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Prevalence of Metabolic Syndrome Among Iranian Female Teachers Residing in Yazd, Iran

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ABSTRACT

Background: Metabolic syndrome (MetS) is a nutrition related diseases, which is predicts several life threatening diseases including diabetes mellitus and cardiovascular diseases.

Objectives: The present study aimed to investigate the prevalence of MetS in female teachers.

Participants and Method: This cross-sectional study was conducted on 450 female teachers who lived in Yazd city, Iran in 2015. Blood pressure, anthropometrics and serum triglyceride, high density lipoprotein cholesterol and fasting blood sugar measurements were conducted following the standardized procedures. General information, socio-economic status, education level and physical activity data were obtained through a self-reported questionnaire.

Results: Findings revealed a high prevalence of MetS based on NCEP ATP III criteria (39.11 %) in female teachers. Low HDL-c (48.67 %) and elevated waist circumference (72.22 %) were the most common components of MetS. Prevalence of high fasting blood glucose and high blood pressure was the same (31.78 %). Age, number of deliveries and menopause were significantly associated with likelihood of MetS.

Conclusions: The study results shows MetS is a serious health problem among female teachers residing in Yazd; community based lifestyle interventions seems to be necessary.

KEYWORDS

Metabolic Syndrome; Prevalence; ATP III; Iran.

INTRODUCTION

Insulin resistance syndrome or syndrome X which are presently known as metabolic syndrome (MetS), refers to a cluster of disorders including insulin resistance, glucose intolerance, obesity, dyslipidemia, and hypertension [1]. The role of MetS in risk of mortality, cardiovascular diseases, stroke, diabetes mellitus, fatty liver and some cancers has been suggested. First MetS diagnosis criteria was announced in 1998 by the world health organization (WHO), after that different definition of MetS appeared [2-6].

Prevalence of MetS varies in different countries. The prevalence of MetS in Saudi females was reported 16.1 and 13.6 % according to international diabetes federation (IDF) and national cholesterol education program (NCEP) ATP III criteria, respectively [7]. Gundogan et al reported the prevalence of MetS in Turkish females to be 41.8 % (based on ATPIII) and 44.0 % (based on IDF) [8]. In Nepal 21.9 % of women had MetS according NCEP and its prevalence in Canadian woman (ATPIII) was 19.5 % [9, 10].

It has been reported that MS has a high prevalence in Iran compared with the other countries and this high prevalence presents a public health problem [11, 12]. In 2009, it was estimated that more than 11 million Iranians affect by MetS and prevalence of MetS ranges between 9.7 % to 62.2 % [11, 13, 14]. Prevalence of MetS in women lived in west of Iran was reported 24.4 % and 20.62 % for women in north east of Iran [15, 16]. Sarrafzadegan et al [17] in Isfahan Healthy Heart Program found 35.1 % of women had MetS. In Tehran lipid and glucose study 42 % of women had MetS [18]. The only related population based study in Yazd city date back to about a decade ago and reported the prevalence of MetS among women to be about 62.2 % [14]. Therefore, we are not able to discuss about the trend of MetS in recent years for Yazd city. Different prevalence rates reported from the understudied region of Middle East makes it necessary to investigate about prevalence of MetS and its associated factors. The aim of the present study was to determine the prevalence of the metabolic syndrome and some of its life-style related determinants in female teachers residing in Yazd city, Iran.

MATERIALS AND METHODS

Participants

The present cross-sectional study was conducted in 2015 among female teachers in Yazd. Four hundred and fifty female teachers aged 20-60 years, were selected using multistage cluster random-sampling method. Informed consent was taken from the female teachers who agreed to participate in the study. Our study was approved by the Nutrition and Food Security Research Center of Shahid Sadoughi University of Medical Sciences (Registry Number: P.17.1.11523).

