Metabolic Syndrome in Outpatient Cardiology Clinics

José Bonifácio Barbosa, Antonio Augusto Moura da Silva, Fabrício de Flores Barbosa, Francisco das Chagas Monteiro Júnior, José Albuquerque de Figueiredo Neto, Vinicius José da Silva Nina, Waston Gonçalves Ribeiro, Eduardo Durans Figuerêdo, José Xavier de Melo Filho, Maria Bethânia da Costa Chein
Faculdade de Medicina da Universidade Federal do Maranhão (UFMA/UDI Hospital), São Luís, MA - Brazil

Abstract

Background: In Brazil, the prevalence of the metabolic syndrome (MS) is little known in several regions.

Objective: To analyze the prevalence of MS, its components and the agreement between two diagnostic definitions in a population aged > 13 years.

Methods: Cross-sectional study conducted from June to October 2007 in 719 patients of outpatient cardiology clinics in the city of São Luis, State of Maranhão, Brazil. Blood pressure (BP), weight, height, waist circumference and lipid profile were measured. Risk factors for MS were evaluated according to the International Diabetes Federation (IDF) definition. Prevalence ratios and 95% confidence intervals were estimated using Poisson regression.

Results: The prevalence of MS was higher in both genders when using IDF definition (62.3% in men and 64.6% in women) than when using that of the National Cholesterol Education Program – Adult Treatment Prevention (NCEP ATPIII) (48.9% in men and 59% in women). The most prevalent MS components were: hypertension (87.2% and 86%); hypertriglyceridemia (84.4% and 82.5%); increased waist circumference (77.8% and 100%); low HDL-c (58.1% and 49.9%); and high blood glucose (59.9% and 51.9%), using NCEP ATPIII and IDF definitions, respectively. In the adjusted analysis, age ≥ 60 years and body mass index (BMI) ≥ 30 were associated with a higher risk of MS (p<0.001).

Conclusion: The prevalence of MS was much higher than in the overall population, and hypertension was the most prevalent component. There was good agreement between the two definitions, very good in the female gender and moderate in the male gender. (Arq Bras Cardiol 2010; 94(1) : 44-51)

Key words: Metabolic syndrome; ambulatory care facilities ; ethic; cardiology.

Introduction

The metabolic syndrome (MS) consists of the presence of glucose changes (hyperinsulinemia, insulin resistance, glucose intolerance, or type-2 diabetes mellitus), lipid changes (increased triglycerides and LDL-cholesterol and decreased HDL-cholesterol), abdominal obesity, hypertension, and coagulation disorders (increased platelet adhesion and PAI-1-plasminogen activator inhibitor). A proinflammatory state is also observed, with increased C-reactive protein, tumor necrosis factor alpha and interleukin-6[1].

There is a close cause-effect relationship between MS and cardiovascular diseases (CVDs). MS increases overall mortality by approximately one and a half times, and cardiovascular mortality by approximately two and a half times[2]. Genetic predisposition, inappropriate eating and sedentary lifestyle contribute to its development[3,4].

In 1998, the World Health Organization (WHO) developed criteria for the definition of MS, including obesity and microalbuminuria in addition to hypertension and dyslipidemia[5]. In 2001, the National Institutes of Health, by means of the National Cholesterol Education Program (NCEP) and the Third Adult Treatment Panel (ATP III) suggested another definition for MS, without including weight and microalbuminuria, and requiring at least three abnormal components[6].

In April 2005, the first Brazilian Guideline on the Diagnosis and Treatment of The metabolic Syndrome was published with the support of the Brazilian Society of Cardiology, using NCEP ATPIII criteria to define MS[7]. In 2006, IDF formulated a new definition for MS, considering the different ethnic populations[8].

The incidence of MS increases with age, both in men and women, reaching 50% among those aged 60 to 69 years[9,10]. A recent study showed that 20% to 25% of obese children and adolescents present insulin resistance, a key element of MS that can lead to type-2 diabetes[10,11].

