

Prevalence of the Metabolic Syndrome in the Old Institutionalized People in Zagreb, Croatia

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ABSTRACT

Metabolic syndrome (MeS) is defined by a cluster of abnormalities comprising obesity, hypertension, carbohydrate intolerance and dyslipidemia. MeS increases the risk of developing various diseases, including coronary heart disease, stroke, peripheral angiopathy and type 2 diabetes^{1,2}. In our study, the subjects were 561 persons, residents of 11 homes for the elderly in Zagreb, Croatia. There were 160 men (28,5%) and 401 women (71,5%), aged from 56 to 96 years (the average being 79 years). Physical examination was conducted, which included blood pressure measurement, and body height and weight. Blood samples were taken for biochemical analysis. Along with other biochemical parameters, the levels of glucose, triglycerides and cholesterol (LDL, HDL-C) were also measured. The results have shown the prevalence of MeS in the elderly institutionalised people to be in the range of 20.8%, according to WHO criteria. The most common MeS component was hypertension, and it was significantly more frequent in women than in men; also, the elevated triglyceride levels were more often found in women; the difference between men and women was also statistically significant. MeS is a serious and growing health problem not only in Croatia but worldwide as well. Further studies are needed to verify the prevalence of MeS in Croatia, as it is a major risk for CVD and many other severe diseases.

Key words: metabolic syndrome (MeS), hypertension, senior population

Introduction

Metabolic syndrome (MeS) is defined by a cluster of abnormalities that consists of obesity, hypertension, carbohydrates intolerance and dyslipidemia. MeS increases the risk of developing various diseases, including coronary heart disease, stroke, peripheral angiopathy and the development of type 2 diabetes^{1,2}. At first MeS was named »syndrome X« and in 1998 the term »metabolic syndrome« was accepted by the World Health Organization (WHO) and according to WHO criteria obesity was taken as the main component for the definition of MeS³. Prevalence of MeS rises with age and it is believed that 40% of individuals of 60 years and above, and 10% in the age group 20–60 years have MeS^{4,5}. Significant increase in MeS prevalence is noted in developed countries, recent studies showed that age adjusted prevalence (adults 20 and above) of MeS in the U.S. rose from 24% in NHANES

III⁴ study to 27% in NHANES study⁶. Undeveloped countries also are not excluded, where MeS prevalence is increased especially in the obese and the overweight youth⁷. Two recent studies in isolated populations in Croatia were conducted, one took place in the interior of Croatia: the Baranja region; and the other in an island population of eastern Adriatic coast, they showed the prevalence of MeS of 40 and 42% respectively⁸. The data about the prevalence of MeS in the elderly population vary, ranging from 11.3% in women and 12.5% in men in people over 70 in a French representative study of the population (using NCEP ATP III criteria) and up to 69% in a Greek population-based study (using the IDF criteria). We found no data in the literature about the prevalence of MeS in the elderly population of Croatia⁹.

There are several definitions used to identify MeS, such as the WHO criteria, European group for the study of insulin resistance (EGIR) criteria, National cholesterol education program – adult treatment panel (NCEP ATP III) criteria and International diabetes federation (IDF) criteria. Mostly two definitions are used in diagnosing MeS, the WHO criteria and the second one as defined in the NCEP ATP III criteria^{10,11}. In our survey we used the WHO criteria that take obesity as the main component of MeS. With obesity, as the main component, at least two of the following four components must be fulfilled: carbohydrate intolerance (fasting glucose above 6.1 mmol/L), elevated blood pressure (measured above 140/90 mmHg), elevated triglycerides (above 1.7 mmol/L), low HDL – cholesterol (in men <0.9mmol/l; women <1.0 mmol/L) and obesity (waist hip ratio more than 0.9 in men and more than 0.85 in women; or body mass index (BMI) over 30 km/m²).

