

PREVALENCE OF METABOLIC SYNDROME IN AN IRANIAN ADULT POPULATION

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Abstract

INTRODUCTION: The clustering of several cardiovascular disease risk factors such as abdominal obesity, hypertension, dyslipidemia and disturbances in glucose metabolism has been termed the Metabolic Syndrome (MS). The MS has been shown to predict cardiovascular disease (CVD) and diabetes. Epidemiological studies have demonstrated that CVD is the main cause of worldwide mortality; they have also linked diabetes to an increased risk of mortality due to CVD.

METHODS: According to the ATP III (Adult Treatment Panel) reports, individuals having three or more of the following criteria are defined as having the MS: abdominal obesity (waist circumference > 102 cm in men and >88 cm in woman), hypertriglyceridemia (triglyceride \geq 150 mg/dl), low high-density lipoprotein (HDL) cholesterol (HDL <40 mg/dl in men and <50 mg/dl in women), high fasting blood sugar (FBS) (FBS \geq 110 mg/dl) and high blood pressure (BP) (BP \geq 130/85 mmHg). The SPSS package (SPSS Chicago IL) was used and the significance level was set at $P < 0.05$.

RESULTS: Overall, the age-adjusted prevalence of the MS was 25.4% and 21.7% in the urban and rural areas of Isfahan, respectively. It was the highest among 50-59-year-old rural Isfahani women (68.9%) and the lowest among rural Araki men (5.6%).

DISCUSSION: We found approximately 21.9% of Iranian adults living in Central Iran to have the MS. In summary, this study showed an increasing risk of the MS among middle-aged woman in urban areas owing to their physical quality of life. The results indicate that primary prevention should not only consider biological risk factors, but also take account of sociodemographic variables to identify individuals at high risk for diabetes and cardiovascular disease.

Keywords • Metabolic syndrome • ATP III • Prevalence • Iran

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Introduction

The clustering of several cardiovascular disease risk factors, such as abdominal obesity, hypertension, dyslipidemia and disturbances in glucose metabolism has been termed the Metabolic Syndrome (MS).¹ The MS has been shown to be predictive of cardiovascular diseases (CVD) and diabetes.^{2,3} Some epidemiological studies have shown cardiovascular diseases (CVD) to be the main cause of worldwide mortality; they have also demonstrated that diabetic patients are at an excessive risk of CVD mortality.

In addition to increasing the risk of CVD, the MS may hasten the development of stroke, type 2 diabetes, diabetic nephropathy, retinopathy and distal neuropathy.⁴

Results of a representative sample of US adults demonstrated that the MS is highly prevalent; 24% of the US adults were shown to have the MS.⁵

Some socioeconomic changes such as transition from a rural to urban lifestyle, socioeconomic status, education and exercise are related to the prevalence of the MS.⁶

There is limited data concerning the prevalence of this disorder in Iran. Because the implications of the MS for the Health Care system are substantial, we sought to determine the prevalence of this condition in a population of Iranian adults.

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Materials and methods

In 2000-2001, as part of a national community-based program for CVD prevention and control known as Isfahan Healthy Heart Program (IHHP), a survey using a multistage, stratified sampling design was conducted in the cities of Isfahan, Najaf-Abad and Arak in Central Iran. After a home interview, the participants were invited to attend 1 of 3 examination session: morning, afternoon or evening. The methodology has been previously published in detail.⁷ According to the ATP III (Adult Treatment Panel) reports, participants having 3 or more of the following criteria are defined as having the MS:⁴

1. Abdominal obesity: waist circumference (WC) >102 cm in men and > 88 cm in woman.
2. Hypertriglyceridemia: triglyceride (TG) ≥150 mg/dl
3. Low high-density lipoprotein (HDL) cholesterol: HDL < 40 mg/dl in men and <50 mg/dl in women
4. High fasting blood sugar (FBS): FBS ≥ 110 mg/dl
5. High blood pressure (BP): BP ≥ 130/85mmHg

Participants who reported current use of antihypertensive and/or antidiabetic medications (insulin or oral agents) were regarded as hypertensive and/or diabetic, respectively. Serum total cholesterol (TC) and TG were measured with enzymatic colorimetric methods (Elan Auto Analyzer 2000).

