

Metabolic syndrome in Iranian elderly

Nizal Sarrafzadegan⁽¹⁾, Mojgan Gharipour⁽²⁾, Masoumeh Sadeghi⁽³⁾,
Ali Reza Khosravi⁽⁴⁾, Ali Akbar Tavassoli⁽¹⁾

Abstract

BACKGROUND: This study aimed to compare Iranian elderly with the middle-aged population in terms of the prevalence of metabolic syndrome and its components.

METHODS: This cross-sectional study was conducted using the data from the third phase of the Isfahan Healthy Heart Program. Male and female residents of Isfahan over 19 years of age were selected by multistage cluster random sampling. A questionnaire including demographic characteristics, health status, medical history, medications used, as well as waist circumference, weight, height, and systolic and diastolic blood pressures was completed for all participants. Fasting blood samples were obtained from all subjects and examined for fasting blood sugar and lipid profile. T-test and Mann-Whitney test were used for quantitative data and chi-square test was performed for qualitative data.

RESULTS: The prevalence of metabolic syndrome in individuals aged over 60 years was significantly higher than those under 60 (49.5% vs. 17.5%, respectively; $P < 0.001$). Metabolic syndrome was also more prevalent among elderly females than in males (59.2% vs. 39.8%, respectively; $P < 0.005$). Some anthropometric measures such as height, body mass index, abdominal circumference, waist-hip ratio, and waist-to-height ratio were significantly different in men and women below 60 years in comparison with those over 60 years ($P < 0.05$). Moreover, there were significant differences in most studied parameters between the elderly and non-elderly women ($P < 0.001$).

CONCLUSION: This study showed that metabolic syndrome has a relatively high prevalence in Iranian elderly people, especially in elderly women. Therefore, early diagnosis and management of the complication are recommended among this high-risk group to avoid the subsequent complications.

Keywords: Metabolic Syndrome, Elderly, Iran.

ARYA Atherosclerosis Journal 2012, 7(4): 157-161

Date of submission: 15 Jun 2011, *Date of acceptance:* 27 Sep 2011

Introduction

Today, the world is facing a phenomenon called elderly population, i.e. almost 600 million people in the world are old or in fact over 60 years of age.¹ According to the Iranian national census, approximately 7.3% of the population in the country were the elderly people in 2004 which was significantly higher than in past records.¹ Medical science has been able to reduce mortality rates worldwide and has therefore increased life expectancy. However, longer life has been associated with increased age-related diseases and disabilities.²

Metabolic syndrome is considered a disorder whose concurrence with some cardiovascular risk factors such as insulin resistance, dyslipidemia, abdominal obesity and hypertension increases the risk of cardiovascular diseases and type 2 diabetes.² Previous studies reported the incidence and prevalence of metabolic syndrome in young and middle-aged people. They also suggested associations between this disorder and a number of lifestyle factors including immobility, high-carbohydrate diet and smoking regardless of age.³⁻⁵ On the other hand, our previous studies in the Isfahan Healthy Heart Program (IHHP)

1- Professor, Cardiovascular Research Center, Isfahan Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran.

2- PhD Student, Cardiac Rehabilitation Research Center, Isfahan Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran.

3- Associate Professor, Cardiac Rehabilitation Research Center, Isfahan Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran.

4- Associate Professor, Hypertension Research Center, Isfahan Cardiovascular Research Center, Isfahan University of Medical Sciences, Isfahan, Iran.

Correspondence To: Mojgan Gharipour, Email: gharipour@crc.mui.ac.ir

showed a direct and significant correlation between increased prevalence of metabolic syndrome and age.⁴ However, based on the literature review, the prevalence of this disorder has not been reported in Iranian elderly people. Hence, this study was designed and implemented to determine the prevalence of metabolic syndrome and its components in the Iranian elderly. It also compared the elderly with the middle-aged population.