Materials and Methods

Subjects were 561 persons, residents of 11 old peoples' homes in Zagreb, Croatia, 160 men (28.5%) and 401 women (71.5%), aged 56 to 96 (average 79 years). Physical examination was conducted, which included measuring of blood pressure, height and weight. Blood samples were taken for biochemical analysis. Along with other biochemical parameters we measured level of glucose, triglycerides and cholesterol (LDL, HDL-C). 505 subjects had all the data need for detection of MeS, and 56 subjects had missing data, invalid data or have left the study. They were excluded from further evaluation of MeS prevalence.

WHO criteria takes hyperglycemia (defined as a history of diabetes or a fasting blood glucose greater than or equal to 6.1 mmol/L) as the main component of MeS with at least two of the following four components:

- 1) hypertension – defined as a history of hypertension or a blood pressure greater than or equal to 140/90 mm Hg
- 2) hypertriglyceridemia – defined as fasting triglycerides greater than or equal to 1.7mmol/L
- 3) a low HDL-C – defined as a fasting HDL-C less than 0.9 mmol/L in men or less than 1.0 mmol/L in women, and
- 4) central obesity – defined as a Body Mass Index (BMI) greater than or equal to 30 kg/m²

Data were collected individually, in the institution, as a part of a greater longitudinal study named »Biological, psychological and sociological factors of health in old age« which also included testing of psychological and sociological factors of ageing. The study received approval from ethical committee. All participants have signed informed consent and no fee was paid to participants, they could leave the research at their own will at any time without any consequences. Results were statistically analyzed using statistical software package Statistica 7. Level of statistical significance was set at 95% (alpha = 95%), p value less than 0.05 was considered as statistically significant.

Results

We found positive criteria for MeS in 35 men and in 70 women, with prevalence of MeS of 25.4% in men, and 19.1% in women. Totally, MeS was noted in 120 participants with the prevalence of 20.8%. When we analyzed the components of MeS separately, abnormal glucose level or previous diagnosis of diabetes mellitus was found in 35 men (25.4%) and 70 women (19.1%). Triglycerides levels were elevated in 38 males (27.5%) and 138 females (37.6%). HDL – cholesterol was below normal level in 18 males (13.0%) and 31 females (8.4%). Elevated BMI (equal to or above 30 kg/m²) was noticed in 21 males (16.4%) and 90 females (23.7%). Prevalence of metabolic syndrome components shows that hypertension is present in 87 men (54.4 %) and 276 women (68.8%). Totally, elevated glucose level or previous diagnosis of diabetes mellitus was found in 120 participants (21.3%). Abnormal triglycerides levels were noticed in 206 subjects (36.5%). Low HDL cholesterol has been established in 49 examinees (9.7%). Hypertension was recorded in 363 participants (64.7%), and elevated BMI we found in 111 subjects (21.9%). When comparing components of MeS in men and women, we found that men had higher percentage of glucose intolerance or diabetes mellitus (25.4 to 20.8%) and abnormal levels of HDL cholesterol (13.0 to 9.7%), but the difference was not statistically significant ($p>0.05$ and $p>0.05$). We also noticed that women more often have elevated triglycerides levels (27.5 to 34.8%), elevated blood pressure (68.8 to 54.4%) and elevated BMI (23.7 to 16.4%). Statistical significance was found when comparing elevated triglycerides levels and elevated blood pressure in women and men ($p=0.03$ and $p<0.01$ respectively). There was no statistical significance for BMI between men and women ($p>0.05$). All data are summarized in Table 1.

Discussion

In our current study the criteria proposed by the WHO for the epidemiological studies, which excluded microalbuminuria, for the MeS were used. Our results show that prevalence of MeS in an old people is 20.8% using the WHO criteria. MeS was found more frequently in men than in women (25.4 to 19.1%) but the difference was not statistically significant ($p>0.05$). The most frequent MeS component was hypertension, and it was significantly more frequent in women than in men ($p<0.05$), also raised triglycerides levels were more often found in women, the difference was also statistically significant ($p<0.05$).

