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RESEARCH ARTICLE

THE PREVALENCE OF THE METABOLIC SYNDROME AND ITS COMPONENTS IN A GROUP OF APPARENTLY HEALTHY SAUDI WOMEN

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ABSTRACT

Background: Metabolic syndrome is a common health problem in the Saudi population and is a known cardiovascular risk. Most of the studies that were conducted to estimate the prevalence of the metabolic syndrome among Saudi population included subjects with a wide age range. The aim of this study was to determine the prevalence of the metabolic syndrome and its components in a group of apparently healthy and relatively young group of women.

Subjects and Methods: This is a cross-sectional study that was conducted in the "Center of Excellence for Osteoporosis Research", King Abdulaziz University, in Jeddah, Saudi Arabia, during the year 2011. Saudi women were enrolled for this study (n=205, age range 20-45 years). All recruited subjects were free of any chronic illnesses and not on any regular medications. "National Cholesterol Education Program (NCEP)- Adult Treatment Panel (ATP III) criteria" were used to identify women with the metabolic syndrome. Anthropometric measures were taken and blood pressure was measured in a standardized manner. Fasting blood samples were taken for various biochemical tests.

Results: The prevalence of the metabolic syndrome in the study group was 7.8%, and the most common component was central obesity (46.3%). Reduced high density lipoprotein was the second most common component (29%). At least one component was present in 59% of the studied women.

Conclusion and recommendation: The presence of the metabolic syndrome (8%) along with the high prevalence of central obesity in this young healthy group of women is quite alarming. Timely measures to reduce obesity in this group may reduce the incidence of future cardiometabolic disorders.

INTRODUCTION

The metabolic syndrome (MetS) describes the clustering of a number of cardiometabolic risk factors including central obesity, dyslipidemia, glucose intolerance and hypertension. However, not all of these factors must be present in the subject to be diagnosed as having the MetS (Cornier *et al.,* 2008). A quarter of the world's adults have MetS (Alberti *et al.,* 2006) and its prevalence is increasing throughout the world (Cornier *et al.,* 2008). Nevertheless, the prevalence could be changed according to the definition used and the characteristics of the studied population (sex, age, race and ethnicity). Racial/ethnic composition has an impact on sex, age and definition-related differences in the prevalence (Ford 2005; Hollman and Kristenson 2007; Lorenzo *et al.,* 2003). Socioeconomic status, diet and lifestyle also appear to influence its prevalence (Cornier *et al.,* 2008; Al-Daghri *et al.,* 2013). The underlying pathophysiology of the syndrome is not yet clear (Cornier *et al.,* 2008). However, the root causes of the MetS and its components seem to be central obesity and insulin resistance along with physical inactivity (Carr *et al.,* 2004). Individuals with the MetS have higher incidence of cardiovascular diseases (2-4 folds) (Isomaa *et al.,* 2001; Lakka *et al.,*2002; Malik *et al.,* 2004; Ninomiya *et al.,* 2004) and type 2 diabetes (5-folds) (Grundy *et al.,* 2004) than individuals without the MetS. According to the previous studies, the prevalence of the MetS in Saudi population can be considered as one of the highest prevalences worldwide (more among Saudi women than men) (Al Qahtani and Imtiaz 2005; Al-Nozha *et al.,* 2005; Al-Qahtani *et al.,* 2006). Up to our knowledge, no studies were performed to evaluate the prevalence of the MetS among healthy young Saudi women. Therefore, the aim of the present study was to evaluate the prevalence of the MetS and its individual components among a group of apparently healthy young women.