In the city of Ribeirão Preto – State of Sao Paulo, a population survey conducted among adults aged between

Mailing address: José Bonifácio Barbosa •
Faculdade de Medicina da Universidade Federal do Maranhão-UFMA/UDI Hospital, São Luís, MA - Brazil
E-mail: josebbarbosa@uol.com.br, jbarbosa@cardiol.br
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22 and 28 years, and published in 2007, showed a 7.6% prevalence[12]. Data from the WHO show that, in developing countries, the frequency of obesity has increased two to three fold in the past decade[13].

Innumerous international but few Brazilian studies on MS are available, and this is the reason for the interest in studying this entity in our midst, where we observe a marked heterogeneity of factors related to MS, such as demographic factors and those inherent to the lifestyle of the population

Methods

This is a cross-sectional study including 719 patients seen in outpatient cardiology clinics of the city of São Luís – State of Maranhão and conducted between June 1st and October 1st, 2007. The patients were aged between 13 and 96 years, with mean of 56.3 years. The study was approved by the Research Ethics Committee of *Hospital Universitário da Universidade Federal do Maranhão*. All individuals who agreed to participate gave their written informed consent. All patients who attended the outpatient cardiology clinics during the period mentioned were included, except for those younger than 13 years, those lacking laboratory tests or who refused to undergo them, pregnant women, and patients with ascites. A protocol form was completed for all subjects, containing data on name; gender; age; skin color; level of educational attainment; profession; family income; past medical history; physical activity; smoking; alcohol consumption; blood pressure (BP) measurement; waist circumference; height; weight; body mass index (BMI); fasting blood glucose; triglycerides (TG); total cholesterol (TC); HDL-cholesterol; and LDL-cholesterol.

The concept of MS was defined according to the NCEP ATP III and IDF guidelines[6,7] taking the following risk factors into consideration: waist circumference, TC, HDL-c, BP, and fasting blood glucose. The diagnosis of MS according to the NCEP ATPIII consists of the alteration of three of the factors mentioned above, whereas according to IDF the diagnosis is made when increased waist circumference is present plus at least two other risk factors. Both the NCEP and the IDF use the same parameters to define abnormal values of TG ($\geq$ 150mL/dL), BP ($\geq$ 130/85 mmHg) and HDL-c (< 40 for men and < 50 for women). Abnormal values of waist circumference adopted by the NCEP ATPIII are $\geq$ 102cm for men and $\geq$ 88cm for women, whereas those adopted by IDF are $\geq$ 90cm for men and $\geq$ 80 cm for women; these values have been proposed for South-American peoples. Abnormal fasting blood glucose levels for both NCEP and IDF were those $\geq$ 100mg/dl. The TG/HDL-c ratio was also assessed, with values $\geq$ 3.5 considered abnormal. Agreement in the diagnosis of MS based on the two definitions was assessed using the Cohen's kappa coefficient[14].

BP was measured using the indirect method with the auscultatory technique and calibrated aneroid sphygmomanometers. Cuffs adequate to the arm size were selected and fastened tight at approximately 2 to 3 centimeters above the cubital fossa. Systolic blood pressure level was estimated by palpating the radial pulse and inflating the cuff until it disappeared. After rapid inflation and one-minute interval, the stethoscope bell was placed over the brachial artery. The cuff was rapidly inflated to 20 to 30 mmHg above the estimated systolic blood pressure level. Deflation was slow (rate of 2 to 4 mmHg per second), and the systolic blood pressure was determined by the auscultation of the first sound (Korotkoff phase I); diastolic blood pressure was determined when the sounds disappeared (Korotkoff phase V). Patients were required not to exercise 60 to 90 minutes before the assessment, drink alcoholic beverages and coffee, or smok 30 minutes before blood pressure reading. They should be seated resting for least five minutes in a quiet room, with the right arm bared, legs not crossed, feet flat on the floor, back supported by the chair and relaxed. The arm should be supported at the heart level, with the hand palm turned upwards, elbow slightly flexed. The patients were asked not to talk during the procedure. The measurements were taken at two different timepoints, with approximately two-minute interval; the lowest level found was considered as the patient's BP[15]. Patients with systolic blood pressure (SBP) $\geq$ 140 mmHg and/or diastolic blood pressure (DBP) $\geq$ 90 mmHg or taking antihypertensive drugs were classified as hypertensive[16].

