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Prevalence of metabolic syndrome among 40- and 50-year-old inhabitants of Wroclaw, Poland

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Abstract

Introduction and objective. The metabolic syndrome (MetS) has been discussed for many years, but there is no doubt that those who have confirmed the presence of risk factors comprising the MetS had a higher risk of cardiovascular disease. The aim of this study was to evaluate the prevalence of MetS among 40- and 50-year-old (y.o.) inhabitants of Wroclaw, Poland.

Materials and methods. The study group included Wroclaw inhabitants who were recruited between 2001-2004 into the Cardiovascular Disease Prevention Programme. The study group consisted of 18,583 participants (females: 40 y.o. – 5,248 and 50 y.o. – 5,329; males: 40 y.o. – 4,229 and 50 y.o. – 3,777). The MetS was defined by IDF/NHLBI/AHA (2009) criteria.

Results. MetS was found in 12.7% of 40 y.o. and in 33.1% of 50 y.o. females, while in males, respectively, in 30.4% and 42.1%. Overall, MetS occurred in 28.5% of the study group. MetS occurred significantly more frequent among the older than the younger groups, both in females and males. MetS was found significantly more frequent among males than females from Wroclaw, in both 40- and in 50 y.o. participants. Among those females with MetS, the most frequently (more than 90% in both age groups) occurred excessive waist circumference (WC), followed by elevated blood pressure-BP (72.1% of 40 y.o., 86.8% of 50 y.o.). Excessive WC, elevated BP and triglycerides-TG was found in more than 80% of males aged 40 and with diagnosed MetS. Among the older group of males with MetS, the most frequently occurred elevated BP (90.4%), followed by excessive WC (87%) and elevated TG (78.5%).

Conclusion. MetS was diagnosed more frequent in males than females of Wroclaw. Prevalence of MetS increased with age. The most significant impact on reducing the prevalence of MetS in the study group would be the lowering of BP and WC to recommended values.

Key words

metabolic syndrome, cardiovascular disease (CVD), risk factors

INTRODUCTION

Nowadays, urbanization and an unhealthy lifestyle, e.g. low physical activity, diet rich in energy, fats, refined sugars and low fruit and vegetable consumption, are the reasons why diseases such as obesity, diabetes type 2, hypertension and cardiovascular disease (CVD) are spreading, especially in developing countries [1, 2, 3]. Over the years it was observed that some risk factors of CVD often occurred together, and were called metabolic syndrome (MetS). The definition of MetS was modified during recent years, and described by the World Health Organization (WHO, 1999) [4], the European Group for the Study of Insulin Resistance (EGIR, 1999) [5], the Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, Adult Treatment Panel III (NCEP-ATP III, 2001) [6], and its modification by the American Heart Association (AHA) in 2005 [7], and by International Diabetes Federation (IDF, 2005) [8]. The latest definition of MetS was described in 2009 by the International Diabetes Federation (IDF), National Heart, Lung and Blood Institute (NHLBI), AHA, World Heart Federation, International Atherosclerosis Society and International Association for the Study of Obesity. This definition is the result of merger of the NCEP-ATP III and IDF definitions [9].

MetS has been discussed for many years and for sure this problem has not yet been resolved. The growing interest in the MetS in recent years is confirmed by the number of publications with the phrase 'metabolic syndrome' in articles appearing each year: in 2001 – 69 publications, in 2005 – 881 publications, and 2009 – 1,433 publications [10]. Discussion on the definition of MetS and the importance of its isolation as a clinical entity will continue, and there is no doubt that those who have confirmed the presence of risk factors comprising the metabolic syndrome have a higher risk of CVD.

OBJECTIVE

The aim of this study was to evaluate the prevalence of metabolic syndrome among 40- and 50-year-old inhabitants of the city of Wroclaw in Poland.