Anthropometric Measurements

Weight was measured to the nearest 100 g using SECA portable digital scale (model no: 813), when the participants were minimally clothed and without shoes. Height was measured to the nearest 0.5 centimeter in the standing position while the participants shoulders were in a normal state, using a plastic non-stretchable tape measure fixed on a straight wall [19]. Participants with BMI < 24.9 Kg/m^2 were categorized as normal and those with BMI ≥ 25 Kg/m^2 and < 30 Kg/m^2 were defined as overweight. Other study attendants with BMI ≥ 30 Kg/m^2 were regarded as obese. Waist circumference (WC) was recorded by using a non-stretchable plastic tape placed midway between iliac crest and lowest rib while participants were in standing position and were removed belts and tight garments that could change the shape of the body [20]. WC was measured to the nearest 0.5 centimeter while the participants were asked to express the tension of the tape on their body to make sure about proper tension. All measurements were done by a trained nutritionist.

Laboratory Assessments

For laboratory assessment each participant were referred to laboratory after overnight fast (10-12 hours) and venous blood samples were drawn. Serum was separated immediately by centrifugation. Serum levels of fasting Blood Glucose (FBG), HDL-cholesterol, and triglycerides were measured using an auto-analyzer (Technicon, model no: RA1000) and Pars Azma kits.

Assessment of Blood pressure

Blood pressure (BP) was measured when participants were seated at least for 15 minutes using a standard mercury sphygmomanometer (ALP k2-Japan). The systolic blood pressure was defined as the appearance of the first sound (Korotkoff phase 1) and the diastolic blood pressure was defined as the disappearance of the sound (Korotkoff phase 5) during deflating the cuff. All measurements were taken by the same person.

Assessment of other variables

A questionnaire about the demographic characteristics, physical activity, history of chronic diseases, and medication use was filled by each participants and send it back to researchers. Data on physical activity were asked using the short-form of Iranian version of international physical activity questionnaire (IPAQ); then we categorized the participants' physical activity to sedentary or active (those with at least 60 minutes of severe activities per week were categorized as physically active) [21].

Definition of metabolic syndrome

Having 3 or more of the following was considered as MetS according to the ATP III Criteria [22]:

1) Abdominal Obesity: Waist Circumference > 88 cm;

2) Hypertriglyceridaemia: Serum triglycerides level > 150mg/dl;

3) HDL-Cholesterol < 50 mg/dl;

4) High Blood Pressure: systolic blood pressure (SBP) > 130 mmHg and/or diastolic blood pressure (DBP) > 85 mmHg or on treatment for hypertension;

5) High Fasting Glucose: Serum glucose level > 100 mg/dl or medication use to control serum glucose levels.

Statistical Analysis

Prevalence rates of metabolic syndrome and its components for all study members and also based on participants' age (< 50/ ≥ 50), marital status (single/married), economic status (low income/ middle income/high income), education (high school/bachelor's degree/master's degree), number of parities (none, one, two, three or more), physical activity (sedentary/active), husband's education (high school/bachelor's degree/master's degree), menstruation (yes/no), family history of Diabetes mellitus (DB) (yes/no) and history of cardiovascular diseases (CVD) (yes/no) were calculated and reported.

Comparison of continuous and categorical variables was done by the use of independent samples student's t-test and chi-square test, respectively. All statistical analyses was done by SPSS version 20 (IBM SPSS, Tokyo, Japan). P-values ≤ 0.05 were considered as Statistical significant level.

RESULTS

Four hundred and fifty participants aged 40.60±8.25 years had complete data to be included in the current analysis. Metabolic syndrome was prevalent among 39.11 % of participants. Table 1 shows the prevalence of the metabolic syndrome components according to participants general and lifestyle characteristics of included participants. Prevalence of high fasting blood glucose (FBG) increased with age (P = 0.005) and number of deliveries (P = 0.002). High FBG levels was more prevalent in participants who experienced menopause (P < 0.001). The overall prevalence of high FBG in the study population was 31.74 %. Prevalence of high blood pressure (BP) was statistically higher in older subjects (P < 0.001) and increased by number of deliveries (P = 0.002). Participants with family history of cardiovascular diseases (CVDs) showed higher prevalence of hypertension (P = 0.022). Low HDL-c was more common compared to other components of MetS (48.67 %); low HDL-c was more prevalent in subject with cardiovascular diseases (CVDs) history (P = 0.022). Similar to the other components prevalence of high triglyceride (TG) (P < 0.001) and abdominal obesity (P < 0.001) was increased with age and number of deliveries.