Body weight was measured in an electronic scale (to the nearest 0.1kg) with the patient on an empty bladder and wearing only underwear. Height was measured on a scale stadiometer, with the individual barefoot and to the nearest 0.5 cm. BMI was calculated (BMI = Weight/Height^2) according to the WHO recommendations for nutritional assessment[13]. The following cut-off points were used for the classification of the individuals as regards BMC (kg/m^2): normal < 25; overweight from 25 to 29.99; and obese $\geq$ 30. Indexes $\geq$ 25 kg/m^2 were considered excess weight. Waist circumference was measured midway between the iliac crest and the lower costal margin, with a non-stretchable tape measure, while the individual was standing bare chest, and at end-expiration[17].

Biochemical tests were determined in an ADVIA 1650 instrument. LDL-c levels were calculated using Friedwald's formula[18].

Those who smoked cigarettes during the study period were considered smokers regardless of the amount. Second-hand smokers were not considered.

Alcohol consumption was considered positive for individuals who drank alcohol regardless of type or amount of beverage.

Sedentary individuals were considered those who did not engage in physical activity at least three times a week, thirty minutes per day[8].

The control group was comprised of individuals without MS according to both definitions – NCEP ATPIII and IDF.

Statistical analysis was carried out in Stata 9.0. The Poisson's regression model was used for the analysis of the association between the risk factors studied and the prevalence of MS, according to the IDF definition[18]. Studies demonstrate that when the prevalence of an event is higher than 10%, the use of the logistic regression model for the estimate of the odds ratio leads to an overestimated risk. Prevalence ratios were calculated using the robust method and its respective 95% confidence interval. Significance level was set 5%. All variables presenting $p < 0.20$ in the non-adjusted analysis were selected for multivariate analysis. The stepwise variable selection method with backward elimination was used in the adjusted analysis. Only variables associated with $p < 0.10$ remained in the final model[19].

Results

Baseline characteristics of the subjects studied in outpatient cardiology clinics are summarized in Table 1. The mean age was 56 and 58 years for men and women, respectively. As regards the past medical history (coronary insufficiency – ICo, stroke, peripheral vascular disease – PVD, diabetes mellitus – DM, and hypertension), only ICo showed gender-related differences, with 23.4% among men versus 13.9% among women ($p< 0.001$). The prevalence of MS was higher in both genders according to the IDF definition (62.3% for men and 64.6% for women), in comparison to that according to the NCEP definition (48.9% for men and 59% for women). Among the lipid variables, means of TC (194 mg/dl), HDL-c (51 mg/dl), and LDL-c (118 mg/dl) were higher among women than among men (TC 183mg/dl; HDL-c 44 mg/dl and LDL-c 108.5 mg/dl). Mean TG and TC/HDL ratio were higher among men in relation to women (mean TG= 141mg/dl and120 mg/dl; and mean TC/HDL ratio = 4.1 and -3.8, respectively). Mean TG (141 mg/dl) and mean TG/HDL-c ratio $\geq$ 3.8 (38.3) were higher among men in relation to women (TG = 120 mg/dl and TG/HDL-c = 19.2). Among men, there was 30.7% of low HDL-c in relation to 42.6% among women, whereas 68.7% of men had hypertriglyceridemia versus 54.6% of women. No statistically significant differences were found between men and women for obesity, hemodynamic variables, smoking and physical activity. The alcohol use was significantly more frequent among men (49.2%) than among women (19.5%).

Characteristics of the subjects studied according to the NCEP and IDF definitions for MS are shown in Table 2. Of the 719 individuals assessed, 243 did not have MS, 391 had MS according to the NCEP definition, and 457 according to the IDF definition. Individuals with MS according to both definitions were older, had more previous diseases (DM, hypertension and ICo), abnormal fasting blood glucose and abnormal lipid variables (lower HDL-c, higher LDL-c, higher TC/HDL-c ratio, hypertriglyceridemia, TG/HDL-c ratio ≥ 3.8). They were also heavier, shorter, and had higher BMI, waist circumference, systolic and diastolic blood pressure. They also had a higher frequency of obesity, excess weight, abnormal waist circumference and hypertension. The comparison between individuals with and without MS did not show differences regarding the past medical history (stroke and PVD), total cholesterol, and variables related to lifestyle (smoking, alcohol use and physical activity).