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MATERIAL AND METHODS

Sample and data collection. The study group consisted of Wroclaw inhabitants recruited between 2001-2004 into the Cardiovascular Disease Prevention Programme, organized by the Health Division of the Municipal Office in Wroclaw. The study group was selected by the PESEL number (Universal Electronic System for Registration of the Population). Invitations with information about the assumptions and objectives of the programme were sent once to every 40-year-old Wroclaw inhabitant, and to randomly selected 50-year-old inhabitants. Overall, between 2001-2004, the invitations were sent to 30,035 inhabitants aged 40, and to 18,183 inhabitants aged 50. Among the invited 40- and 50-year-old inhabitants, respectively, 9,501 and 9,152 persons responded to the invitations. Because there were some incomplete data, the study group overall consisted of 18,583 residents of Wroclaw (10,577 females, 5,248 aged 40, and 5,329 aged 50, and 8,006 males – 4,229 40-year-olds and 3,777 50-year-olds).

The study was conducted in two stages. During the first visit, blood tests (concentrations of total cholesterol, HDL cholesterol, triglycerides and glucose in blood serum) were conducted. During the second visit, blood pressure, weight, height, waist and hip circumference were measured, and dietary interviews collected by previously trained nurses.

Measurements. Blood tests were conducted using the biochemical analyzer Bayer Express Plus (Bayer Diagnostic, Germany). Total cholesterol, triglycerides and glucose were measured with Bayer's tests (Bayer Diagnostic, Germany) and HDL cholesterol measured with Randox tests (Randox Laboratories Ltd., UK). LDL cholesterol was calculated using the Friedewald formula. Systolic and diastolic blood pressure was obtained by the auscultatory method, using a standard sphygmomanometer. Weight was measured within an accuracy of 0.1 kg, and height – 1 cm. Waist and hip circumferences were measured using a non-stretch measuring tape within an accuracy of 1 cm. Body mass index (BMI) and waist-to-hip ratio (WHR) were calculated based on the anthropometric measurements.

Diagnosis of MetS was based on IDF/NHLBI/AHA criteria published in 2009 [9]. MetS was diagnosed when at least 3 of the 5 following abnormalities were met:

- Elevated waist circumference: population- and country-specific definitions (for Europid ≥80 cm in females, and ≥94 cm in males)
- Elevated triglycerides ≥150 mg/dl (1.7 mmol/l), or drug treatment for elevated triglycerides
- Reduced HDL – cholesterol level: <50 mg/dl (1.3 mmol/l) in females, and <40 mg/dl (1.0 mmol/l) in males, or drug treatment for reduced HDL – cholesterol
- Elevated systolic blood pressure ≥130 mm Hg and/or diastolic ≥85 mm Hg, or antihypertensive drug treatment in a patient with a history of hypertension
- Elevated fasting blood glucose ≥100 mg/dl (5.6 mmol/l), or drug treatment for elevated glucose.

There are not many studies in which the prevalence of MetS, according to the criteria from 2009, was been assessed; however there has been a lot of research carried out in which the IDF definition from 2005 was used [8]. Therefore, to compared the results the presented study with other researches, the prevalence of MetS was additionally assessed by the IDF criteria.

Statistical analysis. Mean, standard deviation (SD) and median were calculated for a summary continuous variables. The normality of distributions was assessed by the Shapiro-Wilk test. To compare linear data between groups (independent samples), the parametric Student's t-test or non-parametric Mann-Whitney test were used. Categorical variables were compare with a χ^2 test. Statistical analyses were performed using STATISTICA v 10.0 PL software (StatSoft Inc., USA). Differences were considered statistically significant when p-value < 0.05.

