

Association of Socio-Economic Status with Metabolic Syndrome – The Case of the Northwest Region of the Republic of Macedonia

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Abstract

Background: The impact of the socio-economic status of the population on the prevalence of metabolic syndrome has been described in several studies. It varies in different populations and regions based on their socio-economic specifications.

Aims: The aim of this study was to evaluate the impact of socioeconomic specificities of the northwest region of the Republic of Macedonia on the prevalence of metabolic syndrome.

Study design: We conducted a cross-sectional study with 320 women and 310 men, aged over 18 years, selected at random from the primary healthcare register, representing the population of about 200000 inhabitants of a district in northwest region of the Republic of Macedonia.

Methods: All subjects were interviewed by completing a questionnaire, according to the "WHO STEPS Instrument (World Health Organization Stepwise approach to chronic disease risk factor surveillance) modified for current conditions. For the detection of metabolic syndrome, physical examinations and laboratory tests were performed.

Results: Prevalence of subjects with metabolic syndrome living in rural areas was significantly greater than those in

urban areas (3.32 % versus 23.60 %). There was significant difference according to the number of components of metabolic syndrome in relation to the level of education (at $p < 0.001$) and household income (at $p < 0.001$). Subjects with high education (OR=0.08; 95%CI: 0.03-0.19), secondary education (OR=0.11; 95%CI: 0.05-0.24) and primary education (OR=0.34; 95%CI: 0.17-0.68), had a lower risk of metabolic syndrome than those who have not finished primary school. Subjects with high household income (OR=0.22; 95%CI: 0.11-0.44) and average household income (OR=0.34; 95%CI: 0.19-0.62), had a lower risk of metabolic syndrome than those with minimal household income (receive social assistance).

Conclusions: In our region, low socioeconomic status is strongly associated with higher prevalence of metabolic syndrome.

Keywords: Socioeconomic factors; metabolic syndrome; Prevalence; Republic of Macedonia.

List of abbreviations

MetS	Metabolic syndrome
NCEP ATP III	National Cholesterol Education Program Adult Treatment Panel III
CI	Confidential Interval
OR	Odds ratio

Cm	Centimeter
mmol/L	Millimoles per liter
mmHg	Millimeters of mercury
vs.	Versus
DECODE	Diabetes Epidemiology Collaborative Analysis of Diagnostic Criteria in Europe
NHANES	National Health and Nutrition Examination Survey
WHO	World Health Organization
STEPS	Stepwise approach to chronic disease risk factor surveillance

Background

In the prevalence of metabolic syndrome (MetS), in addition to the clear impact of age, race and ethnicity, for which there is mainly consensus among the researchers of this problem [1-5], there are also the social, economic and lifestyle factors which also affect the occurrence of MetS. [6-11]. this influence of socio-economic status in the prevalence of metabolic syndrome has been described in many studies but not always with consistent data between them. In some studies in developed and developing countries, it has been demonstrated that the level of education and family income are important socioeconomic determinants in the occurrence of metabolic syndrome and stay in an inverse relationship with the prevalence rate of metabolic syndrome [12-15]. In the NHANES study, the risk of metabolic syndrome in members of low-income families was higher than those with higher incomes, but in the same study, the level of education had no impact on the occurrence of metabolic syndrome [16]. There are studies in which the influence of socio-economic factors has been more pronounced in women than in men [17-19], or it had an impact only on women and not on men [20]. There is also a new Chinese study that indicates higher levels of higher education and higher family income were

associated with a higher prevalence of metabolic syndrome in males but associated with lower prevalence of metabolic syndrome in women [31]. Although these differences can sometimes occur due to differences in the definition and quantification of socio-economic factors that are used during the study, there are still features of social, economic, cultural and behavioral factors of the different populations and countries that determine this change.

So far, there have been no studies in the Republic of Macedonia regarding social and economic impact on the prevalence of metabolic syndrome at regional and national level. The aim of this study was to investigate the impact of socioeconomic features of our region on the prevalence of MetS.

