



## Prevalence of metabolic syndrome and the association with sociodemographic characteristics in adult population of Banja Luka

Prevalencija metaboličkog sindroma i njegova povezanost sa sociodemografskim karakteristikama odraslog stanovništva Banje Luke

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### Abstract

**Background/Aim.** Metabolic syndrome (MS) is a cluster of metabolic and hemodynamic disorders that increase the risk of developing atherosclerotic cardiovascular diseases and type 2 diabetes mellitus. The aim of this study was to determine the prevalence of MS and its components in adult population of Banja Luka and association with sociodemographic characteristics. **Methods.** A total of 685 participants (348 men and 337 women), aged 18 years and over, were analyzed. The diagnosis of the MS was based on definition set by the International Diabetes Federation (IDF). **Results.** The prevalence of the MS was high (37.5%), slightly higher in women (38.3%) than in men (36.8%), but without statistically significant difference ( $p = 0.686$ ). Prevalence of each individual component of the MS in the study group was over 30% (systolic blood pressure  $\geq 130$  mmHg – 42.0%; diastolic blood pressure  $\geq 85$  mmHg – 31.0%; triglycerides  $\geq 1.7$  mmol/L – 36.1%; high density lipoprotein (HDL) cholesterol  $< 1.03$  for men and  $< 1.29$  for women – 31.2%; glucose  $\geq 5.6$  mmol/L –

32.8%; central obesity  $\geq 94$  cm male and  $\geq 80$  cm female – 62.6%). The prevalence of the MS was not associated with gender, but with age. A number of participants increased with increased age in the group with the MS with statistically significant difference compared to the group without the MS. The study showed an association between level of education and the MS. Low level of education was associated with the appearance of the MS with statistically significant differences ( $df = 3$ ;  $p = 0.013$ ). Association between level of education and the MS was shown in women ( $df = 3$ ;  $p = 0.000$ ), but not in men ( $df = 3$ ;  $p = 0.883$ ). Retirees and housewives were significantly present in the group with the MS, students and unemployed in the group without the MS, while employed participants showed no statistically significant difference. **Conclusion:** The MS was diagnosed in over one-third of adults in Banja Luka. Prevalence of MS was not associated with gender, but it was associated with age, level of education as well as with some categories of employment.

**Key words:** metabolic syndrome; prevalence; socioeconomic factors; demography; age factors; education.

### Apstrakt

**Uvod/Cilj.** Metabolički sindrom (MS) je skup metaboličkih i hemodinamskih poremećaja koji povećavaju rizik od aterosklerotskih kardiovaskularnih bolesti i dijabetesa melitusa tipa 2. Cilj rada bio je da se utvrdi prevalencija MS i njegovih komponenti kod odraslog stanovništva Banja Luke, kao i povezanost MS sa sociodemografskim karakteristikama. **Metode.** Analizirano je ukupno 685 ispitanika (348 muškaraca i 337 žena), starosti 18 godina i više. MS je procenjivan na osnovu definicije Internacionalnog udruženja za dijabetes (*International Diabetes Federation* – IDF). **Rezultati.** Prevalencija MS bila je visoka (37,5%), nešto

viša kod žena nego kod muškaraca, ali bez statistički značajne razlike (38,3% : 36,8%;  $p = 0.686$ ). Zastupljenost svake pojedinačne komponente MS iznosila je preko 30% (sistolni krvni pritisak  $\geq 130$  mmHg – 42,0%; dijastolni krvni pritisak  $\geq 85$  mmHg – 31,0%; trigliceridi  $\geq 1,7$  mmol/L – 36,1%; lipoproteini velike gustine HDL holesterol  $< 1,03$  muškarci i  $< 1,29$  žene – 31,2%; glikemija  $\geq 5,6$  mmol/L – 32,8%; centralna gojaznost  $\geq 94$  cm muškarci i  $\geq 80$  cm žene – 62,6%). Pokazalo se da pojava MS u ispitivanoj grupi nije zavisila od pola, ali jeste od godina života. Sa povećanjem godina života zastupljenost ispitanika se povećavala u grupi sa MS (statistički značajna razlika u odnosu na grupu bez MS). Potvrđena je poveza-