Table 1. Characteristics of the study group by gender and age

Parameters	Females				Males			
	40 years old, n=5248		50 years old, n=5329		40 years old, n=4229		50 years old, n=3777	
	X±SD	Median	X±SD	Median	X±SD	Median	X±SD	Median
Weight (kg)	64.8±11.9*	63.0	69.8±13.6	68.0	83.1±13.3*	82.0	82.0±14.1	81.0
Height (cm)	163.5±5.9*	164.0	162.0±6.6	162.0	176.9±6.5*	176.0	173.4±7.4	174.0
BMI (kg/m^2)	24.2±4.2*	23.4	26.6±4.8	25.8	26.5±3.8*	26.1	27.2±4.1	26.8
Waist (cm)	77.9±10.2*	76.0	84.8±11.9	83.0	93.3±10.4*	93.0	95.1±11.4	95.0
Hip (cm)	100.0±8.8*	99.0	104.2±9.8	103.0	102.5±7.3*	102.0	103.6±7.9	103.0
WHR	0.78±0.06*	0.77	0.81±0.07	0.80	0.91±0.06*	0.91	0.92±0.07	0.92
SBP (mmHg)	116.1±14.6*	115.0	127.1±18.6	125.0	126.0±15.3*	124.0	132.2 ±17.9	130.0
DBP (mmHg)	75.9±9.8*	75.0	80.7±11.2	80.0	81.9±10.5*	80.0	84.3±11.4	80.0
Pulse	72.8±8.4*	72.0	74.2±8.7	74.0	74.4±9.0*	74.0	75.3±8.8	76.0
Glucose (mg/dl)	89.0±13.7*	87.9	94.7±22.4	91.0	93.2±16.5*	91.9	100.3±25.4	96.0
Triglycerides (mg/dl)	101.5±70.2*	84.1	133.7±109.0	111.6	170.0±137.0*	132.8	175.3±147.7	139.0
Cholesterol – Total (mg/dl)	201.8±35.5*	198.9	221.8±41.4	217.9	216.9±43.5*	212.9	223.4±42.6	220.6
Cholesterol HDL (mg/dl)	61.6±14.5	60.0	61.8±15.1	60.0	52.6±12.9*	50.3	54.9±13.6	53.0
Cholesterol LDL (mg/dl)	120.1±30.9*	118.2	133.9±35.2	131.8	132.3±35.9*	129.3	135.9±36.4	134.0

BMI – body mass index, WHR – waist to hip ratio, SPB – systolic blood pressure, DBP – diastolic blood pressure, *X* – mean, SD – standard deviation, * – statistically significant differences between 40- and 50-year-old participants, Student's t-test or Mann-Whitney test.

RESULTS

Characteristics of the study group is presented in Table 1. All anthropometric parameters (except height), blood pressure, pulse, blood glucose level, triglycerides, total and LDL cholesterol level were significantly higher among 50- than 40-year-old females. There was no significant difference in HDL cholesterol level between older and younger females. Among males, all parameters (except weight and height) were significantly higher in the older compared to younger group.

Three components which are necessary to diagnose MetS occurred in 8.5% of females aged 40 years, and in 20.2% of those aged 50 years, and, respectively, in 20.1% and 26.1% of males (Tab. 2). More than 3 components of MetS were found in 4.2% of younger and in 12.9% of older females. Among males, more than 3 components occurred in 10.4% of those aged 40, and in 16.0% of those aged 50 (Tab. 2).

Table 2. Number of metabolic syndrome components (according to IDF/NHLBI/AHA 2009) in the study group

No. of MetS components	Females				Males			
	40-years-old n= 5248		50-years-old n= 5329		40-years-old n= 4229		50-years-old n= 3777	
	n	%	n	%	n	%	n	%
0	1918	36.5	856	16.1	701	16.6	405	10.7
1	1664	31.7	1304	24.5	1107	26.2	776	20.5
2	1002	19.1	1406	26.4	1134	26.8	1006	26.6
3	447	8.5	1075	20.2	851	20.1	986	26.1
4	172	3.3	529	9.9	383	9.1	532	14.1
5	45	0.9	159	3.0	53	1.3	72	1.9

MetS – Metabolic Syndrome; n – No. of participants.

Table 3 shows the prevalence of selected MetS components in the whole study group. It was found, that among 40-year-old females the most frequently occurred excessive waist circumference (36.1%), followed by elevated blood pressure (27.3%). In the older group of females, the excessive waist circumference was noted in 62.6%, while elevated blood pressure was found in 55.3%. Among 40-year-old males, excessive waist circumference, elevated blood pressure and triglycerides were found in more than 40%. In the older group, the elevated blood pressure was noted in 67.2% of males, excessive waist circumference in 55.4%, and elevated triglycerides in 45%.

Taking into consideration only those participants with diagnosed MetS (Tab. 4) it was found that more than 90% of females in both age groups had excessive waist circumference. Elevated blood pressure occurred most frequently (72.1% of 40-year-old females, 86.8% of 50-year-old females). Excessive waist circumference, elevated blood pressure and triglycerides, was noted in more than 80% of males aged 40 and diagnosed with MetS. Among the older group of males with MetS, elevated blood pressure (90.4%) occurred the most frequently, followed by excessive waist circumference (87%) and elevated triglycerides (78.5%).