Study Design and Method

The study included cross-sectional data summarized in our previous research for Mets prevalence using the same data, so the survey methodology has been described elsewhere [21]. Briefly, 630 participants. (320 women and 310 men) were selected at random from the primary healthcare register representing the population of about 200000 inhabitants of a district in northwest region of the Republic of Macedonia. Inclusion criteria were all individuals over the age of 18. Pregnant women were excluded from the study. The data were collected from September 2013 to March 2014, after notifying and verbal approval by the subjects. All subjects were interviewed by completing a questionnaire, according to the "WHO STEPS, Instrument for Chronic Disease Risk Factor Surveillance" modified for current conditions. The questionnaire was completed by the primary doctor according to the instructions and the preliminary training on the interview method.

The level of education is classified as none (not finished primary school), elementary (finished primary school),

secondary (finished secondary school) and high (finished high school).

Monthly household incomes are classified as minimal (receive social assistance), low (receive income at the level of minimum wage), average (receive income up to the level of the average wage) and high (receive income above the level of the average wage). (Data provided by the State Statistical Office of the Republic of Macedonia for 2013) [29].

The metabolic syndrome was defined according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) [30]. According to this definition, an individual has MetS if three or more of the following five diagnostic criteria are present:

1. Abdominal obesity (waist circumference ≥ 102 cm in men and ≥ 88 cm in women).
2. Triglycerides ≥ 1.7 mmol / l or specific treatment for this disorder.
3. HDL-Cholesterol < 1.03 mmol / l in men and < 1.29 mmol/l in women or specific treatment for this disorder.
4. Systolic blood pressure ≥ 130 mmHg and/or diastolic blood pressure ≥ 85 mmHg or hypertension treatment.
5. Fasting glucose ≥ 5.6 mmol / l or prior diagnosis of diabetes mellitus.

Statistical analysis

Statistical data processing is done in SPSS 13.0 statistical program. The following methods have been implemented:

- In series with numerical variables, were assigned: Descriptive Statistics (Mean \pm Std. Dev. \pm 95% CI: Minimum Value, Maximum Value)
- In series with categorical variables, differences between analyzed parameters are tested with Pearson Chi-square (χ^2);
- Logistic regression was used to calculate odds ratios and their 95% CI for socio-economic factors as predictors of metabolic syndrome.

Results

From 630 subjects included in the study, 178 subjects met the criteria for metabolic syndrome. The prevalence rate was 28.25%, (34.06% were women and 22.26% men). The difference was significant ($p=0.004$). Of particular components, only abdominal adiposity was significantly more present in women (59.4% vs. 26.5 %) ($p<0.001$). Prevalence of subjects with metabolic syndrome living in rural areas was significantly greater than those in urban areas (31.32 % vs. 23.60 %), (95% CI: 2.7923 - 12.5985, $p=0.002$) (Table 1).

Table 1 Prevalence of metabolic syndrome and its components by sex and place of residence.

	Prevalence %					
	METABOLIC SYNDROME	Arterial hypertension	Hyperglycemia	Abdominal adiposity	Low HDL-C	Hypertriglyceridemia
Total	28.3	52.1	25.2	43.2	46.4	39.1
Men	22.3	50.7	25.8	26.5	44.5	42.3
Women	34.1	53.4	24.7	59.4	48.1	35.9
<i>p value*</i>	$p=0.004$	$p=0.48$	$p=0.75$	$p < 0.001$	$p=0.50$	$p=0.10$
Rural area	31.32					
Urban area	23.6					
<i>p value*</i>	$p=0.002$					

*** χ^2 - Chi-square test**

Distribution of subjects according to the number of metabolic syndrome components is presented in Table 2. In relation to the subjects gender, for $\chi^2=14.91$ $p < 0.05$ ($p = 0.01$), there was significant differences. Also, in relation to the age group, for $\chi^2=193.15$ and $p < 0.001$ ($p = 0.000$), there was significant difference. In the distribution of subjects according to the level of education and the number of components of MetS, for $\chi^2=95.65$ and $p < 0.001$ ($p=0.000$), there was a significant difference (Table 2). In subjects with elementary education, 18.57% of subjects had 3 components, 14.98% had 4 components and 3.26% had 5 components of MetS. In subjects with high education, 5.26% of subjects had 3 components, 5.26% of subjects had 4 components, and 1.05% of subjects had 5 components of MetS present.