HDL was measured after the precipitation of other lipoproteins (with a heparin manganese chloride mixture) and LDL cholesterol level was derived from the Friedwald equation.⁹ Serum glucose concentration was measured using an enzymatic reaction.¹⁰ All of the tests were performed at Isfahan Cardiovascular Research Center laboratory which is under the

qualitative control of the National Reference Laboratory (a WHO Collaborating Center) and St Rafael University, Leuven, Belgium. Three blood pressure readings were obtained at home. The average of the second and third systolic and diastolic blood pressure readings were used in the analyses. For men and non-pregnant women aged at least 19 years who attended the medical examination and had fasted at least 8 hours, we calculated the prevalence of the MS by age, sex and area of residence (rural/urban) in three provincial cities of Central Iran. The SPSS package (SPSS Chicago IL) was used and the significance level was set at P<0.05.

Results

A total of 12514 subjects from Isfahan, Arak and Najaf-Abad participated in this study. 4873 subjects from the rural areas and 1302 subjects from the urban areas of Isfahan/Najaf-Abad, as well as 4220 and 2119 subjects from the rural and urban area of Arak, respectively, participated in the study. Women had the highest age-adjusted prevalence of the MS (Table 1). The rural and urban men had the highest prevalence of hypertriglyceridemia and low HDL cholesterol (Table 2).

Men had the highest prevalence of hypertriglyceridemia and women had the highest prevalence of abdominal obesity and low HDL cholesterol concentration. Overall, the age-adjusted prevalence of the MS was 25.4% and 21.7% in urban and rural areas of Isfahan, respectively. It was highest among rural 50-59-year-old Isfahani women (68.9%) and lowest among rural Araki men (5.6%).

TABLE 1. Age- and sex-specific prevalence of the metabolic syndrome among 12600 Iranian adults aged at least 19 years

| | Age | Men | | | | | Women | | | | |
|---------|-------|-----------------|----------------|----------------|----------------|---------------|----------------|----------------|----------------|----------------|---------------|
| | | 20-29 F* (%) | 30-39 F (%) | 40-49 F (%) | 50-59 F (%) | 60≤ F (%) | 20-29 F (%) | 30-39 F (%) | 40-49 F (%) | 50-59 F (%) | 60≤ F (%) |
| Isfahan | Urban | 124 (17.7) | 251 (33.7) | 212 (46.4) | 146 (57.9) | 180 (63.6) | 25 (3.5) | 50 (8.4) | 75 (17.9) | 64 (26.2) | 180 (65.7) |
| | Rural | 27 (14.3) | 56 (28.7) | 53 (44.5) | 35 (53.0) | 51 (68.9) | 6 (2.9) | 9 (5.7) | 13 (10.7) | 20 (28.2) | 51 (71.8) |
| Arak | Urban | 80 (14.1) | 166 (27.0) | 165 (45.5) | 118 (53.6) | 175 (60.6) | 17 (2.9) | 31 (5.7) | 35 (10.4) | 50 (21.1) | 175 (62.5) |
| | Rural | 35 (10.6) | 60 (22.5) | 72 (33.0) | 56 (47.5) | 68 (48.9) | 2 (0.6) | 15 (5.9) | 11 (6.7) | 9 (8.5) | 68 (51.1) |

*F: Frequency

TABLE 2. Prevalence of the metabolic syndrome abnormalities in rural and urban areas of Isfahan Province

| | | | WC | TG | HDL | FBS | SBP |
|---------|-------|-------|---------------|---------------|---------------|---------------|---------------|
| | | | Frequency (%) | Frequency (%) | Frequency (%) | Frequency (%) | Frequency (%) |
| Isfahan | men | Urban | 396 (16.8) | 1230 (52.5) | 793 (33.9) | 138 (5.9) | 443 (18.7) |
| | | Rural | 64 (10.0) | 347 (54.8) | 189 (31.1) | 28 (4.4) | 139 (21.6) |
| | women | Urban | 2152 (86.1) | 1426 (45.5) | 1507 (61) | 203 (6.5) | 458 (18.5) |
| | | Rural | 499 (75.8) | 298 (45.7) | 342 (54.8) | 41 (6.3) | 151 (22.9) |
| Arak | men | Urban | 224 (10.8) | 996 (48.6) | 821 (40.5) | 110 (5.3) | 292 (14) |
| | | Rural | 51 (5) | 377 (38.5) | 300 (30.6) | 27 (2.8) | 172 (16.7) |
| | women | Urban | 1571 (73.8) | 904 (43.2) | 1351 (65.6) | 129 (6.1) | 344 (16.1) |
| | | Rural | 605 (55.6) | 404 (37.8) | 649 (60.6) | 56 (5.3) | 216 (19.8) |

