

EPIDEMIOLOGY OF THE METABOLIC SYNDROME IN THE ADULT POPULATION IN THE CITY OF TIMIȘOARA

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Abstract

The metabolic syndrome (MS) is a condition associated with risk for atherosclerotic cardiovascular disease and for type 2 diabetes mellitus (DM), conditions which reduce significantly the quality and the duration of patients' life and are a financial burden for the society.

The prevalence of the MS at a world wide level has increased dramatically in the last decades parallel with the appearance of a true obesity epidemic as result of a sedentary lifestyle and excessive caloric intake. In the last decade, the MS prevalence in general adult population in the city of Timișoara was not evaluated until this study.

We performed a cross-sectional study in order to evaluate the prevalence of the MS in the adult population in the city of Timișoara. In addition, we aimed to assess the components of the MS present in the study population and the prevalence of atherosclerotic cardiovascular disease in individuals with MS.

The prevalence of MS, defined according to International Diabetes Federation (IDF) criteria, was 27.71% in the study population, similar to the one reported in the western European countries. In Timișoara, the MS prevalence in adult population increased by 4.6 percentage points in the past 10 years.

The prevalence of atherosclerotic cardiovascular diseases was significantly higher in individuals with MS than in those without MS, and increased parallel with the increase in number of met IDF diagnostic criteria for MS.

Background and Aims

The MS represents a major public health problem of the XXI century, by increasing 2-3 times the risk for atherosclerotic cardiovascular disease and up to 5 times the risk for type 2 DM, conditions which reduce significantly the quality and the duration of patients' life and are a financial burden for the society (1, 2, 3, 4).

The prevalence of the MS at a world wide level has increased dramatically in the last decades parallel with the appearance of a true

obesity epidemic as result of a sedentary lifestyle and excessive caloric intake (1, 5).

The heterogeneity of MS definitions elaborated over time led to difficulties when evaluating syndrome's prevalence (5). Starting from this premise, after a world consensus, IDF formulated in 2005 a unitary definition for MS, easy to use both in clinical practice and epidemiologic studies (6, 7).

In the city of Timișoara, MS prevalence in general adult population was not evaluated in the last decade. Previous studies used diagnostic criteria different than the ones of IDF, which are presently recommended. That

is why, before this study, the current local prevalence of MS and its consequences were not known.

The main objective of this study was to evaluate the prevalence of the MS in the adult population in the city of Timișoara. In addition, we aimed to assess the components of the MS present in the study population and the prevalence of atherosclerotic cardiovascular disease in individuals with MS.

Material and Method

We performed a cross-sectional study in order to evaluate the prevalence of the MS in the adult population in the city of Timișoara. We assessed the components of the MS present in adults from Timișoara and the characteristics of persons with and without MS. Additionally, we intended to identify the factors which influence the MS prevalence and, for this, we analyzed comparatively MS prevalence for the two genders, on age groups, on body mass index (BMI) groups, according to waist circumference (WCF) and fasting glycemia.

The study subjects were 2122 adults aged 20 years and more (940 men and 1182 females) coming from urban environment (city of Timișoara). The study subjects have been randomly chosen from data base of 6 general practitioners which had their praxis situated in 3 different areas of Timișoara (center, middle and periphery).

All subjects were informed about the importance of the study, and those who agreed to take part to the research signed an informed consent. A series of anamnestic data has been collected from the participants; each subject underwent a physical examination which

included the assessment of body weight, the measurement of height, WCF, systolic blood pressure (SBP), diastolic blood pressure (DBP). Fasting blood samples were collected for laboratory analysis, which included determination of fasting glycemia, plasma levels of total cholesterol (TC), triglycerides (TG) and HDLc. All determinations were made by standard methods. The results were written in an individual file for each subject.

The diagnosis of MS was established according to the IDF criteria.

The biological analyses were performed in the laboratory of Spitalul Clinic Județean de Urgență Timișoara which has high qualified personnel, modern technology and standardized methods.

The statistic analysis of data was computerized, the database being created in Microsoft Excel. The main statistic methods were t test, χ^2 test, ANOVA, Pearson correlation. The threshold for signification was a p value <0.05.

The diagnosis of ischemic heart disease (IHD) was established in patients who presented a positive result at World Health Organization (WHO) standard questionnaire for pectoral angina and/or ECG changes suggestive for myocardial ischemia, according to Minnesota codes.