MATERIALS AND METHODS

This study was a cross sectional one. It was conducted in the "Center of Excellence for Osteoporosis Research" (CEOR), "King Abdulaziz University", Jeddah, Saudi Arabia, during the

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year 2011. The study was approved by the ethical committee of CEOR. Women attending the center were approached and asked to participate in the study. Out of 228 women, 205 apparently healthy pre-menopausal Saudi women living in Jeddah (age range: 20-45 years old) were enrolled in the study. Women diagnosed with thyroid disorders, a chronic renal or liver disease, diabetes or hypertension were excluded from the study. Medical history, socioeconomic status (including education level, occupation, income and marital status), and lifestyle (including level of physical activity and smoking) were recorded using a validated questionnaire. A written informed consent was obtained from each subject participating in this study.

"National Cholesterol Education Program **(**NCEP**)** Adult Treatment Panel **(**ATP III**)** criteria" (Grundy *et al.,* 2004; NCEP 2001) were used to identify women with the MetS. At least three out of five criteria must be present to diagnose a person clinically as having the MetS:

1. Abdominal obesity given as a waist circumference of ≥80 cm. The modified central obesity cut-off point for women was used (≥80 cm instead of ≥88 cm) according to our natural variation in body shape and composition from other ethnicities (Alberti *et al.,* 2006).
2. Triglyceride level ≥150 mg/dL (1.69 mmol/L).
3. High density lipoprotein (HDL) cholesterol level <50 mg/dL (<1.28 mmol/L).
4. Fasting blood glucose ≥100 mg/dL (≥5.6 mmol/L). In 2004 (Grundy *et al.,* 2004), NCEP:ATPIII organization recommended to modify the definition of impaired fasting blood glucose according to the "American Diabetes Associations" to be ≥100 mg/dL instead of ≥110 mg/dL (Grundy *et al.,* 2004; THCDCD 2003; SMCD 2011).
5. Systolic blood pressure of ≥130 mm Hg and/or diastolic of ≥85 mm Hg.

Height and weight were measured while subjects were wearing light clothes and no shoes, to the nearest half centimeter and kilogram respectively. Waist circumference (WC) (midway between the lower rib margin and the iliac crest), and hip circumference (HC) (the maximal circumference over the buttocks) were measured in cm. Additionally body mass index (BMI) was calculated as weight (kg)/ [height*height] (m^2) and waist to hip ratio (WHR) was calculated as WC/HC. An "automated blood pressure monitor", the "Bp TRU" (VSM MedTech Ltd, Coquitlam, Canada), was used for blood pressure measurement. This monitor was validated by the "British Hypertension Society" (BHS) (Myersa 2006). Each participant was asked to sit on a comfortable chair in a quite private room. Appropriately sized cuff (three sized cuffs were available) was used and applied to the right arm (the arm was supported) in the seated position. The subject was asked to refrain from talking, crossing legs, using the mobile or doing anything that may disturb the blood pressure measurement. After 5 minutes rest (a stop watch was used) three readings were recorded 1 minute apart, and the average of the last two readings was used for analysis. Blood sample (after 10-12 hours of fasting) (Fischbach 2004) was obtained from each subject in two plain tubes (for measurement of various biochemical parameters) and a sodium fluoride additive tube (for glucose test). Routine biochemical tests (liver and renal function tests) and specific hormones tests (follicular-stimulating hormone) were also performed. Lipid Profile (HDL and Triglycerides) and fasting blood glucose tests were done using "VITROS 250 Clinical Chemistry Autoanalyzer" (Ortho-Clinical Diagnostics Inc., Rochester, NY, USA).

Statistical Analysis

The statistical analysis was performed using the "Statistical Package for Social Science" (SPSS program version 16). Raw data were checked for any inaccuracies. Minimum and maximum values for all continuous variables were checked and all identified anomalies were corrected before starting statistical analysis. Data were examined for normal distribution by Kolmogorov-Smirnov statistic. Continuous variables that were normally distributed were expressed as mean and standard deviation while those that were not normally distributed were expressed as median and interquartile range. Categorical variables were expressed as frequency and percentage.

RESULTS

A total of 228 were initially recruited. Out of these, 23 women were excluded from the study. The reasons behind subject exclusion are listed in Table-1.