nost pojave MS sa stepenom obrazovanja. Nizak nivo obrazovanja bio je udružen sa pojavom MS [statistički značajna razlika ( $df = 3; p = 0.013$ )]. Udruženost između stepena obrazovanja i MS je potvrđena kod žena ( $df = 3; p = 0.000$ ), ali ne i kod muškaraca ( $df = 3; p = 0.883$ ). Penzioneri i domaćice bili su statistički značajno zastupljeniji u grupi sa MS, a studenti i nezaposleni u grupi bez MS, dok kod zaposlenih nije bilo statistički značajne razlike. **Zaključak.** MS je zastupljen kod više od jedne trećine odra-

slog stanovništva Banja Luke. Pokazalo se da pojava MS nije zavisila od pola, ali je postojala zavisnost u odnosu na životno doba, stepen obrazovanja, kao i određenih kategorija radnog statusa.

**Ključne reči:**  
**metabolički sindrom; prevalenca; socioekonomski faktori; demografija; životno doba, faktori; obrazovanje.**

## Introduction

Metabolic syndrome (MS) is a collection of cardiometabolic abnormalities that represent a risk for type 2 diabetes, coronary heart disease and other cardiovascular diseases<sup>1</sup>. The World Health Organization (WHO) in 1998 proposed a definition of the MS on the basis of previous studies<sup>2</sup>. WHO definition put diabetes or impaired fasting glycaemia or impaired glucose tolerance or insulin resistance as a mandatory criterion for the MS. Besides, a person must have 2 more following risk factors: diagnosed hypertension ( $\geq 140/90$  mmHg), dyslipidemia (elevated triglycerides  $\geq 1.7$  mmol/L or low level of high density cholesterol (HDL) cholesterol – for male  $< 0.9$  mmol/L and for female  $< 1.0$  mmol/L, obesity determined by body mass index  $\geq 30$  kg/m<sup>2</sup> or waist/hip ratio  $> 0.9$  (male) or  $> 0.85$  (female) and microalbuminuria ( $\geq 20$   $\mu$ g/min). It was pointed out that this was only a framework of definitions and that there was the need to work on its improvement.

Today there are more definitions used in research which makes it difficult to compare results. There are definitions in use which do not set any component as a condition for assessing the presence of the MS. These are the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III – ATP III) and that of the National Heart, Lung, and Blood Institute (NHLBI). According to these definitions, presence of 3 components represent the MS, but using different limits for individual components. For example, according to the ATP III definition<sup>3</sup> the MS exists when 3 or more of the following factors are fulfilled: 1. central obesity: waist circumference  $> 102$  cm (male) or  $> 88$  cm (female); 2. triglyceridemia ( $\geq 1.7$  mmol/L); 3. low HDL cholesterol:  $< 1.0$  mmol/L (male) and  $< 1.3$  (female); 4. blood pressure  $\geq 135/85$  mmHg or medication; 5. fasting plasma glucose  $\geq 6.1$  mmol/L.

One of recent definition is the definition of the International Diabetes Federation (IDF)<sup>4</sup>. IDF definition made abdominal obesity a mandatory criterion with cut-points for waist circumference based on gender and ethnicity, for European men  $\geq 94$  cm and women  $\geq 80$  cm. According to the IDF definition, diagnosis of the MS is based on the presence of abdominal obesity plus any 2 out of 4 risk factors.

Several associations (IDF Task Force on Epidemiology and Prevention, NHLBI, American Heart Association, World Heart Federation, International Atherosclerosis Society and

International Association for the Study of Obesity) continued to debate criteria for diagnosis of the MS and in 2009 a harmonized definition was released [Joint Interim Statement (JIS) definition]. JIS definition excludes abdominal obesity as a mandatory risk factor while making the presence of any 3 out of 5 risk factors (waist circumference  $\geq 94$  cm – male and  $\geq 80$  cm – female; triglyceridemia  $\geq 1.7$  mmol/L or medication; low HDL cholesterol  $< 1.0$  mmol/L – male and  $< 1.3$  – female or medication; blood pressure  $\geq 130/85$  mmHg or medication; fasting plasma glucose  $\geq 5.6$  mmol/L or diabetes mellitus diagnosis) necessary for diagnosis of the MS<sup>5</sup>.

