizations (American Heart Association, World Heart Federation, International Atherosclerosis Society) which suggested a new definition characterized by the presence of at least 3 of the 5 criteria with the same variables and thresholds, except Waist circumference which would follow the national/regional thresholds and where this criterion would not be mandatory [17].

In our study and according to both definitions, high waist circumference was the criterion most predominant in subjects with SM, this predominance could be explained by the fact that many of the subjects were overweight or obese, and that waist circumference increases with weight gain. Our results agree with those of a study by Abu Sham et *al.* [18] on the prevalence of MS and other cardiovascular risk factors among Palestinian subjects from Jerusalem aged 20 years and older.

To conclude this research, we can say that the metabolic syndrome is frequent in our population regardless of the definition criteria used. The definition of NCEP ATP III may be more appropriate for diagnosing metabolic syndrome because it is what touches from all associated pathologies. The most strongly associated variables were high waist circumference and hyperglycemia. An effective intervention program should therefore be planned because the complications of the metabolic syndrome, such as diabetes and cardiovascular disease, will become an epidemic in Marrakech, and in the near future in Morocco.

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