MeS is believed to be a strong predictor of cardiovascular disease (CVD), which was confirmed by a number of studies¹². A sub-study of Botnia study, which included 4000 Finish and Swedish adults, showed that people with MeS have a three times higher risk of CVD than those without the syndrome, also cardiovascular mortality was significantly increased (12% to 20%) in people with MeS than in those without the syndrome¹³. Mentioned above was confirmed by the number of observational studies

TABLE 1
METABOLIC SYNDROME ACCORDING TO WHO AND GENDER

		Gender				N	%	Value	χ^2	
		Male	%	Female	%				df	p
Glucose	Normal	103	74.6	297	80.9	400	79.2			
	Abnormal	35	25.4	70	19.1	105	20.8	2.41	1	0.12
	N	138	100	367	100	505	100			
Triglycerides	Normal	100	72.5	229	62.4	329	65.2			
	Abnormal	38	27.5	138	37.6	176	34.8	4.47	1	0.03*
	N	138	100	367	100	505	100			
HDL-cholesterol	Normal	120	87.0	336	91.6	456	90.3			
	Abnormal	18	13.0	31	8.4	49	9.7	2.42	1	0.12
	N	138	100	367	100	505	100			
Hypertension	Normal	73	45.6	125	31.2	198	35.3			
	Abnormal	87	54.4	276	68.8	363	64.7	10.46	1	0.00*
	N	160	100	401	100	561	100			
BMI	Normal	107	83.6	290	76.3	397	78.1			
	Abnormal	21	16.4	90	23.7	111	21.9	2.97	1	0.08
	N	128	100	380	100	508	100			
MS (WHO)	No	103	74.6	297	80.9	400	79.2			
	Yes	35	25.4	70	19.1	105	20.8	2.41	1	0.12
	N	138	100	367	100	505	100			

p<0.05; N – number of participants; df – degrees of freedom

which included the Finnish Kuopio study¹⁴, the San Antonio Heart Study¹⁵, European DECODE Study¹⁶ and the AIRC study¹⁷. Also some studies have disputed whether the MeS is a good predictor of CVD above individual CVD risks, this was possibly related to an inadequate definition of MeS or the cut points used¹⁸. When comparing people who meet criteria for MeS but do not have diabetes, it has been noted that they have a very high risk for developing diabetes; the risk is five times higher than in people without MeS¹⁸. According to McNeill et al. women and men with MeS were 20% to 30% more likely to develop any CVD than subjects without MeS¹⁹. Many international studies have shown high correlation of MeS and the complex diseases, coronary disease, brain infarction and diabetes type II^{20–22}. When comparing our results to similar studies we found that our results were in concordance with their findings. Earl et al.²³ showed that the prevalence of MeS in US adults was 21.8% to 23.7%. Also they have noted that the prevalence of MeS rises with age, from 6.7% in individuals aged 20–29 to 43.5% in subjects aged over 60, their results are somewhat higher than ours, taking in consideration that most of our population was aged above 60. It must be noted that they have used ATP III criteria for definition of MeS, which is much more sensitive. We found no comprehensive data for MeS prevalence in Croatia, some studies performed in an isolated population were made. Missoni conducted a research in the isolated population of the is-

land of Vis, he used WHO criteria for MeS definition and the NCEP ATP III criteria for MeS definition. He found that 21.2% of subjects have MeS using the WHO criteria, this results are also in concordance with ours. MeS prevalence using the NCEP criteria was 47.2%, which proved that NCEP criteria is more sensitive than the WHO estimation. It also should be noted that hypertension was again the most often single risk factor for MeS²⁴. Missoni also noted that MeS is somewhat important factor for development of complex diseases, and also in his study was shown that 66.7% of subjects with malignant tumors have MeS as well, and that could suggest that MeS is also a high risk factor for those complex diseases²⁴. A few other studies using the WHO criteria for MeS were conducted in Croatia. Deka et al. found that the prevalence of MeS using the BMI as the indicator of obesity is 26% in the island of Hvar (32% in men and 24% in women above the age of 19)¹. Kolcic et al. preformed a several studies in Croatia, in an isolated island population of Rab, Mljet, Vis and Lastovo. The highest prevalence of MeS was found in Mljet (using the NCEP version) of 53%².