Table 1: Prevalence of metabolic syndrome components in all participants (n = 450).

		High FBG (%)	Hypertension (%)	High TG (%)	Low HDL (%)	Abdominal obesity (%)
Age group	20-50 y	29.21	27.11	30.0	50.53	69.21
	Over50 y	46.38	56.52	62.32	37.68	88.41
	P_{value}	0.005	< 0.001	< 0.001	0.05	0.001
Marital Status	Single	30.23	30.23	37.21	37.21	60.47
	Married	31.85	32.10	34.81	49.63	73.58
	P_{value}	0.828	0.803	0.754	0.121	0.068
Economic Status	Low	27.66	24.82	31.21	51.06	70.92
	Middle	31.79	35.76	33.77	49.01	70.86
	High	35.67	34.39	39.49	45.86	75.16
	P_{value}	0.334	0.093	0.304	0.662	0.628
Physical Activity	Sedentary	33.83	33.83	35.61	47.18	73.59
	Active	24.53	26.42	30.19	52.83	68.87
	P_{value}	0.072	0.154	0.305	0.310	0.342
Education	college	39.77	37.50	48.86	48.86	79.55
	Bachelor's degree	30.74	30.42	32.36	49.84	72.49
	Master's degree or higher	23.53	29.41	27.45	41.18	58.82
	P_{value}	0.114	0.422	0.008	0.518	0.031
Husband's Education	High school	37.93	44.83	39.66	48.28	81.03
	College or Bachelor's degree	28.65	27.85	34.18	50.63	72.15
	Master degree or higher	31.25	26.56	29.69	50.0	71.88
	P_{value}	0.215	0.003	0.374	0.917	0.171
Number of Deliveries	None	17.31	15.38	17.31	44.23	36.54
	1 child	26.44	25.29	26.44	44.83	68.97
	2 children	30.16	28.57	34.92	50.26	70.90
	3 or more children	43.80	47.93	47.93	51.24	91.74
	P_{value}	0.002	< 0.001	< 0.001	0.697	≥ 0.001

Menopause	no	28.04	26.72	29.89	50.0	68.52
	Yes	51.39	58.33	61.11	41.67	91.67
	P_{value}	< 0.001	< 0.001	< 0.001	0.195	< 0.001
Family history of cardiovascular diseases	Yes	40.0	40.71	35.71	40.0	80.71
	No	27.36	27.70	33.78	51.01	67.57
	P_{value}	0.022	0.025	0.238	0.022	0.014
Family history of diabetes mellitus	Yes	36.07	31.15	37.70	46.99 ± 0.50	75.96
	No	28.40	32.40	34.40	48.40 ± 0.50	69.20
	P_{value}	0.168	0.139	0.178	0.704	0.426
Total		31.78	31.78	34.89	48.67 ± 0.50	72.22

For more analysis and detailed description of prevalence of MetS, women without any previous or current chronic disease (cardiovascular diseases, stroke, diabetes, polycystic ovary syndrome, multiple sclerosis and cancers) were analyzed, separately (Table 2). Older age was linked to high BP (P = 0.001) and high TG (P = 0.02) also increasing the number of deliveries was associated with high BP (P = 0.002) and high WC (P < 0.001). Postmenopausal women also had higher rates of hypertension (P = 0.001), hypertriglyceridemia (P = 0.022) and abdominal obesity (P = 0.014).

Table 2: Prevalence of metabolic syndrome components among participants without history of chronic diseases (n = 255).

