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Prevalence of metabolic syndrome in elderly Iranian people living in nursing homes

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A B S T R A C T

Background: Population aging is accompanied by higher prevalence of MetS, which varies depending on the population and the used diagnostic criteria. The objective of this study is to determine prevalence of MetS among Iranian elderly.
Methods: 245 of elderly residents in private nursing house in Tehran (90 men and 155 women) were studied. MS was defined according to National Cholesterol Education Program: Adult Treatment Panel III (NCEP ATP III) criteria. They were evaluated by clinical examination, fasting glucose, fasting insulin, lipid profile and anthropometric measurements - weight, height, waist circumference and systolic and diastolic blood pressure. The prevalence of MetS was estimated by NCEP ATP III.
Results: 57.5% showed normal status while 39.2% have MetS. Analysis of logistic regression in two groups after adjustment for gender, education, marital and vocation status and smoking habit showed that the risk of MetS in elderly women were 2-fold higher than men (OR: 2.077, CI: 1.198-3.601 and p= 0.009).
Conclusion: Our study indicates that MetS is highly prevalent in the elderly people particularly among women. These results highlight an immediate action of preventive measures programs for modification of cardio-metabolic risk factors in elderly population.

Introduction

Metabolic syndrome (MS) is collections of multiplex risk factors that may be exist in a person [1-2]. Other names of this syndrome are dismetabolic syndrome, cardio metabolic syndrome, quarter deadly, syndrome X, and insulin resistance syndrome [1].

Some of the underlying causes of this syndrome, which increases metabolic risk factors (cardiovascular disease, type II diabetes atherogenic dyslipidemia, hypertension and increased mortality finally) [7-8-9] are as follows: obesity, overweight, sedentary physical activity, having insulin resistance, genetic factors, etc. that represent the prognosis of fatal diseases [10].

Although there are several diagnoses of metabolic syndrome, most applications of clinical diagnosis is based on NCEP ATP III criteria [5,6]. According to the NCEP ATP III definition, metabolic syndrome is present if three

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or more of the following five criteria are met: abdominal obesity (waist circumference >102 cm (>40 in) for men, >88 cm (>35 in) for women), dyslipidemia (elevated triglycerides ≥150 mg/dl), hypertension (≥130/≥85 mmHg), Insulin resistance (glucose intolerance) and low HDL cholesterol (<40 mg/dl in men, <50 mg/dl in women)[11].

Several studies have shown that MS prevalence increases with age, making its diagnosis necessary in this group because of 2.5-fold increased risk of cardiovascular disease and five-fold increase for the development of diabetes mellitus (DM) [12] and especially abdominal fat distribution and peripheral increases in both gender elevating in elderly people with normal weight, overweight or obese [13-15].

Since the elderly are a very vulnerable group of society [16], and considering that the MS represents a higher risk for cardiovascular diseases [17], DM [18], and mobility alterations of elderly [19-24] living in nursing homes, this study aims at determining the prevalence of MS diagnostic criteria based on NCEP ATP III and the agreement between them in a population older than 60 years of age.

Methods

Study design

In a cross-sectional study, we selected all those participants (n=245) residing in the nursing homes of Tehran, during the time period between March to September 2015 who were 60 years or older. All subjects were recruited consecutively from nursing homes of Tehran city and Shemiranatin by through Cluster sampling in 2015. Inclusion criteria were (a) age 60 years or older (b) willingness to participate. The exclusion criteria were moderate to severe psychiatric disorders and inability to respond or measured anthropometric and blood drawing. All participants were signed an informed consent form. The study was approved by the ethics committee of the Tehran University of Medical Sciences.

Subjects

Study population includes residents (aged 60 years and older) of the nursing homes and voluntarily takes part. 245 subjects were interested in this study (90 men and 155 women). The exclusion criteria were younger than 60 years old and moderate to severe psychiatric disorders and inability to respond or measured anthropometric and blood drawing.

Demographic and clinical data

Age and gender, level of education and vocation, marital status, and smoking habits were recorded using questionnaire and face to face interview and when it was too difficult to question the older (dementia, problem language); the data were completed with the aid of Head nurse's center. Common chronic disease and number of drugs were recorded upon admission. The drugs were classified base on Iranian Official Pharmacopoeia [1]. The participants' ages ranged from 60 to 100 years old, with a median of 79 [17] years. Categories of educational attainment included illiterate, under diploma, diploma and academic. Marital status was classified into four categories: single, married, divorced, or widowed. Vocation status included retired salaried, retired without paid, housewife without paid, unemployed without paid. The categories of smoking were never smoking, former smoking and current smoking. Consumption of cigarettes was classified into four categories: up to 5, 6-14, 15-25 and ≥ 25 cigarettes per day.