High prevalence of MeS was also found in Baranja region in the study of Tucak-Zoric et al., prevalence is high as 40% (35% in males and 42% in females) with BMI as predictor of obesity^{S25}. Unfortunately there is no data about the overall prevalence of MeS in Croatia, and there is no data about MeS in the elderly population of Croatia.

Conclusion

MeS is a serious and growing health problem worldwide and in Croatia. Further studies are needed to verify the prevalence of MeS in Croatia as it a major risk for CVD and complex diseases. Studies are especially needed in subjects of all ages so preventive actions, including the education about exercise and nutritional habits, could be performed until it is too late.

REFERENCES

1. DEKA R, SMOLEJ NN, TUREK S, ČUBRILLO TUREK M, VRHOVSKI HEBRANK D, JANČIJEVIĆ B, TOMLJENOVIC A, SZIROVICZA LL, ČKARABORTY R, RUDAN P, Coll Antropol, 1 (2008) 85. — 2. KOLČIĆ I, VORKO JOVIĆ A, SALZER B, SMOLJANOVIĆ M, KERN J, VULETIĆ S, Croat Med J, 47 (2006) 585. — 3. ALBERTI KGMM, ZIMMET P, SHAW J, Diabet Med, 23 (2006) 469. DOI: 10.1002/(SICI)1096-9136 (199807). — 4. FORD ES, GILES ES, DIETZ WH, JAMA (2002) 287. DOI: 10.1001/jama.287.3.356. — 5. LIEBERMAN LS, Coll Antropol, 31 (2007) 1. — 6. FORD ES, GILES ES, MOKDAD AH, Diabetes Care, 27 (2004) 2444. DOI: 10.2337/diacare27.10.2444. — 7. CIZMECIOGLU FM, ETILER N, HAMZAOGLU O, HATUN S, J Pediatr Endocrinol Metab, 22 (2009) 703. DOI: 10.1515/JPEM.2009.22.8.703. — 8. RANJAN D, SMOLEJ NN, HUIFENG X, TUREK S, ČUBRILLO-TUREK M, VRHOVSKI-HEBRANG D, JANČIJEVIĆ B, TOMLJENOVIC A, SZIROVICZA L, JIN L, Coll Antropol, 32 (2008) 85. — 9. VICZA L, JIN L, CHAKRABORTY R, RUDAN P, Coll Antropol, 32 (2008) 85. — 10. ALBERTI KG, ZIMMET PZ, Diabetes Med, 15 (1998) 539. DOI: 10.1002/diacare.15.5.685. — 11. BETHESDA MD, (2001). 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). NIH. — 12. KAHN R, BUSE J, FERRANNINI E, STERN M, Diabetes Care, 28 (2005) 2289. DOI: 10.2337/diacare.28.9.2289. — 13. ISOMAA B, ISOMAA B, ALMGREN P, TUOMI T, FORSÉN B, LAHTI K, NISSLÉN M, TASKINEN MR, Groop L Diabetes Care, 24 (2001) 683. DOI: 10.2337/diacare.24.4.683. — 14. LAKKA HM, LAAKSONEN DE, LAKKA TA, NISKANEN LK, KUMPUSALO E, TUOMILEHTO J, SALONEN JT, JAMA, 288 (2002) 2709. — 15. KELLY J, HUNT, ROY G, RESENDEZ, KEN WILLIAMS, STEVE M, HAFFNER, AND MICHAEL P, Stern Circulation, 110 (2004) 1251. — 16. HU G, QIAO Q, TUOMILEHTO J, BALKAU B, BORCH-JOHNSON K, PYORALA K, DECODE Study Group, Arch Intern Med, 10 (2004) 1066 — 17. MCNEILL AM, ROSAMOND WD, GIRMAN CJ, GOLDEN SH, SCHMIDT MI, EAST HE, BALLANTYNE CM, HEISS G, Diabetes Care, 28 (2005) 385. DOI: 10.2337/diacare.286.21.231. — 18. STERN MP, WILLIAMS K, GONZALEZ-VILLALPANDO C, HUNT KJ, HAFFNER SM, Diabetes Care, 11 (2004) 2761. DOI: 10.2337/diacare.27.11.2676. — 19. MCNEILL, AM, KATZ, R., GIRMAN, CJ, ROSAMOND, WD, WAGENKNECHT, LE, BARZILAY, JI, TRACY, RP, SAVAGE, PJ AND JACKSON, SA (2006), J American Geriatrics Society, 54 (2006) 1317. — 20. LAKKA HM, LAAKSONEN DE, LAKKA TA, NISKANEN LK, KUMPUSALO E, TUOMILEHTO J, SALONEN JT, JAMA, 288 (2002) 2709. — 21. MCNEILL AM, KATZ R, GIRMAN CJ, ROSAMOND WD, WAGENCHNEKT LE, BARZILAY JI, TRACY RP, SAVAGE PJ, JACKSON SA, J Am Geriatr Soc, 54 (2006) 317. — 22. ISOMMA B, HENRICSSON M, ALMEGREN P, TUOMI T, TASKINEN MR, GROOP L, Diabetologia, 44 (2001) 1148. — 23. EARL SF, WAYNE H, GILES WH, DIETZ J, JAMA, 287 (2002) 356. — 24. MISSONI S, Coll antropol, 3 (2006) 30. — 25. TUCAK-ZORIC S, BILIC ČURČIĆ I, MIHALJ H, DUMANČIĆ I, ZELIĆ Ž, MAJETIĆ CETINA N, SMOLIĆ R, VOLAREVIĆ M, MISSONI S, TOMLJENOVIC A, SZIROVICZA, L, DURAKOVIC Z, XI H, CHAKRABORTY R, DEKA R, TUCAK A, RUDAN P, Coll Antropol, 32 (2008) 659.