The prevalence of MetS assessed by IDF/NHLBI/AHA criteria (2009) and IDF criteria (2005) is presented in Figure 1. According to the IDF/NHLBI/AHA criteria, MetS was found in 12.7% of 40-year-old and in 33.1% of 50-year-old females, while in males, respectively, in 30.4% and 42.1%. Overall, MetS occurred in 28.5% of the study group. It was observed that MetS occurred significantly more frequent among the older than younger groups, both in females ($p<0.0001$) and males ($p<0.0001$). The significant differences in MetS occurrence were also found between 50-year-old males and 40-year-old females ($p<0.0001$), and between 50-year-old females and 40-year-old males ($p=0.0058$). MetS occurred significantly more frequently in the studied males than females from Wroclaw, in both 40-year-old participants ($p<0.0001$) and in 50-year-old participants ($p<0.0001$).

MetS, according to the IDF criteria, was found in 11.7% of females aged 40 and in 31.7% of females from the second group and, respectively, in 26.8% and 36.6% of males (Fig. 1). Comparing the number of people with MetS, a significantly higher prevalence of MetS was observed according to IDF/NHLBI/AHA than IDF criteria among 40-year-old males ($p=0.0002$), 50-year-old males ($p<0.0001$), total males ($p<0.0001$), total females ($p=0.0391$) and overall ($p<0.0001$).

In a separate analysis a simulation carried out to discover what influence the selected factors had on the prevalence of MetS (Tab. 5). Also was checked how the prevalence of MetS decreases when the selected components were modified

Table 3. Prevalence of selected metabolic syndrome components in the study group.

Gender	Age	Waist circumference [cm]		Triglycerides [mg/dl]		HDL cholesterol [mg/dl]		Blood pressure [mmHg]		Glucose [mg/dl]	
		F <80 M <94	F ≥ 80 M ≥ 94	< 150	≥ 150	F ≥ 50 M ≥ 40	F < 50 M < 40	<130/85	≥130/85	< 100	≥100
Females	40 y.o. n=5248	3351 (63.9%)	1897 (36.1%)	4530 (86.3%)	718 (13.7%)	4135 (78.8%)	1113 (21.2%)	3816 (72.7%)	1432 (27.3%)	4486 (85.5%)	762 (14.5%)
	50 y.o. n=5329	1995 (37.4%)	3334 (62.6%)	3825 (71.8%)	1504 (28.2%)	4204 (78.9%)	1125 (21.1%)	2383 (44.7%)	2946 (55.3%)	3986 (74.8%)	1343 (25.2%)
	40+50 y.o. n=10577	5346 (50.5%)	5231 (49.5%)	8355 (79%)	2222 (21%)	8339 (78.8%)	2238 (21.2%)	6199 (58.6%)	4378 (41.4%)	8472 (80.1%)	2105 (19.9%)
Males	40 y.o. n=4229	2218 (52.4%)	2011 (47.6%)	2411 (57%)	1818 (43%)	3657 (86.5%)	572 (13.5%)	2267 (53.6%)	1962 (46.4%)	3172 (75%)	1057 (25%)
	50 y.o. n=3777	1685 (44.6%)	2092 (55.4%)	2079 (55%)	1698 (45%)	3362 (89%)	415 (11%)	1239 (32.8%)	2538 (67.2%)	2286 (60.5%)	1491 (39.5%)
	40+50 y.o. n=8006	3903 (48.8%)	4103 (51.2%)	4490 (56.1%)	3516 (43.9%)	7019 (87.7%)	987 (12.3%)	3506 (43.8%)	4500 (56.2%)	5458 (68.2%)	2548 (31.8%)
Overall	40+50 y.o. n=18583	9249 (49.8%)	9334 (50.2%)	12845 (69.1%)	5738 (30.9%)	15358 (82.6%)	3225 (17.4%)	9705 (52.2%)	8878 (47.8%)	13930 (75%)	4653 (25%)

F – females, M – males, y.o. – years old.

