Prevalence of Metabolic Syndrome and Its Related Factors among Adults

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ABSTRACT

Background: This study was designed to estimate the prevalence of metabolic syndrome and its determinants, as well as baseline information about the related factors among the adult population.

Method: A cross sectional study of 252 participants has been conducted in February 2017 at King Abdulaziz Hospital and Oncology Center. A structured questionnaire was administered, collecting information on personal medical history as well as socio-demographic and behavioral characteristics. Anthropometrics, blood pressure, and venous blood samples were obtained. Metabolic syndrome was defined according to the International Diabetes Federation (IDF) criteria.

Results: The prevalence of metabolic syndrome was 32% according to the IDF. In addition to WC is the best predictor for metabolic syndrome in the Saudi population.

Conclusion: This study showed that Metabolic Syndrome is highly prevalent in Jeddah, Saudi Arabia. Also there is a high prevalence of hypertension, obesity and diabetes. Therefore, to reduce the risk of cardiovascular events, screening for and early detection of risk factors for Metabolic Syndrome are suggested.

Keywords: Metabolic Syndrome, Adults

INTRODUCTION

Metabolic syndrome (MetS) is a cluster of interrelated risk factors for cardiovascular disease (CVD) [1]: diabetes, high fasting plasma glucose, abdominal obesity, low high-density lipoprotein cholesterol (HDL-C), elevated triglycerides and high blood pressure [2,3]. The concept of MetS has existed for at least 80 years [4]. MetS was first described as X syndrome [5]. Different organizations have proposed several diagnostic criteria for MetS and the most commonly used is the Adult Treatment Panel III (ATP-III) and adapted ATP-III criteria (NCEP /ATP-III-A) [6, 7] by the National Cholesterol Education Program (NCEP), the International Diabetes Federation (IDF) [8] and the World Health Organization (WHO) criteria [9].

The prevalence of MetS is increasing globally [10]. Based on reports, around 20-25% of the world's adult population has MetS, and mortality rate amongst these people is twice as likely from heart attack and three times as likely from stroke compared with people without MetS [11]. A survey among adolescents in the United States reported a prevalence of MetS in more than a quarter of the obese population and in nearly seven percent of the overweight population [12]. More importantly, the prevalence of this disorder is increasing in children and young adults worldwide [13]. The underlying cause of the MetS continues to challenge the experts but both insulin resistance and central obesity are considered the main causes [14]. Genetic and environmental factors such as a sedentary lifestyle, unhealthy dietary habits and high rates of cigarette smoking contribute to MetS development [15]. In the general population, genetic and environmental differences may partially be responsible for the difference in prevalence rates of MetS in different countries [15-18]. MetS enhances the risk for various diseases such as diabetes, cardiovascular disease, fatty liver, asthma, ovarian cysts [19] and some cancers [20]. To reduce the risk of these mentioned diseases, studying the prevalence of this syndrome seems to be essential in different populations. The findings of this study will provide a baseline information about the prevalence of MetS and its related factors among the adult population.

METHODS

Samples were collected at King Abdulaziz Hospital and Oncology Center in Jeddah, Saudi Arabia. As part of the admission process, these individuals underwent clinical and laboratory screening with an inclusion criterion of being aged 20 years or older. A total of 430 individuals identified to be overweight or having abdominal or generalized obesity presented for pre-admission screening during the four-week study period in February 2017.

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A total of 178 individuals were excluded. Of those, 67 did not present subsequently for a fasting venous blood collection and 27 individuals did not consent to blood collection for the study. The remaining 252 participants were analyzed, of which 84 participants were diagnosed to have MetS according to the defined parameters.

Anthropometric measures were recorded, namely Weight, height, and waist/hip circumferences. Body weight was measured to the nearest 0.1 kg using a digital scale, and height was measured to the nearest centimeter in the standing position using a wall stadiometer. Body mass index (BMI) was calculated as the weight in kilograms divided by the square height in meters. The waist circumference (WC) was measured midway between the lower limit of the rib cage and the iliac crest. The hip circumference (HC) was measured as the maximum circumference of the buttocks.