Anthropometric Measurements

Older people were weighted without shoes, in light clothing and height was calculated using age and Knee Height (KH) according to recommended World Health Organization (WHO) [2,3] advises. To measure KH, the person must be able to bend knee and the ankle of left leg to degree angles, and then measured between the thigh and heel. Brachial circumference was measured on the forearm half way between acromial surface of the scapula and the olecranon process of the elbow on the back of the arm. The waist circumference (WC) was measured using a SANNY inelastic measuring tape at the midpoint between the iliac crest and the last rib, with the patient standing at the end of exhalation [28]. All of the measurement repeated 3 times and were made by one person. Moreover we calculated body mass index (BMI) as weight/height^2 (kg/m^2). Elderly people with a body mass index less than 23 classified as "underweight", between 24-30 "normal weight" and above 31 to "overweight" were considered [4]. Blood pressure measurement in elderly should be seated for at least 5 minutes, relaxed and not moving or speaking, the left arm must be supported at the level of the heart. Ensure no tight clothing constricts the arm and using the

Table 1. Demographic Characteristics and prevalence of metabolic syndrome in population study

Characteristics		Total N (%)	Metabolic syndrome N (%)	No metabolic syndrome N (%)	P value
Sex	Male	90(36.7)	27(29.9)	63(70)	0.005
	Women	155(63.3)	73(46.4)	82(53)	
Age* (years)	60-74	84(35.9)	37(44.1)	47(55.9)	
	75-89	123(52.6)	49(39.8)	74(60.2)	0.873
	≥90	27(11.5)	9(33.3)	18(66.6)	
	Illiterate	78(37.1)	32(29.2)	46(59)	
Education	<1-12Th grade	51(24.3)	21(41.2)	30(58.8)	0.792
	≥12Th grade	43(20.5)	17(39.5)	26(60.5)	
	Academic	38(18.1)	17(44.7)	21(55.3)	
Marital status	Single	46(20.5)	20(43.5)	26(56.6)	
	Married	46(20.5)	17(38.1)	29(63.1)	0.911
	Separated	20(8.9)	9(45)	11(55)	
	widow	112(50)	45(40.2)	66(59)	
Vocation status	Retired salaried	95(42.2)	32(33.9)	63(66.5)	
	Retired without paid	19(8.4)	8(42.1)	11(57.8)	0.928
	Housewife without paid	101(44.9)	45(44.7)	56(55.6)	
	Unemployed without paid	10(4.4)	4(40)	6(60)	
Smoking habit	No smoking	207(84.5)	85(41.1)	122(59)	
	Former smoking	9(4)	7(77.7)	2(22.2)	0.377
	Smoking	29(12.9)	8(27.4)	21(72.3)	
Consumption of cigarettes	Up to 5	10(4.1)	4(40)	6(60)	
(at least 1year)	6-14	12(4.9)	4(33.4)	8(66.7)	0.096
	15-25	6(2.4)	1(16.7)	5(83.3)	
	≥25	5(2)	3(60)	2(40)	

*Age category: 60-74 (Young-old), 75-84 (Aged) and ≥90 (Oldest-old)
Differences assessed by chi-square test
Values are presented as frequency (percentage)

average of the last two measurements [29].

Blood samples

Blood samples were obtained after a 12-fast and subsequently analyzed at Laboratory national nutrition and food technology research institute Shahid Beheshti university of medical science. Serum fasting glucose, total cholesterol, HDL - cholesterol and TG were measured using kits (Parsazmun, Iran). LDL - cholesterol was calculated by the Friedewald equation.

Definition of MetS

According to the NCEP ATP III definition, MetS is present if three or more of the following five criteria are met: Abdominal obesity (WC >102 cm [>40 inch] for men, >88 cm [>35 inch] for women), dyslipidemia (elevated triglycerides ≥150 mg/dl), hypertension (≥130/85 mmHg), Insulin resistance (glucose intolerance) and low HDL-C (<40 mg/dl in men, <50 mg/dl in women)[11].

Data analysis

For descriptive and bivariate analysis, data were stratified by non-metabolic syndrome and metabolic syndrome categories. Continuous data were tested for normal distribution by Kolmogorov-Smirnov test and are presented as mean± standard deviation in the case of normally distributed data, and as median and interquartile range for non-normally distributed data. The remaining results are expressed as frequency (percentage). Proportions were compared by the chi-square test for qualities variable. Binary Logistic regression was performed to assess the impact of a number of factors on the likelihood that elderly would report that they had health status as MS or non-MS. All results were considered to be significant at the 5% critical level ($p<0.05$). The statistical study was carried out with SPSS v.19.