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PREVALENCIJA METABOLIČKOG SINDROMA KOD STARJE INSTITUCIONALIZIRANE POPULACIJE, ZAGREB, HRVATSKA

S A Ž E T A K

Metabolički sindrom (MeS) definiramo nizom abnormalnosti, uključujući gojaznost, povišen krvni tlak, netoleranciju na ugljikohidrate i dislipidemiju. MeS povećava opasnost nastanka niza bolesti, kao npr. koronarne srčane bolesti, moždanog ili srčanog udara, periferne angiopatije te dijabetesa tip 2^{1,2}. U našem ispitivanju je sudjelovala 561 osoba; to su bili šticieni domova za starije i nemoće osobe u Zagrebu, RH. Bilo je 160 muškaraca i 401 žena u dobi između 56 i 96 godina (prosječna dob je 79 godina). Obavljeni su fizikalni pregledi, uključujući mjerjenje krvnog tlaka te tjelesne težine i visine, a krv im je izvadena radi biokemijskih analiza. Od niza biokemijskih parametara mjerena je i razina šećera u krvi, triglicerida i kolesterola (LDL, HDL-C). Rezultati ukazuju na metabolički sindrom u 20,8% starijih institucionaliziranih osoba i to prema kriterijima Svjetske zdravstvene organizacije. Najčešća komponenta MeS-a je povišen krvni tlak, i to više u žena nego u muškaraca, a i povišena razina triglicerida je također češća u žena, uz statistički značajnu razliku između te dvije skupine ispitanika. MeS je značajan i rastući zdravstveni problema ne samo u Hrvatskoj već i u cijelom svijetu. Potrebna su daljnja ispitivanja kako bi se potvrdila prevalencija MeS-a u Hrvatskoj, jer je to značajan rizični čimbenik ne samo za srčanožilne bolesti već i za niz drugih teških bolesti i stanja.

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