The diagnosis of cerebrovascular disease was established in patients who had history of acute ischemic cerebrovascular accidents proven with medical documents.

Results

Prevalence of the metabolic syndrome

The prevalence of MS, defined according IDF criteria, was 27.71% in the study population. The prevalence of MS in women (28.93%) was slightly higher than in men (26.17%), but the difference was statistically insignificant ($p=0.17$).

Out of persons with MS, 43.19% presented 3 diagnostic criteria, 34.19% met 4 criteria, while 22.62% met all IDF diagnostic criteria for MS (table 1)

In the study subjects, the prevalence of the MS increased significantly ($p<0.001$) parallel with the increase of age, from 6.96% in the third decade of age, to a maximum of 45.41% for age group 60-69 years, and decreased slightly after the age of 70 (figure 1).

Table 1. Distribution of individuals with MS, according to the number of met IDF diagnostic criteria for MS

Number of met IDF diagnostic criteria for MS	Men		Women		Total	
	Number	%	Number	%	Number	%
3	100	40.65	154	45.03	254	43.19
4	82	33.33	119	34.79	201	34.19
5	64	26.02	69	20.18	133	22.62

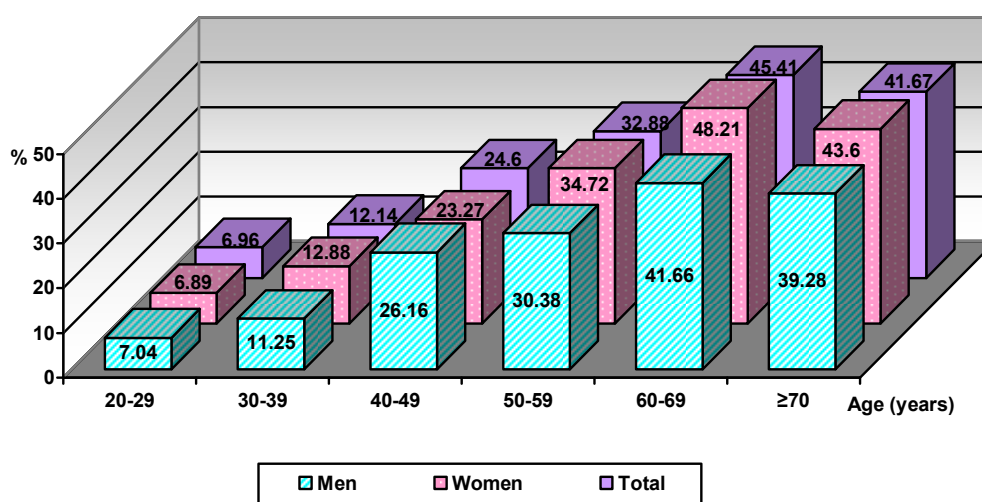


Figure 1. Prevalence of the MS by age groups

MS prevalence was significantly higher ($p<0.001$) in persons with abdominal obesity (56.94%, in men, and 60.42%, in women) than in general adult population and increased parallel with the increase of WCF (table 2).

For both, men and women, MS frequency increased significantly ($p<0.001$) parallel with

the augmentation of BMI (table 3). MS prevalence in overweight individuals was 44.96%, while in obese subjects escalated to 85.58%, reaching a maximum (94.73%) in the third degree obesity.

The prevalence of the MS increased significantly ($p<0.001$) parallel with the raise

of fasting glycemia, both in men and in women (table 4).

According to WHO criteria for glucose regulation disorders, the frequency of MS was 24% in normoglycemic individuals and

45.94% in persons with impaired fasting glucose (IFG). The MS prevalence in individuals with type 2 DM was 73.98%, significantly higher than in adult general population (27.71%).

Table 2. Prevalence of the MS according to WCF

	WCF (cm)	Prevalence of MS (%)	WCF (cm)	Prevalence of MS (%)
Men	94-101.9	44.82	≥ 94	56.94
	≥ 102	65.10		
	p	<0.001 (ES)		
Women	80-87.9	52.24	≥ 80	60.42
	≥88	67.78		
	p	<0.001 (ES)		
P was calculated with χ^2 test.				

Table 3. Prevalence of the MS according to BMI

BMI (kg/m ²)	Men (%)	Women (%)	Total (%)
25 – 29.9	49.27	41.06	44.96
30 – 34.9	79.48	82.67	81.58
35 – 39.9	93.33	93.84	93.68
≥ 40	95.46	94.28	94.73
p	<0.001	<0.001	<0.001
P was calculated with χ^2 test.			