Table 4. Prevalence of selected metabolic syndrome components in the participants with metabolic syndrome

Gender	Age	Waist circumference [cm]		Triglycerides [mg/dl]		HDL cholesterol [mg/dl]		Blood pressure [mmHg]		Glucose [mg/dl]	
		F <80 M <94	F ≥ 80 M ≥ 94	< 150	≥ 150	F ≥ 50 M ≥ 40	F < 50 M < 40	<130/85	≥130/85	< 100	≥100
Females	40 y.o. n= 664	50 (7.5%)	614 (92.5%)	279 (42%)	385 (58%)	224 (33.7%)	440 (66.3%)	185 (27.9%)	479 (72.1%)	328 (49.4%)	336 (50.6%)
	50 y.o. n= 1763	75 (4.3%)	1688 (95.7%)	637 (36.1%)	1126 (63.9%)	939 (53.3%)	824 (46.7%)	233 (13.2%)	1530 (86.8%)	795 (45.1%)	968 (54.9%)
	40+50 y.o. n=2427	125 (5.2%)	2302 (94.8%)	916 (37.7%)	1511 (62.3%)	1163 (47.9%)	1264 (52.1%)	418 (17.2%)	2009 (82.8%)	1123 (46.3%)	1304 (53.7%)
Males	40 y.o. n= 1287	154 (12%)	1133 (88%)	207 (16.1%)	1080 (83.9%)	895 (69.5%)	392 (30.5%)	191 (14.8%)	1096 (85.2%)	638 (49.6%)	649 (50.4%)
	50 y.o. n=1590	206 (13%)	1384 (87%)	342 (21.5%)	1248 (78.5%)	1260 (79.2%)	330 (20.8%)	152 (9.6%)	1438 (90.4%)	544 (34.2%)	1046 (65.8%)
	40+50 y.o. n=2877	360 (12.5%)	2517 (87.5%)	549 (19.1%)	2328 (80.9%)	2155 (74.9%)	722 (25.1%)	343 (11.9%)	2534 (88.1%)	1182 (41.1%)	1695 (58.9%)
Overall	40+50 y.o. n=5304	485 (9.1%)	4819 (90.9%)	1465 (27.6%)	3839 (72.4%)	3318 (62.6%)	1986 (37.4%)	761 (14.3%)	4543 (85.6%)	2305 (43.5%)	2999 (56.5%)

F – Females, M – Males, y.o. – years old.

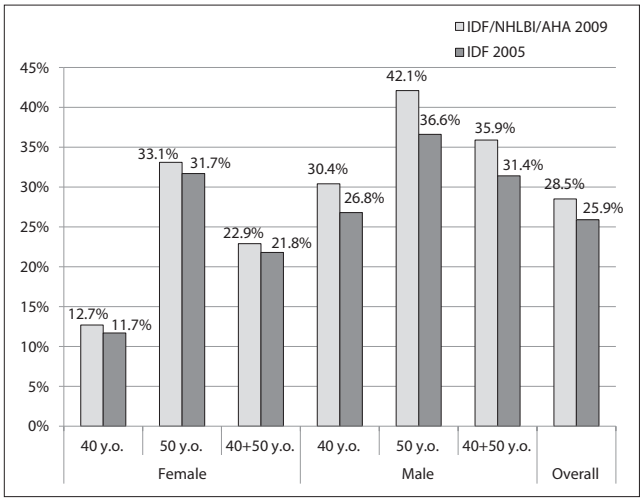

Figure. 1. Prevalence of metabolic syndrome among 40- and 50-year-old inhabitants of Wroclaw, assessed by criteria of IDF/NHLBI/AHA and IDF

to cut-off points. Among 40-year-old females, the greatest impact on reducing the incidents of MetS would have been in reducing waist circumference to less than 80 cm (from 12.7% currently to 5.0% after the simulation), while among 50-year-old females, reducing waist circumference and blood pressure to the recommended values (respectively, from 33.1% currently to 14.2% and 16.5% after the simulation).

If waist circumference had reduced below 94 cm the prevalence of MetS among 40-year-old males would have reduced from 30.4% to 13.6%. Reducing blood pressure below 130/85 mmHg would have caused decreasing MetS incidents from 30.4% to 14.3%. Reducing the triglycerides level below 150 mg/dl would have caused decreasing MetS incidents from 30.4% to 14.7% among 40-year-old males. Among 50-year-old males, the main impact on reducing the incidents of MetS would have been reducing blood pressure to the recommended values (from 42.1% currently to 19.4% after the simulation). If waist circumference had reduced below 94 cm the prevalence of MetS would have reduced from 42.1% to 21.1% (Tab. 5).