The overall agreement as measured using the Kappa statistics was 0.70, $p<0.001$. Kappa values were 0.82 ($p < 0.001$) in the female gender and 0.58 ($p < 0.001$) in the male gender.

The non-adjusted analysis of the risk factors for MS according to the IDF definition is shown in Table 3. Patients with age ≥ 40 years, educational attainment ≤ 8 years of schooling, family income ≤ 1,000 real, who lived with a partner (whether legally or otherwise), and with overweight and/or obesity had a higher risk of MS.

The adjusted analysis of the risk factors for MS according to the IDF definition is shown in Table 4. Statistical significance was found for age $\geq$ 60 years and BMI $\geq$ 30.

Discussion

In this study, two definitions for MS were used: NCEP ATPIII's (I Brazilian Guideline on the Diagnosis and Treatment of Metabolic Syndrome) and IDF's. A total of 719 individuals seen in outpatient cardiology clinics were assessed. The prevalence of MS was 54.4% (391 cases) according to NCEP, and 63.6% (457 cases) according to IDF, and was higher among women. The most prevalent MS components were hypertension, hypertriglyceridemia, and abnormal waist circumference, followed by low HDL-c and abnormal blood glucose. As regards comorbidities, ICo and stroke were the most frequent. MS was more prevalent among low-income and older individuals. Smoking, alcohol use and physical activity were not significantly associated with MS. After an adjusted analysis of risk factors for MS, according to the IDF definition, age $\geq$ 60 years and BMI $\geq$ 30 were those significantly associated with a higher risk of MS.

Prevalence of metabolic syndrome, overall and by gender

In an urban Korean population of individuals 30 to 80 years of age, the prevalence of MS using NCEP ATP III definition was 16% among men and 10.7% among women[20]. Using IDF, the prevalence was 29% among men and 16.8% among women. In the city of Oporto, Portugal[21], a study with 1436 adults (men and women) showed a 23.9% prevalence of MS (27% in women and 19.1% in men) according to the NCEP ATPIII definition. In Taiwan, among 5,936 individuals 20 to 79.9 years of age, the prevalence of MS was 15.7% and 14.3% according to the NCEP ATPIII and IDF definitions, respectively[22]. In a study conducted in the United States[23] with 3601 participants with age ranging from 20 to 70 years, the prevalence of MS was 34.5% according to the NCEP ATPIII definition (33.7% among men and 35.4 among women) and 39% according to the IDF definition (39.9% among men and 38.1 among women). In Denmark[24], a study with 2493 subjects aged between 41 and 72 years showed a 21% prevalence (17.5% for men and 23.8% for women) according to IDF and 16% (14.3% for men and 18.6% for women) according to NCEP ATPIII. In 2007, 1,007 individuals aged from 18 to 74 years were assessed in Talca, Chile[25], and the prevalences of MS found according to the NCEP ATPIII and IDF definitions were 36.4% and 29.5%, respectively.

In the University Hospital of Santa Catarina[26], the prevalence of MS according to the IDF definition was 21.9% among women and 19.4% among men. In the city of Vitória, State of Espírito Santo, Brazil[27], the prevalence of MS according to NCEP ATPIII in 1,663 individuals aged between 25 and 64 years was 29.8%. In a rural area in the State of Bahia, Brazil, 240 individuals with age $\geq$ 25 years were studied[28], and according to the NCEP ATPIII definition, the prevalence of MS was 30% (38.4% in women and 18.6% in men). In the present study, the prevalence of MS, 54.4% according to NCEP and 63.6% according to IDF was higher than that found in the studies previously mentioned, because our sample was comprised of patients seen in outpatient cardiology clinics,

Table 1 - Characteristics of the subjects studied in outpatient cardiology clinics. São Luís-Ma, 2007