Materials and Methods

This study was a part of the IHHP was a cross-sectional study performed from 2001 to 2007 in Isfahan, Najafabad and Arak (Iran).⁶ IHHP consisted of three phases, the first as baseline survey for situational analysis, the second included implementing interventional activities in the intervention areas (late in 2001-2005), and the third as post-intervention survey (2007) to evaluate the program outcomes. After the baseline survey, a five-year intervention program was started both in urban and rural areas of Isfahan and Najafabad (Iran). IHHP team conducted outcome evaluation on 9572 adults, aged ≥ 19 years by multistage random sampling in 2007. In this study we used the data of the third phase. Individuals were included if they were not mentally retarded or pregnant, and were Iranian citizens who had lived in one of the studied areas for at least 6 months. The details of subjects selection have been reported elsewhere.^{6,7} A questionnaire was used to collect demographic data including age and gender, as well as a history of cardiovascular disease risk factors such as diabetes, hypertension and hyperlipidemia. In order to perform test and examinations, the participants were referred to assigned medical centers. Fasting blood samples were obtained from all subjects to evaluate blood glucose, total cholesterol and triglyceride by enzymatic methods using a Hitachi instrument. Serum high density lipoprotein (HDL) cholesterol was measured by heparin manganese precipitation. All the tests were performed in the laboratory of the Isfahan Cardiovascular Research Center.⁶ In order to determine weight parameters such as body mass index (BMI), waist circumference, waist-hip ratio and waist to height ratio, the weight of individuals was measured with thin underwear and without shoes. All measurements were uniformly conducted by trained individuals. Blood pressure on the right arm was measured twice after 5 minutes of rest and the mean value was recorded. Patients with metabolic syndrome were selected based on the definition in ATP III.⁸ The presence of at least three of the following risk factors was considered as metabolic syndrome: A)

waist circumference greater than or equal to 102 cm in men and 88 cm in women; B) serum triglycerides greater than 150 mg/dl; C) HDL cholesterol lower than 40 mg/dl in men and 50 mg/dl in women; D) blood pressure greater than 85/130 mmHg or taking antihypertensive drugs; E) a history of diabetes, receiving oral hypoglycemics, or fasting blood glucose over 110 mg/dl. Individuals aged over 60 years were considered elderly.

Statistical methods:

The data was entered in EPI software and analyzed by the SPSS₁₅ (SPSS Inc, Chicago). The values of cardiovascular risk factors in patients with metabolic syndrome were reported as mean \pm SD. For quantitative variables, the t-test and Mann-Whitney test were used. To compare qualitative variables, the chi-square test was used. $P < 0.05$ was considered as significant.

Results

In this study, the prevalence of metabolic syndrome was 49.5% in people over 60 years of age and 17.5% in people under 60 years of age. The difference between the age groups was significant ($P < 0.001$). In addition, 60.4% of women and 39.6% of men over 60 years were diagnosed with metabolic syndrome. table 1 compares the mean levels of components of metabolic syndrome in subjects over 60 years with individuals under 60 years. According to table 1, significant differences were observed in the mean of height, BMI, abdominal area, waist-hip ratio and waist to height ratio between the two groups. There were significant differences in most of the indicators between elderly and non-elderly women. However, men above and under 60 years of age differed significantly only in the values of mean systolic blood pressure, serum triglycerides, and fasting blood glucose ($P < 0.001$). The frequency of risk factors in women and men in both age groups are shown in table 2. In both genders, cardiometabolic risk factors were accumulated significantly more in people over 60 years.

Discussion

The results of this study showed that metabolic syndrome and accumulation of its components were more common in Iranian elderly people than in middle-aged population. Metabolic syndrome is a multivariable disease whose prevalence has been increased with sedentary lifestyle, obesity, diabetes, and longevity.⁹ Several studies have shown that metabolic syndrome is more common in women than men.⁴ Based on the published results of the IHHP,

Table 1. Comparison of metabolic cariometabolic risk factors in people over and less than 60 years based on gender

Risk factor	Age > 60 years					Age ≤ 60 years					P*	P**
	Female		Male		P	Female		Male		P		
	Mean	SD	Mean	SD		Mean	SD	Mean	SD			
Age (yrs)	68.89	5.37	69.22	6.31	0.661	42.82	10.49	42.21	10.95	0.46	<0.001	<0.001
Weight (kg)	65.56	11.15	78.67	13.17	<0.001	74.68	11.57	87.19	14.55	0.091	0.836	<0.001
Height (cm)	151.47	6.09	166.92	8.94	<0.001	157.17	6.62	171.92	7.96	<0.001	<0.001	<0.001
BMI (kg/m ²)	22.56	4.48	8.26	4.63	0.612	30.23	4.30	29.41	3.92	0.013	<0.001	0.019
Waist (cm)	100.36	10.53	101.45	10.93	0.432	100.17	9.56	101.41	10.43	0.091	<0.001	0.982
HP (cm)	0.66	0.07	0.60	0.062	0.007	0.63	0.06	0.59	0.06	0.373	<0.001	0.003
Waist to hip ratio	0.99	0.07	0.97	0.06	0.085	0.94	0.07	0.95	0.58	0.373	<0.001	0.001
Waist to height ratio	0.66	0.07	0.60	0.06	<0.001	0.94	0.07	0.95	0.05	<0.001	<0.001	0.017
SBP (mmHg)	133.09	20.74	142.36	19.59	<0.001	121.16	18.87	128.44	16.74	<0.001	<0.001	<0.001
DBP (mmHg)	81.07	10.72	83.59	13.82	0.102	79.44	11.66	84.81	9.77	<0.001	0.126	0.414
TC (mg/dl)	229.15	42.65	204.92	39.83	<0.001	212.74	39.55	205.83	40.99	0.026	<0.001	0.847
HDL-C (mg/dl)	42.96	10.07	34.68	7.38	<0.001	40.39	7.95	34.11	6.63	0.026	0.004	0.468
LDL-C (mg/dl)	139.7	37.19	127.33	34.06	0.007	131.29	32.48	120.51	33.11	<0.001	0.007	0.080
Triglycerides (mg/dl)	229.50	154.36	216.05	103.55	0.440	210.62	116.26	270	-	<0.001	0.163	<0.001
FBS (mg/dl)	123.72	54.17	120.80	49.32	0.661	98.09	30.64	106.79	41.57	0.003	<0.001	0.012