DISCUSSION

Adopting a definition of the metabolic syndrome and prevalence of its use has led to a discussion of its actual existence. Reaven [11, 12] undermined the definition of MetS, mainly because it does not take into account insulin resistance and dyslipidemic. He suggested that it should not be isolated as a disease entity [13, 14]. Gale [15] agreed that some risk factors often occurred together, but also formulated a hypothesis that there is no common reason to collect them together and create a clinical entity. Other authors also called into question the clinical usefulness of MetS [16, 17, 18]. Kahn presents some points against MetS, among which

Table 5. Prevalence of metabolic syndrome after modifying selected components to cut-off points

Study group		Prevalence of MetS		Prevalence of MetS after modifying selected components									
				↓waist circumference F < 80 cm M < 94 cm		↓ TG level < 150 mg/dl		↑ HDL level F > 50 mg/dl M > 40 mg/dl		↓ blood pressure <130/85 mm Hg		↓ blood glucose level <100 mg/dl	
Gender	Age	n	%	n	%	n	%	n	%	n	%	n	%
Females	40 y.o.; n=5248	664	12.7%	263	5.0	464	8.8	397	7.6	373	7.1	482	9.2
	50 y.o.; n=5329	1763	33.1%	755	14.2	1227	23.0	1406	26.4	879	16.5	1323	24.8
Males	40 y.o.; n=4229	1287	30.4%	576	13.6	623	14.7	1111	26.3	604	14.3	968	22.9
	50 y.o.; n=3777	1590	42.1%	798	21.1	922	24.4	1459	38.6	734	19.4	1079	28.6

MetS – Metabolic Syndrome; TG – Triglycerides; ↓ – decreasing; ↑ – increasing, F – Female, M – Male, y.o. – years old.

he suggested that there is no clear reason for including or excluding other CVD risk factors, and that it treatment is the same as treatment for its components individually [17]. The definitions are incompatible because they do not indicate the same factors as necessary and sufficient elements to diagnose MetS, and therefore they do not recognize the same patients as having MetS, which can lead to negative consequences in clinical and experimental research [19].

Metabolic syndrome also has its supporters who defend its validity. Grundy [20] emphasized that MetS definition aggregates the factors underlying the development of CVD and diabetes. He also suggested that it can be a usable clinical tool, helpful in patient treatment. According to Grundy [21], MetS is associated with 2-fold increase in risk for CVD and about 5-fold for type 2 diabetes. A meta-analysis made of 87 studies (951,083 patients) confirmed that persons with MetS, compared with those without, have twice the risk for CVD, CVD mortality, myocardial infarction and stroke. MetS caused also a 1.5-fold increase in risk for all-cause mortality [22]. MetS is also connected with other dysfunctions, such as: confirmed increase in pulse pressure and heart rate, enlargement of the left atrium and atrial fibrillation, arterial stiffness, left ventricular hypertrophy, and impairment of diastolic function and its impact on cardiovascular consequences [23]. The results of other meta-analysis also showed that risk of CVD mortality and all-cause mortality is higher among people with MetS, compared with those without it. The authors suggested that detection, prevention, and treatment of the MetS risk factors should have an important influence on reduction of the CVD in the population [24].

Taking into account that during recent years the prevalence of MetS has been evaluated using different definitions, it is difficult to compare the results of these studies. The differences in each definition have been clearly presented in the study of Athyros *et al*. [25] where four definitions of MetS were compared. It was found that prevalence of MetS among Greek adults according to NCEP ATP III (2001) and AHA/NHLBI (2005) criteria was almost two-fold lower than when assessed with IDF (2005) and IDF/NHLBI/AHA (2009) definitions, and amounted, respectively, to 24.5%, 26.3%, 43.4% and 45.7% [25]. The lowest incidents of MetS defined by NCEP ATP III were also observed in the Lithuanian population (males – 27.2%, females – 33.9%); however, the differences between the AHA/NHLBI definition, and IDF and IDF/NHLBI/AHA criteria were not so significant as in the Greek study, and amounted in males from 33.4% – 44.1% and in females from 41.5% – 48.7% [26]. A lower prevalence of MetS defined by the NCEP ATP III criteria, compared with the IDF criteria, was also observed in Germany (females 18% vs 28%, males 22.7% vs 40.3%) [27], the United States (females 35.4% vs 38.1%, males 33.7% vs 39.9%) [28] and in Australia (females 14.4% vs 19.4%, males 15.7% vs 26.4%) [29].