Table 4. Prevalence of the MS according to fasting glycemia

Fasting glycemia (mg/dL)	Prevalence of MS (%)					
	Men		Women		Total	
<100	22.52	22.52	24.66	24.66	23.7	23.7
100-109	32.5	36.11	30	39.13	31.11	37.8
110-125	40.62		50		45.94	
≥126	70.59	70.59	76.39	76.39	73.98	73.98
P	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P was calculated with χ^2 test.						

Prevalence of individual components of the metabolic syndrome

Out of MS components, for general adult population in Timișoara, increased BP (SBP ≥130 mmHg and/or DBP ≥85 mmHg or treated hypertension) had the highest prevalence (62.03%). As frequency, followed abdominal obesity (47.03%), low HDLc (or

specific treatment for hypo-HDLc) (33.36%) and hypertriglyceridemia (or specific treatment for elevated TG) (32.33%); the less frequent component was fasting glycemia ≥100 mg/dL (or treated DM) (13.53%) (figure 2).

In individuals with MS, abdominal obesity was present in all cases, being, according to IDF, the obligatory criterion for this diagnostic. On second place, as frequency,

was the criterion SBP ≥ 130 mmHg and/or DBP ≥ 85 mmHg or treated hypertension (69.39%), followed by low HDLc (or specific treatment for hypo-HDL), with 52.21% prevalence, and by hypertriglyceridemia (or specific treatment for hypertriglyceridemia)

(51.36%); the less frequent criterion being fasting glycemia ≥ 100 mg/dL and/or treated DM (26.02%). The frequency of these disorders in persons with MS was significantly ($p < 0.001$) higher than in general population.

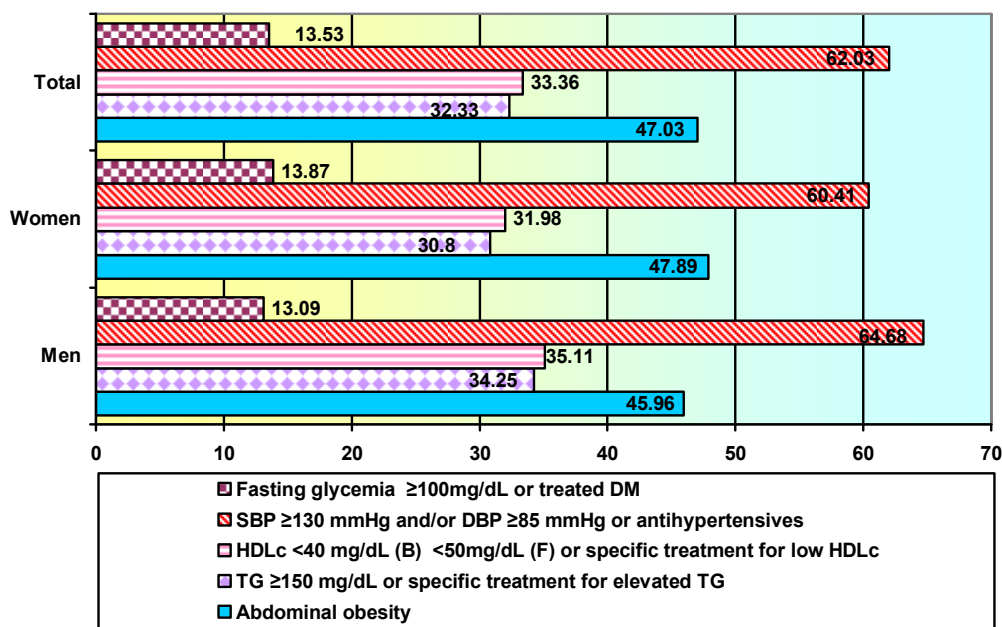


Figure 2. The prevalence of individual components of the MS (IDF 2005) in adult population in the city of Timișoara

Ischemic heart disease in the metabolic syndrome

In the studied population, IHD was present in 202 individuals, correspondent to a prevalence of 9.52%. The frequency of IHD was significantly higher ($p < 0.001$) in subjects with MS (21.09%) than in those without MS (5.08%).

In subjects with MS, the prevalence of IHD raised parallel with the increase in number of met diagnostic criteria for MS, being significantly ($p = 0.02$) higher in individuals who met all IDF criteria (30.07 %), than in those who met 4 criteria (20.89 %)

and comparatively to those who met only 3 criteria (16.53 %) (figure 3).