	Men	Women	p-value
	n = 329	n = 390	
Demographic variables			
Age (years)	56 (26-79)	58 (32-79)	0.106
Past medical history			
Diabetes (%)	17.3	15.4	0.482
Hypertension (%)	66.9	69.7	0.409
Coronary insuficiency (%)	23.4	13.9	0.001
Stroke (%)	3.7	3.6	0.967
Peripheral Vascular Disease (%)	1.5	1.0	0.553
Metabolic variables			
Metabolic syndrome IDF (%)	62.3	64.6	0.522
Metabolic syndrome NCEP (%)	48.9	59.0	0.007
Fasting blood glucose (mg/100ml)	96 (80-181)	92 (79-156)	0.002
Abnormal fasting blood glucose(%)	38.9	33.9	0.159
Lipid variables (mg/100ml)			
Total cholesterol	183 (114-264)	194 (133-260)	< 0.001
LDL-C	108.5 (49-174)	118 (57-186)	< 0.001
HDL-C	44 (30-62)	51 (38-67)	< 0.001
TC/HDL-C	4.1 (2.5-6.7)	3.8 (2.5-5.8)	< 0.001
Triglycerides/HDL-c	3.1 (1.2-11.9)	2.3 (1.0-5.6)	< 0.001
Triglycerides	141 (62-399)	120 (56-248)	< 0.001
Low HDL-c (%)	30.7	42.6	0.001
Hypertriglyceridemia (%)	68.7	54.6	< 0.001
Triglycerides/HDL-c (TG/HDL-c) ≥ 3.8(%)	38.3	19.2	< 0.001
Physical variables			
Weight (kg)	75 (57-105)	62 (48-86)	< 0.001
Height (cm)	169 (158-182)	156 (144-167)	< 0.001
BMI (kg/m^2)	26.5 (21.0-34.8)	25.6 (20.0-34.4)	0.001
Waist circumference (cm)	100 (82-116)	91 (75-112)	< 0.001
Obesity (%)	19.8	18.8	0.758
Excess weight (%)	67.0	55.7	< 0.001
Abnormal waist circumference (%) Abnormal waist circumference (%)	43.8 86.0	64.6 88.2	< 0.001 0.382
Hemodynamic variables			
Systolic blood pressure (mmHg)	130 (110-170)	130 (110-170)	0.055
Diastolic blood pressure (mmHg)	80 (70-100)	80 (70-100)	0.055
Hypertension (%)	72.3	70.5	0.589
Lifestyle variables			
Smoking (%)	8.2	5.6	0.174
Alcohol use (%)	49.2	19.5	< 0.001
Physical activity (%)	24.6	24.1	0.872

BMI - body mass index; IDF - International Diabetes Federation; n – number of patients; NCEP - National Cholesterol Education Program.

Table 2 - Characteristics of the subjects studied according to the NCEP and IDF definitions for metabolic syndrome. São Luís-MA, 2007