In addition to the parameters that are included in the definitions as the MS risk factors, the influence of lifestyle and sociodemographic factors on the occurrence of the MS should be investigated.

The aim of this study was to determine the prevalence of the individual components of the MS as well as association with socio-demographic factors in adult population of Banja Luka.

## Methods

A population-based cross-sectional survey was conducted in 2012 on adult population of Banja Luka, registered in the Family Medicine at the Health Center. According to the Report of the Health Care Fund of the Republic of Srpska, at the time of the study, the Health Center had 175,000 registered citizens. The target group in this study was 18 years of age and over. There were 142,000 registered citizens of the appropriate age. In relation to that number, a representative sample of 700 respondents was formed.

The survey instrument was the questionnaire containing: personal data of the patient, age, gender, education, employment status, the results of 3 consecutive measurements of blood pressure, waist size, and laboratory analyses (fasting glycemia and lipids).

All participants were divided into 4 groups according to their level of education (no schooling, incomplete primary or primary education, secondary school, post-secondary and university education).

The interviews were conducted by 103 family medicine teams. The second and third measurements of blood pressure were averaged and this value was used for further analysis. For each patient, the presence of the MS was determined by using the IDF definition. According to this definition, a person has the MS if, in addition to abdominal obesity, has 2 more of the following risk factors: blood pressure  $\geq 130/85$

mmHg or already diagnosed hypertension; triglycerides  $\geq$  1.7 mmol/L; HDL cholesterol  $<$  1.03 mmol/L for men (M) and  $<$  1.29 mmol/L for women (F) or previously treated lipid disorders; morning fasting glycemia  $\geq$  5.6 mmol/L or already diagnosed diabetes<sup>4</sup>. At the end of the study, we obtained 685 properly filled out questionnaires from which the data was entered into the database in the SPSS computer program. The response rate was 97.85%.

Data analysis was done using descriptive statistical methods. The significance of differences between groups, or different categories of respondents, was calculated by using the Pearson's  $\chi^2$  test. The results are presented in tables.

The research was conducted in accordance with the Declaration of Helsinki as revised in 2013. Before entering the research each participant gave written informed consent.

## Results

This study included 685 participants aged 18 years and more, 348 (50.8%) men and 337 (49.2%) women. The representation of women and men was approximately the same (Table 1). The mean age of respondents was  $48.77 \pm 17.888$  years, for women  $50.40 \pm 18.964$  and men  $47.20 \pm 16.657$ . The mean age of subjects with the MS ( $55.87 \pm 15.762$ ) was higher than of those without the MS ( $44.51 \pm 17.751$ ). Most of the respondents were employed – 285 (41.7%), and the second most represented were retired persons – 180 (26.4%). By level of education most of them had secondary school – 392 (58.1%) (Table 1).

**Table 1**  
**The prevalence of metabolic syndrome (MS) by sociodemographic characteristics in the population of Banja Luka**

Characteristics	MS, n (%)			<i>p</i> *
	total 685 (100)	yes 257 (37.5)	no 428 (62.5)	
Gender				
males	348 (50.8)	128 (49.8)	220 (51.4)	df = 1
females	337 (49.3)	129 (50.2)	208 (48.6)	0.686
Age (years)				
18 – 29	125 (18.0)	18 (7.0)	105 (24.5)	
30 – 39	134 (19.6)	34 (13.2)	100 (23.4)	
40 – 49	97 (14.2)	30 (11.7)	67 (15.7)	df = 5
50 – 59	132 (19.3)	61 (23.7)	71 (16.6)	0.000
60 – 69	100 (14.6)	64 (24.9)	36 (8.4)	
70+	99 (14.5)	50 (19.5)	49 (11.4)	
Employment status				
employed	285 (41.7)	98 (38.1)	187 (43.9)	
self-employed	18 (2.6)	7 (2.7)	11 (2.6)	
retiree	180 (26.4)	103 (40.1)	77 (18.1)	df = 6
housewives	46 (6.7)	26 (10.1)	20 (4.7)	0.000
students	54 (7.9)	1 (0.4)	53 (12.4)	
unemployed	98 (14.3)	22 (8.6)	76 (17.8)	
unable to work	2 (0.3)	0 (0.0)	2 (0.5)	
Level of education				
total				
no schooling	27 (4.0)	15 (5.9)	12 (2.8)	
incomplete primary or elementary education	91 (13.5)	44 (17.1)	47 (11.1)	df = 3
secondary school	392 (58.1)	140 (55.3)	252 (59.7)	0.013
post-secondary and university education	165 (24.4)	54 (21.3)	111 (26.3)	
males				
no schooling	3 (0.9)	1 (0.8)	2 (0.9)	
incomplete primary or elementary education	32 (9.3)	11 (8.7)	21 (9.7)	df = 3
secondary school	212 (61.6)	76 (59.8)	136 (62.7)	0.883
post-secondary and university education	97 (28.2)	39 (30.7)	58 (26.7)	
females				
no schooling	24 (7.3)	14 (11.1)	10 (4.9)	
incomplete primary or elementary education	59 (17.8)	33 (26.2)	26 (12.7)	df = 3
secondary school	180 (54.4)	64 (50.8)	116 (56.6)	0.000
post-secondary and university education	68 (20.5)	15 (11.9)	53 (25.9)	