The prevalence of IHD was significantly higher in men than in women, both for individuals with MS (24.39% vs. 18.71% $p = 0.008$) and without MS (7.06% vs. 3.45%, $p = 0.002$).

The frequency of IHD increased significantly ($p < 0.001$) parallel with the increase in age, both for individuals with and without MS, the highest prevalence being observed for age group ≥ 70 years (36.15 %, for persons with MS, and 11.53 %, for persons without MS). Age specific prevalence of IHD was significantly ($p < 0.05$) higher for

individuals with MS than for individuals without MS.

For men with MS, the IHD prevalence was similar ($p=0.334$) in those with WCF ≥ 102 cm (26.19%) and in those with WCF 94-101.9 cm (20.51%), for both groups being significantly ($p<0.001$) higher than in individuals with WCF <94 cm (5.90%).

IHD prevalence in women with MS, both for the ones with WCF 80-97.9 cm (12.86%)

and the ones with WCF ≥ 88 cm (22.77%), was significantly ($p<0.001$) higher than in those with WCF <80 cm (2.92%).

These results confirm the existence in individuals with MS of a increased cardiovascular risk, starting with values of WCF ≥ 94 cm, for men, and ≥ 80 cm, for women, and justify the decrease of WCF threshold according to IDF (2005) diagnostic criteria for MS.

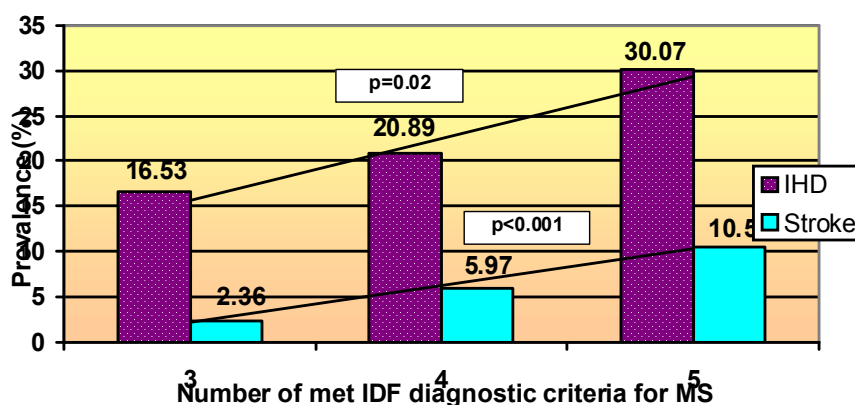


Figure 3. Prevalence of IHD and stroke in MS, according to number of met IDF diagnostic criteria for MS

Cerebrovascular disease in the metabolic syndrome

Cerebrovascular disease was observed in 58 individuals out of the total number included in the study, which corresponds to 2.73% prevalence. The prevalence cerebrovascular disease was significantly higher in individuals with MS than in those without MS, both for men (5.28% vs. 2.02%, $p=0.003$) and for women (5.56 % vs. 1.43 %, $p=0.002$).

The prevalence of cerebrovascular disease raised parallel with the increase in number of met diagnostic criteria for MS, being significantly ($p=0.001$) higher in persons who

met all criteria (10.53 %), than in those who met 4 (5.97 %) and comparatively to those who met only 3 diagnostic criteria (2,36 %) (figure 3).

In age groups 20-29 years and 30-39 years, there was no observed cerebrovascular disease. The frequency of cerebrovascular disease increased significantly ($p<0.01$) parallel with the increase in age, both for individuals with and without MS, the highest prevalence being observed for age group ≥ 70 (10.77 %, for persons with MS, and 5.49 %, for persons without MS). The age specific prevalence of cerebrovascular disease was higher in individuals with MS compared to those without MS.

It was observed a statistically significant increase of cerebrovascular disease parallel with increase of BMI, WCF and fasting glycemia.

The prevalence of cerebrovascular disease in subjects with MS was significantly ($p < 0.001$) higher in those with DM (13.19%), than in those with IFG (11.76%) and than in those with normal fasting glycemia (3.46%).

Discussions

The prevalence of the MS, at a global level, increased significantly in the last decades parallel with the raise at epidemic proportions of obesity prevalence, caused by sedentary lifestyle and excessive caloric intake (1).