Results

The demographic characteristic of the 245 elderly in the study are displayed in Table 1. 63.3% of the participants were woman and 36.7% men with age range of 75-89 years old (52.6%). 37.1% of elderly populations were illiterate and did not receive any salary (44.9%). Half of the elderly were widows. 84.5% were nonsmoker and only 12.9% of smokers used 6-14 cigarettes per day.

The prevalence of metabolic syndrome

Table 2. Comparison of anthropometric profile in nursing homes

Variables	Total	Men	Women	P value
Weight**	57.30±14.64	62.82±15.52	53.50±13.57	0.001
Height	149.05(13.03)	157.11(6.24)	145.10(18.72)	0.001
BMI	24.78(8.53)	25.09(7.74)	24.57(9.25)	0.592

Values are presented by Median (interquartile range)
Body mass index (BMI): less than 23 classified as "underweight", between 24-30 "normal weight" and above 31 to "overweight" were considered
BMI: Body Mass Index

Table 3. Prevalence of metabolic syndrome in nursing homes

Variables	Total nursing homes	Private nursing* homes	Non- Private nursing** homes
	N (%)	N (%)	N (%)
Metabolic syndrome	96(39.2)	49(36.5)	47(42.3)
Non-metabolic syndrome	141(57.5)	82(61.2)	59(53.1)

*Missing values were 3 (2.1)
** Missing values were 5 (4.5)
Values are presented as frequency (percentage)

Table 4. Prevalence of components the metabolic syndrome of gender structure in elderly patients based on ATP III criteria

Characteristics	Total		Men		Women		P value
	N (%)	Median(IQR)	N (%)	Median (IQR)	N (%)	Median(IQR)	
WC[a] (cm)	111(45.3)	93(20)	17(15.3)	99(12.5)	94(84.7)	108(17)	0.001
HDL[b] (mg/dl)	84(34.3)	51.78(20)	24(28.6)	46.5(18.50)	60(71.4)	53(18)	0.104
TG[c] (mg/dl)	82(33.5)	128(69)	26(31.7)	189(69)	56(68.3)	236.5(95.5)	0.103
SBP (mmHg)	140(57.1)	133(36.75)	50(35.7)	148(71)	90(64.3)	148.5(28)	0.404
BP[d] DBP (mmHg)	89(36.3)	79(19)	32(36)	93(9.50)	57(64)	93(12.5)	0.418
FBS[e] (mg/dl)	56(22.9)	84(19)	20(35.7)	114.5(39)	36(64.3)	144(81)	0.713

*ATP III criteria for metabolic syndrome are diagnosed when a patient has at least 3 of the following 5 conditions**: a**)Waist circumference ≥102 cm (40 in) in men or ≥88 cm (35 in) in women, **b**) HDL-C < 40 mg/dL in men or < 50 mg/dL in women (or receiving drug therapy for reduced HDL-C), **c**) Triglycerides ≥150 mg/dL (or receiving drug therapy for hypertriglyceridemia), **d**) Blood pressure ≥130/85 mm Hg (or receiving drug therapy for hypertension), **e**) Fasting glucose ≥100 mg/dL (or receiving drug therapy for hyperglycemia).
WC: Waist Circumference, **HDL**: High Density Lipoprotein, **TG**: Triglyceride, **SBP**: Systolic Blood Pressure, **DBP**: Diastolic Blood Pressure, **BP**: Blood pressure, **FBS**: Fasting Blood Sugar.

according to ATP III was significantly higher in women than all men (46.4%, 29.9%, p=0.005). Other demographic factors, no significant differences were observed in elderly patients with metabolic syndrome and healthy.

In Table 2 the weight and height of elderly men (62.82±15.52, 157.11 (6.24), respectively) were higher than older women (53.50±50, 145.10 (18.72), p=0.001, respectively). Although significant differences as BMI between male and female were not observed (p=0.592), population ageing had normal value of BMI (24.78 (8.53).

According to Table 3 the metabolic syndrome in nursing homes is only 39.2%, so that MS in privately and publicly owned nursing homes are 36.5%, 42.3%, respectively.

The most common metabolic disorder in this syndrome was abdominal obesity (WC), that showed significant differences between the gender (p=0.001). Since that 84.7% WC of women (108 (17)) was higher than older men (99 (12.5)). The only negative criterion had SBP≥130 mmHg (133 (36.75)) in all geriatric criteria (Table 4).

Analysis of logistic regression in two groups, adjusted by variable associated with MS of elderly in nursing homes is shown in Table 5. After adjustment for gender, education, marital and vocation status and smoking habit, showing that the risk of metabolic syndrome in elderly women were higher than that of men (OR: 2.077, CI: 1.198-3.601 and p = 0.009).

