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Original Research Article

Awareness and prevalence of metabolic syndrome among high-risk individuals attending internal medicine clinics across Jordan

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Abstract

Purpose: *To examine the prevalence and awareness of metabolic syndrome (MetS) in high-risk individuals attending 30 internal medicine clinics in Amman, Jordan, and also to evaluate the various factors associated with increased risk of MetS among them.*
Methods: *This retrospective cross-sectional study was carried out across Amman, Jordan from October to December 2014. During the study period, 900 high-risk individuals (with hypertension, diabetes, central obesity and/or dyslipidemia) were recruited from thirty internal medicine clinics in Amman, Jordan. Data collection forms were filled based on patient interview and medical case file.*
Results: *The prevalence of MetS among high-risk individuals was around 40 % (361/900), with around 79 % (284/361) of MetS patients unaware of their condition. Older age, lower income and family history of premature cardiovascular diseases were associated with a higher prevalence of MetS.*
Conclusion: *Although MetS was found to be highly prevalent among high-risk individuals in this study, the awareness of the condition in this group is very poor. These findings support the need for educational programs that involve both health care providers and patients. These programs should especially target those at risk of MetS, in order to improve awareness of the concept of MetS.*

Keywords: *Prevalence, Metabolic syndrome, Jordan, Awareness, Risk factors*

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INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of death worldwide [1]. Despite the various and intensive management protocols used, many patients fail to achieve their desired clinical outcomes. Insulin resistance, elevated blood pressure, central obesity, atherogenic dyslipidemia, genetic susceptibility, hypercoagulable state, and chronic stress are among the most important risk factors of CVDs [2].

There have been numerous definitions of MetS [3-5], but the most commonly used definition at present is the one provided by the American Heart Association/National Heart, Lung, and Blood Institute which defines MetS as the occurrence of at least 3 of the following 5 cardio-metabolic components: fasting blood glucose ≥ 100 mg/dl, blood pressure ≥ 130/85 mmHg, triglycerides ≥ 150 mg/dl, HDL-C < 40 mg/dl in males or < 50 mg/dl in females, waist

circumference ≥ 102 cm (40 in) in males or ≥ 88 cm (35 in) in females [5].

The constellation of three or more of the fore mentioned metabolic risk factors and their imminent link to insulin resistance and consequently to CVDs have suggested the notion of metabolic syndrome (MetS). Although it started as a concept, MetS is a diagnosis that is based on the presence of three or more of its components [5].There is an increasing need for raising the awareness of MetS, especially among patients at risk for diabetes and cardiovascular disease. Patients should be aware that the fore listed metabolic abnormalities are more likely to cluster than occur separately, and when they coexist, they are almost certainly related to insulin resistance and the associated hyperinsulinemia.

The prevalence of MetS continues to increase globally [6-8]. Prevalence rates reported in the literature are variable and related to the definition used, age, gender, race, and other factors [6-8]. Depending on definition, MetS affects between 21 and 38.9 % of the US population [6,7]. In Jordan, the prevalence of MetS was found to be 37.4 % in Jordanian individuals aged 25 years and older [8].

Introduction of lifestyle changes, that accommodate specific recommendations on diet and exercise, is the initial intervention of choice for high-risk individuals [9]. Pharmacological therapy is to be considered for those who fail to sufficiently modify their risk factors by following lifestyle changes [9]. Improving awareness of MetS is essential to execute risk reduction behaviors, and prevent its devastating complications, especially among high risk group. However, it is reportedly low [10,11].

This study aimed to assess the prevalence and awareness of MetS among high risk individuals. It also aimed to investigate the various risk factors affecting MetS prevalence among this population.

METHODS

Study design, setting and subjects

This is a retrospective cross-sectional study that was carried out across thirty internal medicine clinics in Amman-Jordan. The study commenced in October-2014. In order to gain the participation of as many individuals as possible, a convenience sampling method was employed at the clinics over three months period depending on throughput rate of the clinics. Inclusion criteria were: 1) adult individuals 18 years of age and above, 2) with any confirmed component of MetS (NCEP/ATP III): confirmed diagnosis of diabetes, confirmed diagnosis of hypertension, waist circumference ≥ 102 cm in males or ≥ 88 cm in females, recent triglyceride value ≥ 150 mg/dl (taken within the last 6 months), recent HDL-C < 40 mg/dl in males or < 50 mg/dl in females (taken within the last 6 months), 3) and willingness to participate in the study.