	Without MS n = 243	NCEP n = 391	P-value Without MS versus NCEP	IDF n = 457	P-value Without MS versus IDF
Demographic variables					
Age (years)	47 (18-78)	60 (37-79)	< 0.001	61 (39-79)	< 0.001
Male gender (%)	45.7	41.2	0.265	44.9	0.835
Past medical history					
Diabetes (%)	1.2	27.1	< 0.001	24.1	< 0.001
Hypertension (%)	44.0	82.6	< 0.001	80.7	< 0.001
Coronary insufficiency (%)	4.9	24.8	< 0.001	24.3	< 0.001
Stroke (%)	2.8	3.8	0.523	3.9	0.473
Peripheral Vascular Disease (%)	1.2	1.5	0.756	1.3	0.930
Metabolic variables					
Fasting blood glucose (mg/100ml)	88 (77-99)	102 (82-188)	< 0.001	99 (81-182)	< 0.001
Abnormal fasting blood glucose (%)	4.1	59.9	< 0.001	51.9	< 0.001
Lipid variables (mg/100ml)					
Total cholesterol	190 (125-262)	191 (120-265)	0.796	190 (121-260)	0.669
LDL-C	115 (63-180)	112 (48-180)	0.044	112 (51-180)	0.051
HDL-C	54 (38-68)	45 (31-63)	< 0.001	46 (31-64)	< 0.001
TC/HDL-C (TC/HDL-c)	3.6 (2.4-5.2)	4.2 (2.6-6.9)	< 0.001	4.1 (2.5-6.6)	< 0.001
Triglycerides/HDL-c	1.9 (0.9-3.8)	3.5 (1.4-11.5)	< 0.001	3.3 (1.3-10.0)	< 0.001
Triglycerides	101 (50-193)	159 (77-390)	< 0.001	152 (70-370)	< 0.001
Low HDL-C (%)	9.9	58.1	< 0.001	49.9	< 0.001
Hypertriglyceridemia (%)	18.5	84.4	< 0.001	82.5	< 0.001
Triglycerides/HDL-c(TG/HDL-c) ≥3.8	4.9	44.8	< 0.001	39.0	< 0.001
Physical variables					
Weight (kg)	66 (48-95)	71 (52-100)	< 0.001	70 (52-99)	< 0.001
Height (cm)	163 (150-180)	160 (145-178)	0.001	161 (145-177)	0.010
BMI (kg/m^2)	24.5 (19.7-32.6)	27.5 (21.5-35.9)	< 0.001	27.0 (21.9-35.1)	< 0.001
Waist circumference (cm)	90 (73-109)	99 (82-116)	< 0.001	98 (82-116)	< 0.001
Obesity (%)	11.3	28.2	< 0.001	24.4	< 0.001
Excess weight (%)	46.7	74.7	< 0.001	70.6	< 0.001
Abnormal waist circumference (%)	37.9	77.8[9]	< 0.001	100	< 0.001
Hemodynamic variables					
Systolic blood pressure (mmHg)	120 (110-160)	140 (120-170)	< 0.001	140 (110-170)	< 0.001
Diastolic blood pressure (mmHg)	80 (70-100)	80 (70-100)	< 0.001	80 (70-100)	< 0.001
Hypertension (%)	42.4	87.2	< 0.001	86.0	< 0.001
Lifestyle variables					
Smoking (%)	6.2	7.4	0.549	7.2	0.601
Alcohol use (%)	32.1	32.7	0.868	34.4	0.547
Physical activity (%)	22.6	24.3	0.632	25.8	0.352

BMI - body mass index; IDF - International Diabetes Federation; MS - metabolic syndrome; n – number of patients; NCEP - National Cholesterol Education Program.

Table 3 - Non-adjusted analysis of risk factors for metabolic syndrome according to the IDF definition. São Luís-MA, 2007

Variable	N *	% IDF	Prevalence ratio †	95% CI ‡	P-value
Gender					0,836
Female	384	65.6	1.00		
Male	316	64.9	0.99	0.89-1.10	
Age					< 0.001
13 to 29	37	16.2	1.00		
30 to 39	50	34.0	2.10	0.92-4.80	
40 to 49	139	46.8	2.88	1.36-6.13	
50 to 59	151	74.8	4.61	2.20-9.66	
≥ 60	292	79.1	4.88	2.34-10.18	
Color					0.877
White	310	66.5	1.00		
Mixed	300	66.3	1.00	0.89-1.12	
Black	23	60.9	0.92	0.65-1.28	
Educational attainment (years of schooling)					0.004
≥ 12	294	60.2	1.00		
9 to 11	244	65.2	1.08	0.95-1.23	
≤ 8	159	74.8	1.24	1.09-1.42	
Family income (real)					0.009
> 5,000	218	65.1	1.00		
1,001 to 5,000	328	61.0	0.94	0.82-1.07	
≤ 1,000	152	74.3	1.14	1.00-1.31	
Marital status					0.036
With a partner	449	67.7	1.00		
Without a partner	172	58.1	0.86	0.74-0.99	
Smoking [5]					0.584
No	652	65.0	1.00		
Yes	48	68.8	1.06	0.87-1.29	
Alcohol use					0.543
No	465	64.5	1.00		
Yes	235	66.8	1.04	0.93-1.16	
Body Mass Index					< 0.001
< 25	258	50.4	1.00		
25 to 29.9	289	70.6	1.40	1.22-1.62	
≥ 30	135	80.0	1.59	1.37-1.84	
Physical activity					0.339
No	527	64.3	1.00		
Yes	173	68.2	1.06	0.94-1.20	

** Total values may differ for each variable because of unknown data; † Prevalence ratio estimated using Poisson regression with robust adjustment of standard error; ‡ 95% CI – 95% Confidence Interval*

Table 4- **Adjusted analysis of risk factors for metabolic syndrome according to the IDF definition1. São Luís-MA, 2007**