In the distribution of subjects according to the monthly household incomes and number of MetS components present, for $\chi^2=44.50$ and $p<0.001$ ($p=0.000$) there was a significant difference (Table 2). In the subjects with minimal household incomes, 22.03% of them had 3 components, 18.64% had 4 components and 6.78% of subjects had 5 components of MetS. In subjects with high monthly household incomes were recorded 7.09% subjects with 3 components, 8.66% subjects had 4 components and 0.79% subjects had registered 5 components of MetS.

Table 2 Prevalence of metabolic syndrome according to the number of components by gender, age group, education level and household income.

	No. of components of MetS, %						p-value*
	0	1	2	3	4	5	
<i>Overall prevalence</i>	16.03	26.67	29.05	15.24	10.63	2.38	
Gender							0.01
Male	19.35	29.03	29.35	12.90	7.10	2.26	
Female	12.81	24.38	28.75	17.50	14.06	2.50	
Age group							< 0.001
18-29	36.60	39.87	20.26	1.96	1.31	0.00	
30-39	16.91	34.56	25.74	16.18	5.15	1.47	
40-49	13.39	19.69	33.07	16.54	14.17	3.15	
50-59	4.00	23.00	33.00	18.00	21.00	1.00	
60-69	1.62	14.52	32.26	25.81	14.52	11.29	
>70	0.00	5.77	42.31	30.77	19.23	1.92	
Education level							<0.001
None	0	13.1	23.6	39.47	13.16	10.53	
Primary	12.05	19.5	31.5	18.57	14.98	3.26	
Secondary	19.47	36.7	28.9	10.00	5.79	0	
High	28.4	36.8	23.1	5.26	5.26	1.05	
Household income							<0.001
Minimal	11.86	22.03	18.64	22.03	18.64	6.78	
Low	8.68	25.11	31.51	19.63	11.87	3.20	
Average	18.67	29.33	28.44	13.78	8.44	1.33	
High	25.98	26.77	30.71	7.09	8.66	0.79	

* χ^2 -Chi-square test

The predictive role of education level as independent variables on the occurrence of metabolic syndrome as a dependent phenomenon has been analyzed (Tabela 3). For Chi-square = 62.29 and $p<0.001$ ($p=0.000$), the significant link has been verified between primary, secondary and high education as independent variables and metabolic syndrome as the dependent variable. Subjects with secondary education for 0.11 times (OR= 0.11) had a lower risk of metabolic syndrome than those who have not finished primary school. The impact of secondary education was significant (95% CI: 0.05-0.24, p

<0.001). Subjects with high education for 0.08 times (OR=0.08) had a lower risk of metabolic syndrome than those who have not finished primary school. The impact of high education was significant (95% CI: 0.03-0.19, $p <0.001$). Subjects with primary education for 0.34 times (OR=0.34) had a lower risk of metabolic syndrome than illiterate. The impact of primary education was, also, significant (95% CI: 0.17-0.68, $p <0.01$). It can be said that education has a protective effect on the appearance of metabolic syndrome.