Research assistants (pharmacists) were trained to conduct the data collection process in the same manner (to decrease the risk of assessment bias). During the study period, a convenient sample of 900 individuals out of 990 who fulfilled the inclusion criteria were recruited (response rate 90.9 %). All participants were required to provide a written informed consent before the interview, participants' confidentiality was preserved. Study protocol was conducted in accordance with the World Medical Association Declaration of Helsinki guidelines [12]. Ethical approval was obtained from the University of Jordan (ref no. 68/2013-2014).

Data collection

All participants were assessed for their socio-demographic data including: participants age, gender, educational level, income, smoking, drinking alcohol, physical activities, dietary pattern, and whether there is any family history of premature CVDs (definite myocardial infarction or sudden death before age 55 years in father or other male first-degree relative, or before age 65 years in mother or other female first-degree relative). The components of metabolic syndrome were evaluated using patient medical records for hypertension, diabetes, recent triglyceride and recent HDL-C values (based on recent laboratory tests of up to 6 months). Waist circumference was also measured for all participants. All patients were asked whether they were aware of the presence of MetS or not.

Statistical analysis

Data were analyzed with Statistical Package for Social Sciences SPSS version 17 (SPSS, Inc., Chicago, IL, USA). Descriptive analysis was done using mean and standard deviation (SD) for continuous variables and percentage for qualitative variables. Chi-square test was used to evaluate differences between groups for categorical variables. All variables found to have significant association with having MetS in bivariate analysis were entered into logistic

regression analysis to determine which factors have the strongest association. $P < 0.05$ was considered statistically significant and all tests were two-tailed.

RESULTS

A total of 900 participants were recruited in this study. Mean age of participants was 55 years; females represented 52.1 % (470) of the studied sample. The majority 62.7 % (564) of participants had earned a bachelor's degree. The demographic details of the sample are summarized in Table 1.

In this study, the prevalence of MetS components was assessed for all participants (Figure 1). Among the studied components, central obesity was the most prevalent component, while low HDL-C was the least prevalent. The number of MetS components was evaluated; 361 participants had three or more components, resulting in a prevalence of MetS of around 40 %. When those participants were asked if they know that they suffer from MetS, only 21.3 % (77/361) of those participants were aware of having the condition.

The investigation of factors affecting the prevalence of MetS showed that the prevalence was higher among older participants ($p = 0.000$). Lower education and lower income were also associated with higher risk of MetS ($p = 0.000$ for both). The presence of positive family history of premature CVDs was found to be linked to higher prevalence of MetS ($p = 0.028$). No difference in MetS prevalence was related to gender or lifestyle habits (alcohol drinking, smoking, performing exercises, and dietary pattern).

Table 1: Socio-demographic characteristics of study participants and factors associated with risk of having MetS

Parameter		Total sample (n=900)[#]	MetS (≥ 3 components) (n=361)	No MetS (< 3 components) (n=539)	*P*-value[$]
Age (Years)	<50 years	264 (29.5)	72 (20.1)	192 (35.8)	0.000[*]
	≥50 years	631 (70.5)	286 (79.9)	395 (64.2)	
Gender	Male	430 (47.8)	172 (47.6)	258 (47.9)	0.948
	Female	470 (52.2)	189 (52.4)	281 (52.1)	
Educational Level	Not educated/school	336 (37.3)	163 (45.2)	173 (32.1)	0.000[*]
	BSc/Graduate study	564 (62.7)	198 (54.8)	366 (67.9)	
Monthly income	≤ 500 JD	406 (46.1)	190 (53.5)	216 (41.1)	0.000[*]
	>500 JD	475 (53.9)	165 (46.5)	310 (58.9)	
Active smoking	Yes	234 (26.0)	93 (25.8)	141 (26.2)	0.894
	No	666 (74.0)	268 (74.2)	398 (73.8)	
Alcohol drinking	Yes	22 (2.4)	8 (2.2)	14 (2.6)	0.721
	No	877 (97.6)	352 (97.8)	525 (97.4)	
Performing exercises	Yes	248 (27.6)	94 (26.0)	154 (28.6)	0.405
	No	652 (72.4)	267 (74.0)	385 (71.4)	
Family history of premature CVD	Yes	306 (34.0)	138 (38.2)	168 (31.2)	0.028[*]
	No	594 (66.0)	223 (61.8)	371 (68.8)	
Dietary Pattern	Vegetarian	43 (4.8)	15 (4.2)	28 (5.2)	0.474
	Non-vegetarian	857 (95.2)	346 (95.8)	511 (94.8)	