Blood pressure was measured on a single occasion using a standard mercury sphygmomanometer with the cuff on the upper right arm after a 10-min rest. Fasting venous blood glucose, total cholesterol and triglycerides levels were determined using automatic standard routine enzymatic methods. Insulin was measured using the 125I–labelled insulin radioimmunoassay method, and insulin resistance was estimated according to the homeostatic model assessment (HOMA) as the product of fasting glucose (mmol/L) and insulin (μUI/mL) divided by a constant 22.5.

A trained medical student administered a structured questionnaire with only closed ended questions. Information was collected on personal medical history and socio-demographic and behavioral characteristics. A participant was considered a current smoker if he/she smoked daily or occasionally, a former smoker was considered a participant who had stopped smoking for at least six months, and a never smoker was considered a participant who had never smoked.

IDF Definitions of MetS were used[3], which are a WC ≥ 80 cm in women and ≥94 cm in men and the presence of at least two of the following characteristics: fasting glucose ≥100 mg/dL or previously diagnosed type 2 diabetes, blood pressure ≥ 130/85 mmHg or antihypertensive medication, triglycerides ≥150 mg/dL or current treatment for this lipid abnormality, HDL-C < 40 mg/dL in women and <30 mg/dL in men or current treatment for this lipid abnormality (Table 1) .

Table 1: The International Diabetes Federation Consensus Definition for Metabolic Syndrome.

Criteria	
Abdominal Obesity	WC ≥ 94cm in men WC ≥ 80cm in women
Hypertension	≥ 130/85 **or** antihypertensive medication
Hyperglycaemia	FPG ≥100 mg/dL (≥5.6 mmol/L) **or** previously diagnosed type 2 diabetes
Dyslipidaemia	TG ≥150 mg/dL (≥1.7 mmol/L) **or** <40 mg/dL (<1.03 mmol/L) in men <50 mg/dL (<1.29 mmol/L) in women **or** current treatment for this lipid abnormality

WC=Waist circumference; FPG=Fasting plasma glucose; TG=Triglycerides; HDL-c=High density lipoprotein cholesterol

The study was done after approval of ethical board of King Abdulaziz university and an informed written consent was taken from each participant in the study**.**

RESULTS

Out of all participants 73 (86.9%) were young adults aged 20-34 years old and 11 (13.1%) participants were above the age of 34 years old. The mean age was 43 years in men and 27 in women. Most of the participants, 51 (60.71%), were obese, 25 (29.76%) were overweight, while 8 (9.52%) had an ideal BMI. All the participants with ideal BMI had abdominal obesity and were females, except for 1 male. The mean (SD) levels triglycerides in men and women were 158 mg/dL and 162mg/dL respectively. HDL-C levels were 43.3 mg/dL in men and 47.1 mg/dL in women. The mean values of WC were 105 cm in men and 118 cm in women (Table2). Systolic and diastolic blood pressure mean values were 130 / 80 mmHg in men and 135 / 65 mmHg in women. Differences between sexes were significant ($p < 0.001$) for all. The mean values for weight, height, WC, WHR, TG, FPG, SBP and DBP were significantly greater in women than those found in men, while only the mean values of BMI, hip circumference and HDL cholesterol were lower in men than women. Additionally, the prevalence of all metabolic syndrome risk factors (elevated triglycerides, reduced HDL cholesterol, elevated blood pressure, and elevated fasting glucose) was higher in women compared with men.

Table 2: Demographic characteristics of the Metabolic Syndrome subjects			
		Number	**Percentage (%)**
Gender	Male	17	20.24%
	Female	67	79.76%
Age [years]	20 – 34	73	86.9%
	Above 34	11	13.1%
Education [years]	5-12	23	27.38%
	> 12	61	72.62%
Status	Single/divorced/widower	49	58.33%
	Married	35	41.67%
Smoking status	Smoker	33	39.29%
	Ex. Smoker	4	4.67%
	Non Smoker	47	55.95%
Physical exercise	Yes	3	3.57%
	No	81	96.43%
BMI	Obese	51	60.71%
	Overweight	25	29.76%
	ideal BMI	8	9.52%
Fasting plasma glucose [mean]	Male	104.75	
	Female	102.30	
Triglycerides [mean]	Male	158 mg/dL	
	Female	162mg/dL	
HDL cholesterol [mean]	Male	27.2 mg/dL	
	Female	34.1 mg/dL	
Abdominal Obesity [mean]	Male	95 cm	
	Female	92 cm	
Total:		84	

DISCUSSION

Obesity is an alarming public health challenge of the 21st century [21]. Metabolic syndrome is one of the associated co-morbidities of obesity. Previous research suggests that the occurrence of MetS in pre-adult life persists into adulthood and the existence of obesity in childhood predisposes an individual to developing MetS in adult life [22, 23]. The crude prevalence of MetS in our population-based survey varied according to the definition used. The prevalence was 32% according to IDF.