Variable	Prevalence ratio *	95% CI †	P-value
Age			< 0.001
13 to 29	1.00		
30 to 39	2.02	0.91-4.49	
40 to 49	2.74	1.32-5.69	
50 to 59	4.27	2.09-8.73	
≥ 60	4.84	2.38-9.84	
Body Mass Index			< 0.001
< 25	1.00		
25 to 29.9	1.38	1.21-1.58	
≥ 30	1.67	1.45-1.93	

** Prevalence ratio estimated using Poisson regression with robust adjustment of standard error; † 95%CI – 95% Confidence Interval.*

most of them with cardiovascular diseases.

In this study, we found a higher prevalence of MS in the female gender, like in the studies conducted in Denmark[24], Santa Catarina[26], and in the city of Oporto[21], and unlike those carried out in Korea[20], United States of America[24], and Talca (Chile)[25], where a higher prevalence was observed in the male gender.

Prevalence of metabolic syndrome components

According to the NCEP ATPIII definition, the most prevalent MS components found in a Danish study[24] were obesity (38.6%), low HDL-c (37.1%) and hypertension (34%), whereas in our study there was a higher prevalence of hypertension (87.2%), hypertriglyceridemia (84.4%) and low HDL-c (58.1%). TC, LDL-c and TG levels were higher in the Danish study[24], whereas low HDL-c levels were higher in our study. The TC/HDL-c ratio was higher in the Danish study (NCEP ATPIII), and a similar result was found in this study. The incidence of 27.7% of DM found in our study was much higher than the 7% reported in the Danish study[24].

Alcohol use and physical activity were more prevalent in this study, unlike smoking, which was more frequent in the Danish study[24] (44% versus 7.4%).

The most prevalent components of MS in a study conducted in the rural area of the State of Bahia, Brazil[28] were low HDL-c (70.4%) and increased BP (57.1%), whereas in this study they were excess weight and obesity (92.9%), hypertension (87.2%) and hypertriglyceridemia (84.4%). In this study, abdominal obesity, excess weight and low HDL-c were more prevalent in the male gender, unlike in the study in Bahia, where these factors were more prevalent in the female gender.

Agreement between the two definitions of metabolic syndrome

The overall agreement as measured by kappa was considered good, thus indicating that both definitions may be used in the clinical practice. Agreement was very good in the female gender, and moderate in the male gender, thus suggesting that the currently used criteria are not very adequate for the male gender (moderate agreement).

The lower agreement between the two definitions for the diagnosis of MS in the male gender possibly resulted from the parameter used for the characterization of abnormal waist circumference. According to the IDF definition, no difference is found in the prevalence of abnormal waist circumference between genders, whereas according to NCEP ATPIII, 64.6% of women and 43.8% of men have abnormal waist circumference. This suggests that the diagnostic criterion of abnormal WC used by NCEP ATPIII for men may be inadequate and could account for the low agreement observed.

Our findings are similar to those found by Cristal Lee et al in a study of 22,403 subjects aged ≥ 35 years that showed very good agreement between the two definitions among women[29]. Kelliny et al[30] study including 1,218 subjects with mean age of 42 years showed an overall agreement of 0.82 between the definitions[30].

Factors associated with metabolic syndrome

In this study, obesity (BMI ≥ 30 kg/m^2) after adjusted analysis of risk factors was significantly associated with MS. This result was observed in several other studies such as those conducted in the USA[23] and Chile[25], as well as in Brazil, in Vitória-ES[27], and Bahia[28], possibly due to reduced physical activity and increased intake of large amounts of calories in these populations.

Among Americans[23], the prevalence of MS was higher among higher-income individuals, unlike in the present study, in which the prevalence was higher among lower-income individuals. Smoking and alcohol use were independently associated with MS in the American study[23], unlike in ours.

In this study, the prevalence of MS increased with age, like in the studies conducted in Bahia[28], Vitória[27], Talca[25], and United States[23].

Conclusion

This study showed that the prevalence of MS in outpatient cardiology clinics was much higher than in the general population. Hypertension was the most prevalent component. Agreement between the two definitions was good for the overall sample, very good for the female gender and moderate for the male gender.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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