$ Chi square test; * Significant at $p<0.05$ significance level; # some questions have missing data

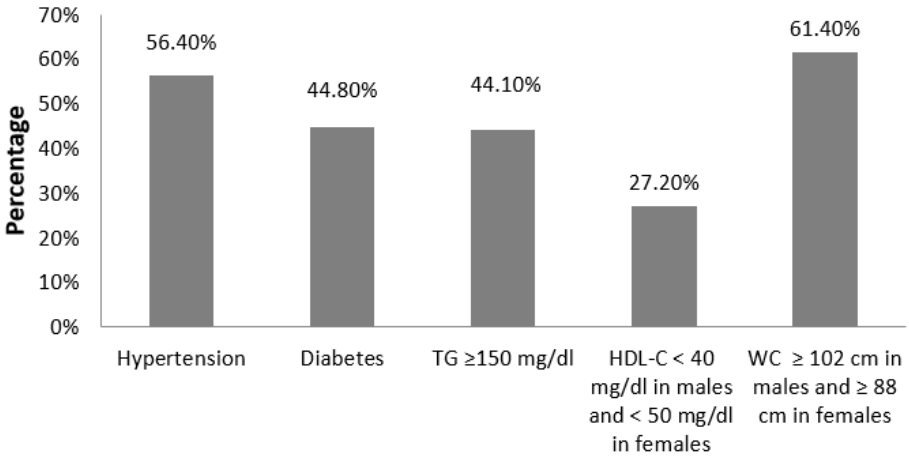

Figure 1: Proportion of variousMetS components among the study sample. ***Note:*** TG: triglyceride, HDL-C: high density lipoprotein-cholesterol, WC: waist circumference

Table 2: Results of logistic regression analysis of factors associated with risk of having MetS (having MetS coded 1, not having MetS coded 0)

Variable	B	SE	*P*-value	Odds ratio (OR)	95% CI for OR
Age (years) (0: <50 years, 1: >=50 years)	0.763	0.164	0.000*	2.144	1.556-2.955
Family history of premature CVD (0: No, 1: Yes)	0.362	0.148	0.015*	1.436	1.073-1.920
Monthly income (0: <=500 JD, 1: >500 JD)	-0.365	0.154	0.018*	0.694	0.513-0.940
Educational levels (0: Not educated/school, 1: BSc/Graduate study)	-0.308	0.158	0.051	0.735	0.539-1.001

* Significant at $p < 0.05$

All variables in Tables 1 that were significantly associated with higher prevalence of MetS in bivariate analysis, were entered into final logistic regression model (Table 2). Among those variables, age ≥ 50 years (p = 0.000, OR 2.144) and the presence of family history of premature CVDs (p = 0.015, OR 1.436) were significantly associated with higher prevalence of MetS, while higher income level (p = 0.018, OR 0.694) was significantly associated with lower prevalence of MetS. A test of the final model goodness of fit using Hosmer and Lemeshow test, showed that the model was statistically reliable X^2 =2.565 (p = 0.959).

DISCUSSION

This study aimed to assess the prevalence and awareness of MetS among high risk individuals attending internal medicine clinic in Jordan. It also aimed to evaluate the effect of various risk factors on the prevalence of this disorder.

The prevalence of MetS among high risk individuals was found to be 40 % (361/900), this was similar to the prevalence rate reported by a previous study from Jordan (37.4 %) [8].The most interesting finding, and possibly the most alarming one, in this study is the fact that 78.6 % (284/361) of MetS patients are unaware of their condition. This finding agrees with that reported by a multicentre Greek Study, where two third of subjects with metabolic syndrome were unaware of the MetS condition [11].This low awareness demonstrates the limited penetration of the concept of MetS among both patients and health care providers who most commonly tend to rather treat each component separately, instead of shedding light on the cluster of these conditions together in the form of MetS, and informing their patients about its associated risk of insulin resistance [13]. Since awareness of MetS is essential to implement risk reduction behaviors, that can potentially reduce the risk of CVDs, these results highlight the poor awareness of this condition and the necessity of

educating, both health care providers and patients, about the clustering of these cardio-metabolic components, and its associated increased risk of CVDs.