HP: Hip circumference; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; TC: Total cholesterol; HDL-C: High density lipoprotein-cholesterol; LDL-C: Low density lipoprotein-cholesterol; FBS: Fasting blood sugar; * Between elderly and non-elderly women; ** Between elderly and non-elderly men

Table 2. The accumulation frequency of cariometabolic risk factors in people over and less than 60 years based on gender

Severity of metabolic disorders	Male			Female		
	Age ≤ 60 years	Age > 60 years	P	Age ≤ 60 years	Age > 60 years	P
	> 1	45.7	27.6	< 0.001	41.7	12.8
> 2	35.7	27.2	< 0.001	31.3	26.1	< 0.001
> 3	12.7	28.1	< 0.001	19.0	29.6	< 0.001
> 4	5.4	12.7	< 0.001	6.6	22.6	< 0.001
5	0.5	4.4	< 0.001	1.4	8.9	< 0.001

the prevalence of metabolic syndrome among individuals over 19 years of age was 25.4% in 2001. A cohort study in Turkey revealed that the prevalence of metabolic syndrome in 30-79 year old women and men was 45% and 27%, respectively.¹⁰ In a prospective study, Kazan et al. showed the prevalence of metabolic syndrome in 20-90 year-old subjects to be 47.4% using the ATP III criteria. They also reported an increase in prevalence as age increased in both genders.¹¹ Our results indicated that in 2007, the prevalence of this syndrome in women and men over 60 years were 60.4% and 39.6%, respectively. The overall prevalence of metabolic syndrome was 49.5% (data not shown). Since these results were not consistent with the numbers reported by other studies, it appears that metabolic syndrome developed slower in the community studied by the IHHP. However, passage of time and increased life expectancy among the participants were expected to increase the frequency of the disorder. Hence, the community-based interventions of the IHHP seem to have been able to provide the necessary training targeting various groups such as physicians and health personnel (as trainers), as well as individuals with at least one cardiovascular disease risk factor (as the trainees). Since this program significantly emphasized lifestyle modification such as increasing physical activity, weight loss, improved diet, and quitting smoking, it seems that the interventions to improve people's lifestyle have been successful in halting or reducing the slope of incidence of metabolic syndrome.¹²

Gender appears to be an important factor in increasing the prevalence of risk factors such as obesity, hyperlipidemia and low HDL cholesterol in women.¹³ This study showed that the indicators of abdominal obesity were significantly higher in elderly women with metabolic syndrome than in men. The risk factors including systolic blood pressure, total cholesterol, serum triglycerides, low density lipoprotein (LDL), and HDL cholesterol levels were also higher among females. These factors are more prevalent in elderly women than in the non-elderly. The younger men had greater height and weight but lower mean systolic blood pressure, blood glucose, and serum lipids than the elderly people. The differences between men and women can be interpreted and explained by several factors such as changes in sex hormones, repeated childbirth, diet, and energy consumption during menopause, among other factors.¹⁴ Males seem to be more successful than females in controlling the risk factors (e.g. blood pressure, serum lipids and blood sugar). Other studies have also reported that women of all ages had higher

cholesterol, waist circumference, waist-hip ratio, blood glucose and HDL cholesterol compared to men.¹⁴ It seems that in addition to the effects of age and gender have on the increased prevalence of cardiovascular risk factors, the accumulation of these factors themselves is also important, i.e. the frequency percentage of people with 4 or 5 simultaneous risks factors increases with age. The results showed that although age increases cardiovascular risk factors in patients with metabolic syndrome, the accumulation of metabolic syndrome components apparently plays a more important role in increasing these factors. Therefore, separate control and management of risk factors in lower ages can be fruitful in preventing the consequences later.