		High FBG (%)	Hypertension (%)	High TG (%)	Low HDL (%)	Abdominal obesity (%)
Age group	20-50 y	24.66	18.83	21.97	50.67	63.68
	Over50 y	29.03	45.16	48.39	38.71	80.65
	P_{value}	0.60	0.001	0.02	0.212	0.062
Marital Status	Single	25.93	29.63	33.33	37.04	51.85
	Married	25.11	21.59	24.23	50.66	67.87
	P_{value}	0.926	0.344	0.303	0.181	0.097
Economic status	Low	23.53	20.00	25.88	56.47	64.71
	Middle	25.61	20.73	18.29	50.00	67.07
	High	26.44	26.44	31.03	41.38	66.67
	P_{value}	0.903	0.542	0.160	0.139	0.941
Physical activity	Sedentary	27.42	23.12	24.19	47.58	66.13
	Active	18.75	20.31	25.00	53.12	67.19
	P_{value}	0.168	0.642	0.897	0.467	0.877
Education	college	25.00	18.18	36.36	50.00	70.54
	Bachelor degree	24.72	23.03	24.16	50.56	68.54
	Master's degree or higher	25.81	22.58	16.13	41.94	45.16
	P_{value}	0.992	0.784	0.113	0.673	0.032
Husband's education	High school	23.73	27.12	18.64	45.76	74.58
	College or Bachelor degree	22.79	21.32	27.21	52.94	65.44
	Master's degree or higher	32.43	16.22	18.92	54.05	70.27
	P_{value}	0.475	0.436	0.329	0.612	0.437
Number of deliveries	None	18.42	15.79	18.42	42.11	34.21
	1 child	25.93	16.67	22.22	50.00	64.81
	2 children	23.42	18.02	26.13	48.65	66.67
	3 or more children	32.69	42.31	30.77	55.77	88.46
	P_{value}	0.443	0.002	0.554	0.640	< 0.001

Menopause	Yes	32.00	48.00	44.00	40.00	88.00
	No	24.35	19.57	23.04	50.43	63.48
	P_{value}	0.402	0.001	0.022	0.322	0.014
Family history of cardiovascular diseases	Yes	32.88	24.66	26.03	42.47	76.71
	No	21.26	21.26	23.56	50.57	60.92
	P_{value}	0.094	0.760	0.221	0.103	0.058
Family history of diabetes mellitus	Yes	26.60	17.02	26.60	48.94	68.09
	No	23.49	25.50	26.17	49.99	64.43
	P_{value}	0.836	0.146	0.411	0.924	0.812
Total		25.10	22.35	25.10	49.41	65.88

Prevalence of metabolic syndrome among all included participant was 39.11 % and this rate among women without history of chronic diseases was 28.24 %. Prevalence of MetS is reported in Table 3.

Table 3: Prevalence of metabolic syndrome in all women (n = 450) and women without history of chronic diseases (n = 255)

		Total participants (n = 450) (%)	**Participants without history of chronic diseases (n = 255) (%)**
Age group	20-50 y	34.74	25.11
	Over50 y	62.33	48.39
	P_{value}	< 0.001	0.007
Marital Status	Single	39.53	33.33
	Married	39.01	27.75
	P_{value}	0.947	0.543
Economic status	Low	34.75	29.41
	Middle	39.74	25.61
	High	42.68	29.89
	P_{value}	0.371	0.798
Physical activity	Sedentary	41.54	29.03
	Active	30.19	25.0
	P_{value}	0.058	0.744
Education	college	47.73	27.27
	Bachelor's degree	38.51	29.21
	Master's degree or higher	27.45	22.58
	P_{value}	0.032	0.965
Husband's education	High school	49.14	27.12
	College or Bachelor degree	37.13	28.68
	Master's degree or higher	31.25	27.03
	P_{value}	0.036	0.535
Number of deliveries	None	13.46	13.16
	1 child	34.48	29.63
	2 children	35.45	23.42
	3 or more children	58.68	48.08
	P_{value}	< 0.001	0.001
Menopause	No	34.66	26.52
	Yes	62.50	44.0
	P_{value}	< 0.001	0.065
Family history of cardiovascular diseases	Yes	42.86	32.88
	No	34.49	25.29
	P_{value}	0.166	0.165

Family history of diabetes mellitus	Yes	43.72	28.72
	No	36.40	28.86
	P_{value}	0.124	0.211
Total		39.11	28.24

Prevalence of MetS according to NCEP ATP III in both groups increased with more age (P < 0.001 and P = 0.007). Number of deliveries was positively associated with prevalence of MetS (P < 0.05). Higher level of teacher's education (P = 0.032) and their husbands education (P = 0.036) was linked with less MetS in all participants, but this relationship was not found in participants without history of chronic diseases. Marriage status, economic status, physical activity, and family history of CVDs and DM associated with MetS neither in all population nor in those without history of chronic diseases.