The baseline measurements of the study population showed increased BMI and waist-to-hip ratio indicating obesity which put an additional risk to insulin resistance. The most prevalent MetS component was abdominal obesity (in 95% of the participants), followed by hypertension (in over 48% of these individuals), hyperglycemia (in about 30.5% of the population) and low HDL-c levels(in one third of the population). The participants with hyperglycemia were more prone to have MetS than those without, while participants with hypertension were 10 times more likely to have MetS than those with normal blood pressure.

The optimal cutoff value of WC for identifying two or more risk factors of metabolic syndrome in the Saudi population was 95 cm for men and 92 cm for women, which lies within the WHO recommended range [14]. This proposed cutoff value for the Saudi population is similar to data reported in other studies from individuals of the same ethnicity (Arabs) (Table 3), while Qataris reported a WC cutoff value of 99.5 cm in men and 91 cm in women [25], and Iraqis reported WC cutoff values at 99 cm for men and at 97 cm for women [26]. This difference in the WC cutoff values between different ethnic groups could be explained by ethnic differences in socioeconomic status, physical activities, lifestyle and cultural factors that could affect the body composition of each population that consequently uses the WC as a surrogate for abdominal fat [27]. The current study highlights that using the proposed WC cutoff values of NECP ATP III criteria [6, 28] will underestimate the prevalence of metabolic syndrome in the Saudi population. At the same time, if IDF criteria [3] for Asians were used in this society, it would underestimate the prevalence of metabolic syndrome among men and overestimate this prevalence among women.

The optimal cutoff value for BMI among our subjects was ≥25 kg/m^2 for men and ≥28 kg/m^2 for women. The proposed values for BMI in the current study are lower than that for Qataris (19) where they reported BMI cutoff values of 28 kg/m^2 and 28.4 kg/m^2 for men and women respectively, and for Jordanians (20) with reported BMI cutoff values of 27.2 and 30 kg/m^2 for men and women respectively. The current study reported significantly higher BMI among women while reporting a significantly lower WC than men. This observation is similar to the findings among Jordanians [27] and could be explained by the fact that men are mostly taller than women, especially when the BMI calculation is mainly dependent on the net body weight and height, regardless of the distribution of muscle and bone mass.

The best anthropometric index for identifying metabolic syndrome is still controversial and varied widely depending on the studied population [29] and ethnicity [30]. In some populations including Australia, Canada, and Japan, the WHR was the best indicator for cardiovascular risk factors compared to BMI, [31-33] while in another Iranian study, WC was superior to BMI and WHR in predicting cardiovascular risk factors [34]. The superiority of WC in identifying metabolic syndrome compared with BMI could be due to the fact that WC is better correlated with abdominal fat and more strongly associated with cardiovascular risk factors than BMI [35].

Table 3: Comparison between the optimal cutoff values for waist circumference for identifying metabolic syndrome among different Arab countries.

Author			**WC cutoff values (cm)**		**BMI cutoff values (kg/m2)**	
			Men	Women	Men	Women
	Current	Saudi	95	92	25	28
Bener *et al*[25]	2012	Qatar	99.5	91	28	28.4
Mansour *et al*[26]	2006	Iraq	99	97	-	-
Khader *et al*[27]	2009	Jordan	88.5	84.5	26.2	30

CONCLUSION

This study showed that MetS is highly prevalent in Jeddah – Saudi Arabia, along with high prevalence of hypertension, obesity and diabetes. WC is the best predictor for metabolic syndrome in the Saudi population. Therefore to reduce the risk of cardiovascular events, screening and early detection of risk factors for MetS are suggested.

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