Conclusion

This study showed that the metabolic syndrome has a relatively high prevalence in Iranian elderly people, especially among women, than in younger populations. The diagnosis and treatment of this syndrome and its components at younger ages can be an effective strategy in reducing the disabilities resulting from its associated diseases in the elderly.

Acknowledgements

The authors would like to thank the Isfahan University of Medical Sciences, Iran. This program is indexed as code No. 86 in the Canadian Heart Health Promotion Projects: www.med.mun.com.

Conflict of Interests

Authors have no conflict of interests.

References

1. Mirzaei M, Shams Ghahfaroki M. Demographic of the elderly population in Iran based on the censuses from 1956-2006. *Iranian Journal of Ageing* 2007; 5(2): 326-31.
2. Ford ES, Schulze MB, Pischon T, Bergmann MM, Joost HG, Boeing H. Metabolic syndrome and risk of incident diabetes: findings from the European Prospective Investigation into Cancer and Nutrition-Potsdam Study. *Cardiovasc Diabetol* 2008; 7: 35.
3. Gharipour M, kelishadi R, Baghaei M, Boshtam M, Rabeie K. Prevalence of metabolic syndrome in an Iranian adult population. *ARYA Atherosclerosis Journal* 2006; 1(3): 188-92.
4. Sarrafzadegan N, Kelishadi R, Baghaei A, Hussein SG, Malekafzali H, Mohammadifard N, et al. Metabolic syndrome: an emerging public health problem in Iranian women: Isfahan Healthy Heart

- Program. *Int J Cardiol* 2008; 131(1): 90-6.
5. Gharipour M, Kelishadi R, Toghianifar N, Tavassoli AA, Khosravi AR, Sajadi F, Sarrafzadegan N. Socioeconomic Disparities and Smoking Habits in Metabolic Syndrome: Evidence from Isfahan Healthy Heart Program. *Iran Red Crescent Med J.* 2011; 13(8): 540-6.
 6. Sarraf-Zadegan N, Sadri G, Malek AH, Baghaei M, Mohammadi FN, Shahrokhi S, et al. Isfahan Healthy Heart Programme: a comprehensive integrated community-based programme for cardiovascular disease prevention and control. Design, methods and initial experience. *Acta Cardiol* 2003; 58(4): 309-20.
 7. Sarrafzadegan N, Baghaei A, Sadri G, Kelishadi R, Malekafzali H, Boshtam M. Isfahan healthy heart program: evaluation of comprehensive, community-based interventions for non-communicable disease prevention. *Prev Control* 2006; 2(2): 73-84.
 8. Ford ES, Li C, Zhao G, Pearson WS, Mokdad AH. Prevalence of the metabolic syndrome among U.S. adolescents using the definition from the International Diabetes Federation. *Diabetes Care* 2008; 31(3): 587-9.
 9. Akbulut G, Koksali E, Bilici S, Acar TN, Yildiran H, Karadag MG, et al. Metabolic syndrome (MS) in elderly: a cross sectional survey. *Arch Gerontol Geriatr* 2011; 53(3): e263-e266.
 10. Onat A, Sansoy V. Metabolic syndrome, major culprit of coronary disease among Turks: its prevalence and impact on coronary risk. *Arch Turk Soc Cardiol* 2002; 30: 8-15.
 11. Kozan O, Oguz A, Abaci A, Erol C, Ongen Z, Temizhan A, et al. Prevalence of the metabolic syndrome among Turkish adults. *Eur J Clin Nutr* 2007; 61(4): 548-53.
 12. Sarrafzadegan N, Kelishadi R, Esmailzadeh A, Mohammadifard N, Rabiei K, Roohafza H, et al. Do lifestyle interventions work in developing countries? Findings from the Isfahan Healthy Heart Program in the Islamic Republic of Iran. *Bull World Health Organ* 2009; 87(1): 39-50.
 13. Hadaegh F, Zabetian A, Tohidi M, Ghasemi A, Sheikholeslami F, Azizi F. Prevalence of metabolic syndrome by the Adult Treatment Panel III, International Diabetes Federation, and World Health Organization definitions and their association with coronary heart disease in an elderly Iranian population. *Ann Acad Med Singapore* 2009; 38(2): 142-9.
 14. Mukuddem-Petersen J, Snijder MB, van Dam RM, Dekker JM, Bouter LM, Stehouwer CD, et al. Sagittal abdominal diameter: no advantage compared with other anthropometric measures as a correlate of components of the metabolic syndrome in elderly from the Hoorn Study. *Am J Clin Nutr* 2006; 84(5): 995-1002.