\*Pearson's  $\chi^2$  test

Table 2

## The prevalence of metabolic syndrome (MS) components in the population of Banja Luka

Parameters	MS, n (%)			p*
	total	yes	no	
Elevated SBP ( $\geq 130$ mmHg)	685 (100)	257 (37.5)	428 (62.5)	0.000
Elevated DBP ( $\geq 85$ mmHg)	292 (42.7)	166 (64.8)	126 (29.4)	0.000
Elevated Triglycerides ( $\geq 1.7$ mmol/L)	212 (31.0)	129 (50.4)	83 (19.4)	0.000
HDL cholesterol ( $< 1.03$ M; $< 1.29$ F)	246 (36.1)	161 (62.9)	85 (20.0)	0.000
Glucose ( $\geq 5.6$ mmol/L)	209 (31.2)	127 (50.0)	82 (19.7)	0.000
Central obesity ( $\geq 94$ cm M; $\geq 80$ cm F)	223 (32.8)	167 (65.5)	56 (13.2)	0.000
	429 (62.6)	257 (100.0)	172 (40.2)	0.000

\*Pearson's  $\chi^2$  test; SBP systolic blood pressure; DBP – diastolic blood pressure; HDL – high density lipoprotein; M – male; F – female.

The prevalence of the MS in the population registered at the Health Center Banja Luka, according to the IDF definition, was 37.5%. The prevalence was slightly higher in women than in men, but without statistically significant difference (Table 1).

It has been shown that the occurrence of the MS in the study group did not correlate with gender, but did correlate with age. With increasing age, the occurrence of the MS was higher in the group of patients with the MS with a statistically significant difference compared to the group without the MS (Table 1). In the group of patients with the MS, prevalence increased with age and reached a maximum in the group of 60–69 years (24.9%), followed by the group aged 50–59 years (23.7%).

By employment status, in the study group, the largest group were the employed patients (41.7%). There were no statistically significant differences in the representation of the employed and self-employed in the groups with and without the MS (Table 1). As a special form of employment status, retirees and housewives were singled out and they were significantly over-represented in the group with the MS compared to the group without the MS, while students and unemployed were significantly more frequent in the group without the MS.

Our study showed association between level of education and the MS (Table 1). The low level of education was associated with the appearance of the MS with statistically significant differences ( $df = 3$ ;  $p = 0.013$ ). The association between level of education and the MS was shown in women ( $df = 3$ ;  $p = 0.000$ ), but not in men ( $df = 3$ ;  $p = 0.883$ ). Women with out schooling and incomplete or finished primary education were significantly over-represented in the group with the MS, and women with post-secondary and university education in the group without the MS.

The risk factors included in the IDF definition (Table 2) were highly represented in the total study group, each with more than 30%. The most common risk factors were central obesity (62.6%) and systolic blood pressure (42.7%), accompanied by other risk factors that were more frequently statistically significant in the group with the MS compared to the group without the MS.