Among MetS components, central obesity was found to be the most prevalent (61 %), while low HDL-C was the least prevalent (27 %). In the literature the prevalence of different components varied considerably with some components being the most prevalent in some studies and least prevalent in other studies [14,15]. The high prevalence rate of central obesity in this study is consistent with the reported increasing rate in the literature [16].

The evaluation of risk factors and their association with MetS, older age was found to increase the risk of MetS. This conclusion is consistent with a previous report, where increasing age was found to affect the prevalence of MetS [14]. Individuals with lower income showed increased risk of MetS. Similar finding was found in a study from china, which highlighted a higher prevalence of MetS in females with lower income [17], while another study showed that higher income was associated with increased odds of having MetS among males [18].

The presence of positive family history of premature CVDs was associated with higher risk of MetS. This finding is consistent with a previous study that concluded a positive association of a positive family history of CVDs and the risk of MetS [8]. MetS is known to have a strong genetic component; higher prevalence of MetS components among parents is expected to be associated with higher prevalence of MetS components among their offspring generation [19].

In our study, no gender related differences in the prevalence of MetS were found. In the literature however, there were great controversial findings regarding the influence of gender on MetS prevalence. In many studies, prevalence of MetS was significantly higher in females than males [15,20]. But in a study by Sobko *et al*, they found that age-adjusted prevalence of MetS was over two times higher in males (10.5 %) than in females (3.7 %) [17]. Other studies showed similar frequency of occurrence of the MetS for both males and females [21].

In this study, patients' education was found to be significantly associated with MetS prevalence in bivariate analysis, but not in multiple logistic regressions. Several previous studies evaluated the effect of educational level on the prevalence of MetS with conflicting results [18,20,22]. One study from Korea showed that the relative risk of MetS was two times higher in those with no or an elementary school education versus university graduation [22]. Another study showed that those with higher education had higher odds of having MetS after adjusting for age [18]. While the level of education, had no significant differences between patients with MetS and those without in a third study [20].

The effect of different lifestyle habits was previously investigated in the literature [8,20,23]. In our study, no difference in MetS prevalence was related to smoking or performing exercises. This finding was similar to previous studies where smoking status and physical activity did not show any statistically significant difference between individuals with MetS and those without [8,20].We also concluded that dietary patterns showed no effect on MetS prevalence, which was inconsistent with finding from the Adventist Health Study 2 that showed a lower risk of MetS among vegetarians compared to non-vegetarians [23]. In our study alcohol consumption showed no beneficial or harmful effect on the prevalence of MetS, while a study from USA found that mild to moderate alcohol consumption is associated with a lower prevalence of the MetS [24]. In contrast another study showed that continuous drinking, especially moderate-to-heavy drinking, is associated with developing MetS in men [25].

Limitations of the study

Although this study has a relatively large sample size, we are aware of the main methodological limitation; since we relied on participants medical file to assess the presence of different MetS components (hypertension, diabetes, triglyceride and HDL-C) rather than evaluating these parameters by obtaining blood samples and measuring blood pressure values, accordingly our study might have underestimated the actual prevalence rate of MetS. This may result in excluding many high risk individuals who have either impaired blood glucose level (blood glucose ≥ 100 mg/dl) or those with high blood pressure (systolic blood pressure ≥ 135 mmHg and diastolic blood pressure ≥ 85 mmHg).

CONCLUSION

The findings of this study reveal a high prevalence rate of MetS among high risk individuals in Jordan. This study have also shown the unexpected, and alarming poor awareness of MetS among this high risk population who should, presumably, have better awareness of this condition. Awareness of MetS

is a prerequisite for introducing lifestyle changes that can modify the risk of CVDs. Despite the worrying low awareness, it should be highlighted, that most of these patients at high risk, have chronic illnesses that will demand their regular visits for their physicians. This offers an opportunity for physicians to reach out to this important group of patients and educate them, and thus improve their awareness of MetS and its associated increased cardiovascular risk.

DECLARATIONS

Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them.

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