In Timișoara, the prevalence of MS was not evaluated in the last decade, before the present study. For the adult population in the city of Timișoara, we found a 27.71% prevalence of MS defined according IDF criteria.

In order to estimate its evolution in time in Timișoara, we applied the IDF 2005 criteria for diagnostic of MS on a group of 929 adults from Timișoara, the characteristics of which were studied in a paper in 1997 (8). We found a MS prevalence, back in 1997, of 23.1% for the general group, on gender being 24.8%, for females, and 22.3%, for males. It was observed an increase in MS prevalence by 4.6 percentage points over last 10 years.

The heterogeneity of diagnostic criteria for MS used in studies, is causing difficulties in comparing the prevalence of MS for different populations (5). That is why it became evident the need to use a unitary

definition of MS, both in epidemiological and clinical studies.

In Europe, the prevalence of MS defined according to WHO criteria, found in studies varied between 5 and 22%, in women, while in men was between 7 and 36% (9).

More recently published studies used IDF definition of MS. The results of the study KORA Survey 2000 from Germany published by Rathmann and co. in 2006, showed in subjects aged 55 to 74 years a MS prevalence of 57%, in men, and 46%, in women (10). Comparatively, in our study, in persons aged 55 to 74 years, we found a similar prevalence of MS for women (44.02%) and much lower in men (36.91%).

Assman and co. published in 2007 the results of PROCAM study, showing in the population aged 16 to 65 years, from the Münster region of Germany, a MS prevalence of 31.5%, in men, and 22.8%, in women (11). Comparatively, in our research, in persons aged 20 to 65 years, we found a similar prevalence in women (23.72%) and significantly lower in men (21.79%).

Third National Health and Nutrition Examination Survey (NHANES III) (1988-1994) showed a 24% prevalence of MS, defined according to National Cholesterol Education Programme - Adult Treatment Panel III (NCEP-ATP III), in adult population (with ages over 20 years) from USA (12). More recent NHANES 1999-2000 showed an increase in the prevalence of MS up to 27%, which is similar to the prevalence we found in adult population in Timișoara (27.71%) (13).

In our research we observed that the prevalence of MS increased significantly ($p < 0.001$) parallel to the increase of subjects' age. This trend was observed also in other studies

(12, 13, 14). NHANES III showed age specific prevalences of MS similar to those found in our study (12).

In table 4 is presented the prevalence of the MS (IDF 2005) on age groups found in our study, comparatively to the prevalence found in a meta-analysis of 7 European populations,

including 4600 men and 5500 women, aged 30 to 89 years (14).

Important differences are noticed for men aged 50 to 59 years, and for women aged ≥ 70 years. For most of the age groups, the age specific prevalence of MS found in our study is similar to the one found in European populations (table 4).

Table 4. Prevalence of the MS (IDF 2005) in Europe (14)

Age group (years)	Men		Women	
	Own study	Europe	Own study	Europe
30-39	11.25%	13.2%	12.88%	10.3%
40-49	26.16%	29.7%	23.27%	20.2%
50-59	30.38%	40.1%	34.72%	35.6%
60-69	41.66%	42.7%	48.21%	45.9%
70-74	39.28%	44.5%	43.60%	54.2%
75-89		39.4%		58.4%

Conclusions

1. In the adult population, in the city of Timișoara, the prevalence of MS, defined according IDF 2005 criteria, was 27.7%, similar to the one reported in the western European countries. In Timișoara, the MS prevalence in adult population increased by 4.6 percentage points in the past 10 years. Most individuals with MS, 43.19%, met 3 IDF diagnostic criteria for MS, while 34.19% met 4 criteria and only 22.62% met all diagnostic criteria.

2. The prevalence of MS was directly correlated with WCF, BMI, age and fasting glycemia. The MS was present in 58.9% of individuals with abdominal obesity and in 77.1% of persons with DM.

3. The prevalence of atherosclerotic cardiovascular diseases (IHD and

cerebrovascular disease) was significantly higher in individuals with MS than in those without MS, and increased parallel with the increase in number of met IDF diagnostic criteria for MS.

4. In the studied population the cumulated prevalence of obesity and overweight was 45.1%, one of the highest values in the country, which puts us in the European regions with high prevalence.

5. In order to identify the individuals with increased cardiometabolic risk it is mandatory that medical examination should include determination of weight, height and WCF. Because of the increased cardiometabolic risk associated with MS, are mandatory the implementation of prophylactic measures, early detection and the elaboration of local protocols for clinical management of MS.

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