## Discussion

The prevalence of the MS in the adult citizens of Banja Luka registered at the Health Center is high. More than one-third of the adult population has the MS that is in accordance with recently published study in the Republic of Srpska<sup>6</sup>. Research conducted in Croatia, in a family medicine setting, showed even higher prevalence of 45%<sup>7</sup>. According to a meta-analysis by Kastorini et al.<sup>8</sup>, the MS occurrence in the world according to the IDF definition ranges from about 7.4% to about 50%. In Western countries, the prevalence of the MS according to the IDF definition is lower comparing to the results of our research, ranging from 20% to 30% (for example in Spain, 24.3%)<sup>9</sup>.

The varying definitions make some study comparisons more difficult. By a certain definition of the NCEP ATP III, the MS prevalence in the US population older than 20 years was 33% during the period from 2003 to 2012<sup>10</sup>. The same definition of the MS used in the Iranian urban population showed a very high prevalence of 42.3%<sup>11</sup>.

There was no statistically significant difference in the MS prevalence between women and men in our study. Results of studies around the world related to the prevalence of the MS by gender are different. Al-Daghri et al.<sup>11</sup> showed that women in Saudi Arabia had a significantly greater prevalence of the MS than men (47.2% to 40.3%, respectively) according to the ATP III definition. The mentioned American study<sup>10</sup> showed that the prevalence of the MS is significantly higher in women than in men (35.6% v.s. 30.3%,  $p < 0.001$ ). Another US study evaluating the occurrence of the MS of 5,227 adult African-Americans, also showed greater occurrence of the MS in women (40%) than in men (27%), according to the NCEP ATP III<sup>12</sup>.

There is a positive association between the MS and age. Representation of patients in the group with the MS increased with age from 7.0% in the group aged 18 to 29 years to 24.9% in the group of 60 to 69 years old, and over the age 70 there was a slight decrease in prevalence. Brazilian LATINMETS study<sup>13</sup> also confirmed the association between the MS prevalence and age, especially over the age of 40 years. Almost all researchers in the world who have addressed this issue confirmed the occurrence of the MS in association with age<sup>1, 14–16</sup>.

It turned out that among the employed participants, there were no statistically significant difference in the occurrence of the MS, while the unemployed were significantly less represented in the group with the MS (8.6% to 17.8%;  $p = 0.001$ ;  $p < 0.05$ ). Research conducted in Saudi Arabia showed a statistically significant lower incidence of the MS among the unemployed in comparison to all other work categories<sup>11</sup>. For our respondents, we singled out two groups – retirees and housewives who had a high presence of the MS. Both are highly statistically more frequent in the group with the MS.

Our study confirmed the association between the MS prevalence and the level of education. Respondents without education and with incomplete primary and finished primary education were significantly more common in the group with the MS than in the group without the MS, which is in accordance with most studies in the world. Research on the adult Saudi population was accompanied by the emergence of the MS through 3 levels of education: school up to 6 years, 7–12 years of school and more than 12 years of school, and the significantly lower incidence of the MS was confirmed in those who had more than 12 years of education compared to the other two groups<sup>11</sup>. A recent study conducted in China including 15,477 urban population adult subjects age 18–74 years showed that higher education is associated with a higher prevalence of the MS in men, but lower among women<sup>16</sup> which is in accordance with our results. In the present study, men with post-secondary and university education were more frequently represented in the group with the MS than in the group without the MS but without statistically significant difference, while women with

post-secondary and university education were represented statistically significantly lower in the group with the MS. Khan et al.<sup>12</sup> showed that the low level of education in African-American women was associated with the emergence of the MS, but not in African-American men.

Prevalence of each individual component of the MS in our study group was over 30%. Among the factors contributing to the MS, the most prevalent was central obesity (62.6%), followed by elevated systolic blood pressure (42.7%), elevated triglycerides (36.1%), elevated blood glucose (32.8%) and low HDL (31.2%). Our results are similar to the results of the study from the North-East China that reported similar results<sup>16</sup>. The results of the great European project MORGAN, investigating the MS in 10 European countries, showed that the individual factors of the MS were dependent upon the age of the subjects. The most prevalent factor in young women was obesity, in older women blood pressure, whereas in men of all ages elevated blood pressure was the dominating factor<sup>1</sup>.