WC: Waist Circumference**SBP:** Systolic Blood Pressure**FBS:** Fasting Blood Sugar**TG:** Triglyceride**HDL:** High Density Lipoprotein**TABLE 3.** Prevalence of one or more abnormalities of the metabolic syndrome among 12600 Iranian adults > 19 years

| | | | 1< | 2< | 3< | 4< | 5 |
|---------|-------|-------|---------------|---------------|---------------|---------------|---------------|
| | | | Frequency (%) | Frequency (%) | Frequency (%) | Frequency (%) | Frequency (%) |
| Isfahan | Urban | men | 835 (35.3) | 544 (23) | 672 (10.6) | 60 (2.5) | 9 (0.4) |
| | | women | 527 (21) | 860 (34.3) | 250 (26.8) | 211 (8.4) | 36 (1.4) |
| | rural | men | 239 (37.2) | 141 (21.9) | 43 (6.7) | 13 (2) | 4 (0.6) |
| | | women | 160 (24/3) | 177 (26.9) | 151 (22.9) | 61 (9.3) | 11 (1.7) |
| Arak | Urban | men | 729 (34.9) | 511 (24) | 146 (7) | 43 (2.1) | 3 (0.1) |
| | | women | 506 (23.7) | 668 (31.3) | 533 (25) | 157 (7.4) | 22 (1) |
| | rural | men | 357 (34.7) | 182 (17.7) | 41 (4) | 9 (0.9) | 2 (0.2) |
| | | women | 351(32.2) | 283(25.9) | 213(19.5) | 71(6.5) | 7(0.6) |

Discussion

Using the ATP III definition, we found approximately 21.9% of the Iranian adults living in Central Iran to have the MS. The prevalence of the MS is highly associated with race, population and cultural habits. Lifestyle factors such as general obesity, sedentary lifestyle change and daily physical activities are closely related with the MS.

The prevalence of obesity as one of the major components of the MS has increased; hence the prevalence of the MS can be presumed to have risen accordingly. Gender and age have also been shown to affect the MS.⁴ The prevalence of MS is higher among rural Iranian women (notably 60-year-olds). Central obesity and low HDL are the highest among women (86.1%, & 65.6%, respectively) and the lowest among rural Araki men (5%).

The prevalence of hypertriglyceridemia is the highest in rural Isfahani men (54.8%). Some studies have

shown that hypertension is not strongly linked to the MS.¹⁵ Clustering of components of the MS is highly raised in woman. Genetic abnormalities, fetal malnutrition and visceral adiposity may play roles in the pathophysiology of insulin resistance and the MS.¹⁶ Although insulin resistance is common in patients with individual components of the MS, significant proportions of these subjects do not have insulin resistance.

Recent studies have demonstrated that dietary modification and enhanced physical activity may delay or prevent the transition form impaired glucose tolerance to type 2 diabetes mellitus and provide relevant treatment paradigms for patients with the MS.

Our results showed that rural women in Isfahan have the highest prevalence of hypertension (22.9%), although other studies have suggested that hypertension is not strongly linked to the MS.¹²

Three-quarters (73.8%) of a random urban population and nearly all (91.3%) hypertensive subjects show at least one cardiovascular risk factor in addition to hypertension itself, including insufficient BP control, overall obesity, atherogenic body fat distribution, hyperinsulinemia, hypercholesterolemia, low HDL cholesterol, and elevated TG levels.¹³

High FBS or medication use is not significantly different between men and women in rural and urban areas. In fact, recent evidence suggests that the other features of the metabolic syndrome are important in determining cardiovascular risk independently of the degree of glucose intolerance.¹⁴

Although the pathogenesis of the MS remains unclear, proper management could reduce morbidity and mortality. It seems unlikely that management of individual abnormalities of this syndrome would provide better outcomes than a more integrated strategy.⁴

Proper management of the individual abnormalities of the MS can reduce morbidity and mortality. Ferranini et al showed a very high degree of overlap between the components of the metabolic syndrome.¹⁵

These results emphasize the importance of preventative efforts on a population scale in order to reduce the risk of cardiovascular disease.

In summary, this study showed an increasing risk of features of the MS in middle-aged woman in urban areas, possibly owing to their physical quality of life. Based on the results, not only should primary prevention be directed towards controlling biological risk factors, but it also must take account of sociodemographic and psychosocial parameters in order to identify individuals at high risk for diabetes and CVD.

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