The predictive role of monthly household income as independent variables on the occurrence of metabolic syndrome as a dependent phenomenon has been analyzed (Tabela 3). For Chi-square=26.16 and $p <0.001$, ($p = 0.000$), an important link has been verified between monthly household income as an independent variable with metabolic syndrome (Table 2). Subjects with a high monthly household income, for 0.22 times (OR=0.22) had a lower risk of metabolic syndrome than those with minimal monthly household income. The impact of high household income was significant (95% CI: 0.11-0.44, $p <0.001$). It can be said that high household income has a protective effect on the occurrence of metabolic syndrome. Subjects with an average monthly household income for 0.34 times (OR=0.34) had a lower risk of metabolic syndrome than those with minimal household income. The impact of average monthly household income was significant (95% CI: 0.19-0.62, $p <0.001$). The impact of low monthly household income on the occurrence of metabolic syndrome was not significant for $p>0.05$, ($p = 0.08$).

Discussion

In this study, we analyzed the impact of the socioeconomic status on the prevalence of MetS. As mentioned above, our study sample has represented the population of about 200,000 inhabitants in a district, in the

north-western region of the Republic of Macedonia. As we have published in our previous publication, overall prevalence of MetS was 28.25%, however, among women was significantly higher than in men (34.06% vs. 22.26%) [21], which was not the case in the surrounding countries like Bulgaria, Greece and Romania where the prevalence of MetS was almost the same in both sexes [22-24]. Also, in the DECODE study, which included cohorts from 7 studies across Western European countries, MetS prevalence was almost the same in both sexes (15.7% in men and 14.2% in women), although considerably lower than in ours [2]. Such a report of significantly higher prevalence of MetS among women in relation to men (as in our study) was also reported in Iran (48.5% vs. 36.3% respectively), Turkey (39.6% vs. 28%), India (39.9% vs. 22.9%), China (Shanghai) (35.1% vs. 28.4%)[25-28]. In these studies, the difference in favor of a greater number of women with MetS is ascribed to socioeconomic and cultural factors. Otherwise, many studies, in developed and developing countries, have shown that education level and family income are important socioeconomic determinants in the occurrence of metabolic syndrome and stay at an inverse ratio to the prevalence of metabolic syndrome. This has been particularly pronounced among the women population [7-11,18].

In our study, from all the MetS components, a significant difference between men and women was only in the prevalence rates for visceral adiposity. It was also the reason for the highest prevalence among women. More than half of the women in our study were with visceral adiposity. This can be explained by some socio-economic and cultural features of the region where the study was conducted. Here is the influence of the woman's position in society. In our contingent, a significant proportion of women, over the age of 40 and the majority of women

over 50 years, were with elementary education, not employed and reported low physical activity. Among others, in societies with higher socioeconomic status, there is a social stigma on obesity, which to a certain extent affects the reduction of obesity. However, such an approach is missing or exists less among the categories with a lower level of education. We think it was also, one of the reasons for the higher prevalence of MetS among the population with low socioeconomic status in our study. There are several mechanisms that explain the influence of the level of education and family income in MetS. First of all, socio-economic status influences the way of nutrition and lifestyle, which then affects the occurrence of MetS. Higher family incomes allow for healthier food selection and better opportunity and access for physical activity. While the population with higher education level is more aware of healthy eating habits and the need for physical activity as one of the prerequisites for good health.

Probably these mechanisms, also, have had an impact, on the difference of MetS prevalence rates between urban and rural residents, presented in our study. The larger number of people with MetS lived in rural areas (31.32% vs. 23.60% s). Also in other studies, social, economic and cultural factors were important determinants of MetS prevalence difference between urban and rural residents [13,14]. In our case, we think that it is attributed to the fact that the majority of our rural population (especially women) are no longer engaged in agriculture, thus excluding the potential protective effect that would have physical activity in the prevalence of metabolic syndrome, while there remain socio-cultural factors, such as the low family income and particularly the lower level of education that determines this difference between urban and rural areas in the region.

Conclusion

In summary, current results showed the influence of socioeconomic status indicators to the MetS prevalence. This influence was particularly pronounced in women. The lower socio-economic status was associated with higher MetS prevalence, driven mainly by obesity.

These data should serve to prepare a public health strategy to contribute to the prevention of cardiovascular disease and type II diabetes. Special attention should be paid to low socioeconomic categories of population.

Conflict of interest

The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

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