### Conclusion

The prevalence of the MS was detected in over one-third of the adult residents in Banja Luka, while prevalence of each individual component of the MS in the study group was over 30%. The most common risk factors were central obesity followed by blood pressure. The prevalence of the MS was not associated with gender but with age.

The association between level of education and the MS was confirmed in women, but not in men.

### R E F E R E N C E S

1. Vishram JK, Borglykke A, Andreasen AH, Jeppesen J, Ibsen H, Jørgensen T, et al. Impact of age and gender on the prevalence and prognostic importance of the metabolic syndrome and its components in Europeans. The MORGAM Prospective Cohort Project. *PloS One* 2014; 9(9): e107294
2. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. *Diabet Med* 1998; 15(7): 539–53.
3. National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation* 2002; 106(25): 3143–421.
4. International diabetes federation. The IDF consensus worldwide definition of the metabolic syndrome. Brussels: IDF; 2006.
5. Alberti K. G, Eckel R.H, Grundy S.M, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. *Circulation* 2009; 120(16): 1640–5.
6. Stojisavljević D. The prevalence of metabolic syndrome in adult population of the Republic of Srpska [dissertation]. Belgrade: Faculty of Medicine, University of Belgrade; 2014. (Serbian)
7. Ivezić – Lalić D, Bergman Marković B, Kranjčević K, Kem J, Vrdoljak D, Vučak J. Diversity of metabolic syndrome criteria in association with cardiovascular diseases – a family medicine-based investigation. *Med Sci Monit.* 2013; 19: 571–8.
8. Kastorini CM, Milionis HJ, Esposito K, Giugliano D, Goudevenos JA, Panagiotakos DB. The effect of Mediterranean diet on metabolic syndrome and its components: a meta-analysis of 50 studies and 534906 individuals. *J Am Coll Cardiol* 2011; 57(11): 1299–313.
9. Corbatón-Anchuelo A, Martínez-Larrad MT, Fernández-Pérez C, Vega-Quiroga S, Ibarra-Rueda JM, Serrano-Rios M, et al. Metabolic syndrome, adiponectin, and cardiovascular risk in Spain (The Segovia Study): impact of consensus societies criteria. *Metab Syndr Relat Disord* 2013; 11(5): 309–18.
10. Aguilar M, Bhuket T, Torres S, Liu B, Wong RJ. Prevalence of the Metabolic Syndrome in the United States, 2003–2012. *JAMA.* 2015; 313(19): 1973–4.
11. Al-Daghri NM, Alkharfy KM, Al-Attas OS, Khan N, Alfawaz HA, Alghanim SA, et al. Gender-dependent associations between socioeconomic status and metabolic syndrome: a

- cross-sectional study in the adult Saudi population. *BMC Cardiovasc Disord* 2014; 14: 51.
12. *Khan RJ, Gebreab SY, Sims M, Riestra P, Xu R, Davis SK*. Prevalence, associated factors and heritabilities of metabolic syndrome and its individual components in African Americans: the Jackson Heart Study. *BMJ Open* 2015; 5(10): e008675.
  13. *Vidigal F de C, Ribeiro AQ, Babio N, Salas-Salvado J, Bressan J*. Prevalence of metabolic syndrome and pre-metabolic syndrome in health professionals: LATINMETS Brazil study. *Diabetol Metab Syndr* 2015; 7: 6.
  14. *Kaur J*. Assessment and Screening of the Risk Factors in Metabolic Syndrome. *Med Sci* 2014; 2(3): 140–52.
  15. *Hajian-Tilaki K, Heidari B, Firouzbaji A, Baqberzadeh M, Hajian-Tilaki A, Halalkhor S*. Prevalence of metabolic syndrome and the associated socio-demographic characteristics and physical activity in urban population of Iranian adults: a population-based study. *Diabetes Metab Syndr* 2014; 8(3): 170–6.
  16. *Song QB, Zhao Y, Liu YQ, Zhang J, Xin SJ, Dong GH*. Sex difference in the prevalence of metabolic syndrome and cardiovascular related risk factors in urban adults from 33 communities of China: The CHPSNE study. *Diab Vasc Dis Res* 2015; 12 (3): 189–98.

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