The prevalence of MetS assessed in 40- and 50-year-old females in Wroclaw was similar to the results from the National Multicentre Health Survey in Poland (project WOBASZ), while among male it was higher. In the presented study, MetS occurred in 22.9% (according to IDF 21.8%) of females and 35.9% (according to IDF 31.4%) of males, while in the Lower Silesian region in the WOBASZ study, respectively, in 20% of females and 24% of males (according to ATP III from 2005). However it is worth noting that the WOBASZ study was conducted in the population aged 20 – 74 years [30]. Higher prevalence of MetS compared with the present study was assessed in Świętokrzyskie Province in the Polish-Norwegian Study (PONS) among participants aged 45-64 years (females 34.3% vs 22.9%, males 49.9% vs 35.9%) [31]. According to NCEP ATP III, the prevalence of MetS in the NATPOL PLUS study in females was 22.6% and in males 18.0%, while according to IDF criteria, respectively, 26.8% and 25.8% [32]. Overall, the prevalence of MetS (IDF criteria) in NATPOL PLUS was 26.2% [32] and in WOBASZ – 25.5% [10], which is similar to the presented study (25.9%).

It was observed that MetS affected a higher percentage of Wroclaw inhabitants aged 50 than those aged 40. The increased prevalence of MetS with age was observed also in other Polish studies [30, 31, 32]. In the WOBASZ study, it was found that MetS occurred in 4.0% of females aged 20-39 years, in 24.4% of females aged 40-59 years, and in 46.3% of those aged 60-74 years. MetS among males was observed in, respectively, 9.7%, 28.4% and 34.5%. Interestingly, in the oldest age group, more female than male from the WOBASZ study had MetS [30]. In the PONS study, the prevalence of MetS also increased with age and amounted to 27.0% in the age group 45-49 years, and to 47.1% in the group aged above 60 [31]. In NATPOL PLUS, the prevalence of MetS (IDF criteria) among 18-39-year-old females was 8.4%, among 40-59-year-old females – 31.4%, and among females aged more than 60 – 50.9%. The prevalence of MetS among males was, respectively, 15.9%, 31.2% and 38.8% [32]. However, Luksiene *et al*. [26] observed that in the Lithuanian urban population, the prevalence of MetS increased with age among females, but not among males.

In the WOBASZ study, it was found that among people with MetS elevated blood pressure was the component which occurred the most often (49.8% of females, 69.2% of males); however, it affected a smaller percentage of the study group than in the presented research. Subsequently, elevated triglycerides and excessive waist circumference occurred in 33.8% and 28.0% of males, and respectively, in 22.3% and 41.1% of females [30]. These different proportions in prevalence of selected components of MetS were caused by the different cut-off point for waist circumference in the definitions used to defined MetS in both studies.

In the PONS study, where the same criteria as in the presented study were used, the prevalence of MetS components was assessed in the whole study group. It was observed that abdominal obesity and elevated blood pressure occurred in more than 70% of the study group. Elevated levels of glucose and triglycerides, and low level of cholesterol HDL, concerned respectively, 37.3%, 21.2% and 15.9% of the study group [31].

CONCLUSIONS

In conclusion, the metabolic syndrome was diagnosed more frequently in males than females in the city of Wroclaw, therefore, they are more at risk of cardiovascular disease. It was observed that the prevalence of MetS increased with age. The authors suggest that the most significant impact on reducing prevalence of MetS in the study group would be in lowering blood pressure and waist circumference to recommended values.

The authors conclude that the treatment of MetS components should be based on changing the lifestyle.

Healthy nutrition and increasing physical activity could lead to reduced body weight, and therefore to reducing blood pressure, improving glucose tolerance and the lipid profile.

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