Table 4 describes the prevalence rates for MetS and its components according to BMI categories. Low HDL-c levels was not significantly associated with overweight or obesity (P = 0.267). However, prevalence of all other MetS components significantly increased with overweight and obesity (P < 0.001). The Prevalence of MetS based on NCEP ATPIII definition was also significantly related to overweight and obesity (P < 0.001).

Table 4: Prevalence of metabolic syndrome and its components in all study participants according to their body mass index (BMI) status [1] (n = 450).

	Normal Number (%)	**Overweight Number (%)**	**Obese Number (%)**	**P value**
High FBS	18 (13.6 %)	66 (33.8 %)	59 (48 %)	< 0.001
High TG	24 (18.2 %)	70 (35.9 %)	63 (51.2 %)	< 0.001
Hypertension	23 (17.4 %)	64 (32.8 %)	56 (45.5 %)	< 0.001
Low HDL	58 (43.9 %)	103 (52.8 %)	58 (47.2 %)	0.267
Abdominal obesity	35 (26.5 %)	167 (85.6 %)	123 (100 %)	< 0.001
Metabolic Syndrome	18 (13.6 %)	80 (41 %)	78 (63.4 %)	< 0.001

[1]Normal weight: BMI < 24.9 Kg/m^2, Overweight: BMI ≥ 25 Kg/m^2 and < 30 Kg/m^2, Obese: BMI ≥ 30 Kg/m^2.

DISCUSSION

The present study showed that the prevalence of MetS among female teachers was 39.11%. This finding was close to a study done by Sadrbafoghi et al [14]; they reported that about one third of Yazd population had MetS according to NCEP criteria. Several studies have reported the prevalence of MetS in different cities of Iran. Most of these studies reported high prevalence of MetS among females [15, 16, 18]. It is estimated that 11 million of Iranian population are affected by MetS [11]. Similar to Iran in other countries like Turkey, Pakistan and Saudi Arabia the prevalence of MetS is high. In Turkey the rate of having MetS among women was reported 45 % and 49 % for women in Pakistan [23, 24]. In the present study, low HDL-c and increased WC were the most common components of MetS. These findings are consistent with other studies that previously carried out in Iran [18, 25, 26].

Changes in lifestyle, unhealthy diet, sedentary lifestyle, increased prevalence of hypertriglyceridemia, overweight and obesity, genetic polymorphism that have been suggested by family and twin studies are associated with low HDL-c. With removing women with previous disease or current disease, these finding still remained the same. In Iran most of women do not have enough physical activity and overweight and obesity are common, so this finding are not unexpected [18, 27-30].

In our study participants' age was related to MetS and its components. Other studies have also reported the association between age and the prevalence of MetS [31]. This increasing trend can be observed to a similar age-related trend in each of the components of metabolic syndrome.

The prevalence of high FBG and high BP was the same in our study and this is noticeable because some findings indicate that about half of the patients with hypertension can have insulin resistance and hyperinsulinemia [32]. A significant correlation between fasting serum insulin level and systolic and diastolic blood pressure was also reported by a meta-analytic review [33].

Our study had several limitations. Causal relationships cannot be inferred from our study because of its cross-sectional nature. Including female teachers in the present study makes it hard to attribute the prevalence rates and the associations found to general population. It should be considered that the last study about prevalence of MetS in Yazd city was conducted in 10 years ago and after that no study is published about

the prevalence of MetS and its associated factors in Yazd city. Although we tried to examine the association between several demographic and lifestyle related variables, as the main objective of the present study was reporting the prevalence of MetS among female teachers we did not investigate the association between dietary intake and its association with MetS.

In conclusion, the findings of our study revealed a high prevalence of the metabolic syndrome in a highly educated part of females residing in Yazd city; Furthermore, about one third of the participants who reported no history of chronic diseases had MetS. Designing community based intervention programs to reduce the prevalence of MetS in Yazd city is highly recommended.

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COMPETING INTEREST

The authors have no conflicts of interest.

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