Discussion

In the current study, MetS prevalence in elderly of nursing homes was 39.2%, according to NCEP-ATP III. The prevalence of this syndrome was significantly higher in women than men in crude model. This difference remained significant after adjustment for gender, age, education, marital, vocation status and smoking habit. The most common metabolic disorder in this syndrome was abdominal obesity, so that abdominal obesity was

Table 5. Logistic regression analysis of factors associated with the metabolic syndrome on ATP III criteria in the studied population

Characteristics		OR (CI 95%)	P value
Sex	Male	1	
	Women	2.077(1.198-3.601)	0.009
Age (years)	60-74	1	
	75-89	0.841(0.479-1.476)	0.546
	≥90	0.635(0.256-1.576)	0.328
	Illiterate	1	
Education	<1-12Th grade	0.544(0.175-1.693)	0.293
	≥12Th grade	0.509(0.159-1.625)	0.254
	Academic	0.630(0.194-2.042)	0.441
	Single	1	
Marital status	Married	1.172(0.343-4.008)	0.800
	Separated	1.633(0.408-6.561)	0.487
	Died	1.394(0.447-4.348)	0.567
	Retired salaried	1	
Vocation status	Retired without paid	0.364(0.053-2.496)	0.303
	Housewife without paid	0.402(0.070-2.294)	0.305
	Unemployed without paid	0.333(0.40-2.769)	0.309
Smoking habit	No smoking	1	
	Former smoking	5.024(1.019-24.77)	0.074
	Smoking	0.547(0.231-1.292)	0.169

The category of the Reference group that received Odd Ratio of 1.00 was the first category of the outcome.
OR: Odd Ratio; **CI**: Confidence Interval.

significantly higher in women than men. To the best of our knowledge, this is the first study that surveyed MetS prevalence in Iranian people 60 years or older in nursing homes, a population that have high risk for developing cardiovascular diseases (CVDs).

In the present study, as abovementioned, the prevalence of MetS was 39.2% based on the ATPIII criteria [5]. High prevalence of MetS has been reported in several studies. Prevalence of this syndrome in a Iranian population between 25 and 64 years old was 35.6% [6]. In Zhao et al., study, the prevalence of MetS among northwest Chinese Adults was reported to be 7.9% [7]. Moreover, analyses performed on data of National Health and Nutrition Examination Survey demonstrated high prevalence of this syndrome in adult 18 years or older (34.2% in 2007-2012) [8]. Finally, in a systematic review study which was carried out in different age groups and gender, the overall prevalence was 24% (38% in men and 25% in women) [10].

We showed that MetS prevalence in women was significantly higher than men. Central obesity, dyslipidemia and insulin resistance appeared in a lot of women with estrogen deficiency [11]. Hadaegh et al., demonstrated that prevalence of MetS in men aged 65 years or older was lower than women [12]. In a cross-sectional study was carried out in Zahedan, Southeast Iran, the prevalence of this syndrome in women vs. men was 24.9% vs. 15.4% [13]. Results of Sarrafzadegan et al., study were also in line with the current study's findings [14]. The MetS prevalence in Egyptian population with rheumatoid arthritis disease in men higher than women (53.8% vs. 49.2%) [15]. In another cross-sectional study was done in 2010-2011, the prevalence of MetS in women and men was 23.8% and 62%, respectively [16]. Results of these two studies were not in line with the present study.

In line with this study, the results of Maharlouei et al., study demonstrated that abdominal obesity is the most common MetS component in participants [9]. High prevalence of central obesity in Iranian population can be attributed to sedentary lifestyle and high carbohydrate intake [14, 17]. In a cross-sectional study on the elderly Iranian people in 1998-2001, high BP had the highest prevalence in components of this syndrome [12]. A survey was conducted among Northern Jordanians, represented low HDL and high BP were the most common abnormalities [18]. Of components, central obesity and high BP had the highest prevalence among Turkish adult women and men, respectively [19].

Limitations

There are several limitations in this study. The main limitation was the cross-sectional nature of the study. For this matter we should precaution in interpreting findings of the analysis

of factors associated with the MetS. Another limitation in our study is usage of one criterion for MetS. Also, we cannot generalize our findings to all Iranian elderly population because of low sample size of study. Therefore, prevalence of MetS assessment with large population, various races and further research work is recommended.

The strength of this study was considering elderly population in nursing homes that other surveys maybe not consider them.

Conclusion

In conclusion, MetS is prevalent in the elderly Iranian population, especially in women. Because abdominal obesity is the most widespread MetS component in elderly Iranian women and that is a very important risk factor for developing CVDs, the best approach is to consider public health policies for prevention and treatment of this metabolic disorder.

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Conflict of interest

The authors declare that they have no competing interests.

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