Table 1. Number and reasons for subject exclusion

Reasons for Exclusion	No. of Excluded Subjects
Less than three BP readings	6
High levels of FSH (> 15 mlU/L)	5
Diabetic or hypertensive patients	5
High liver enzymes	3
Fasting less than 10 hours	3
Hemolyzed sample	1
Total number	23

BP; Blood Pressure, FSH; Follicle Stimulating Hormone.

Anthropometric and Biochemical Characteristics of the Study population

The following Table (Table-2) illustrates the mean and standard deviation of the age of the study participants and their various anthropometric and biochemical measurements.

Blood Pressure Readings of the Study Population

The mean and standard deviation of the blood pressure readings of the study population were 103.1 (11.3) mmHg for the systolic BP and for the 65.9 (8.2) mmHg diastolic BP.

The Prevalence of the MetS in the Study Population

According to NCEP:ATPIII definition, only 7.8% (n = 16) of the study population had the MetS. All of studied women, whom had been identified with the MetS, had central obesity (WC ≥ 80 cm). The prevalence of each component of the MetS is presented in Table-3.

Table 2. Mean and standard deviation (or median and IQR) for each measured anthropometric and biochemical parameter

Variable	Mean (SD)	Median (IQR)*
Anthropometric Characteristics		
Age	32.93(8.40)	
Weight (kg)	67.74 (15.33)	
Height (m)	1.58 (0.056)	
WC (cm)	78.59 (12.33)	
HC (cm)	99.50 (11.68)	
BMI (kg/m^2)	27.26 (6.08)	
WHR	0.79 (0.081)	
Biochemical Characteristics		
TG (mmol/L)	1.02 (0.45)	0.92 (0.69-1.245)
HDL (mmol/L)	1.45 (0.37)	
FBG (mmol/L)	4.63 (1.15)	4.5 (4.2-4.8)

WC; Waist Circumference, HC; Hip Circumference, BMI; Body Mass Index, WHR; Waist to Hip Ratio, TG; Triglyceride , HDL; High Density Lipoprotein, FBG; Fasting Blood Glucose, SD; Standard Deviation, IQR; Interquartile Range. *median and interquartile range were calculated for variables that were not normally distributed.

Table 3. Prevalence of each component of the MetS in the study population

Component of the MetS	n (%)
Central obesity	95 (46.3%)
Raised TG	19 (9.3%)
Reduced HDL	59 (28.8%)
Impaired FBG	10 (4.9%)
High BP	7 (3.4%)
Women had at least one component	121 (59.02%)

MetS; MetS, TG; Triglyceride, HDL; High Density Lipoprotein, FBG; Fasting Blood Glucose, BP; Blood Pressure, n; number of women.

DISCUSSION

This study examined the prevalence of the MetS and each of its individual components in an apparently healthy young group of Saudi women. Although apparently healthy young women with no known history of any previous medical illnesses were recruited, the MetS was prevalent among 8% of the studied subjects. The most common component of the MetS was central obesity (46%) followed by reduced HDL (29%). The present study showed that three out of five (59%) Saudi pre-menopausal women had at least one component of the MetS. The prevalence of the MetS worldwide is reported to be 25% among the adult population (Grundy 2008). Several studies on Saudi subjects used NCEP:ATPIII definition to identify those with the MetS (Al Qahtani and Imtiaz 2005; Al-Nozha *et al.,* 2005; Al-Qahtani *et al.,* 2006). In 2005, Al-Nozha *et al.* (2005) conducted a large community-based national epidemiological health survey including subjects from all over Saudi Arabia (17,293 men and women, 30-70 years old). They found that the prevalence of the MetS was higher in women (42%) than in men (37.2%) (Al-Nozha *et al.,* 2005). They also reported that the most common component of the MetS was reduced HDL levels (81.8% in women and 74.8% in men). Another study conducted by Al-Qahtani and co-workers on 1922 women (18-59 years old) living in Hafr Al-Batin reported that 13.6% of the studied women had the MetS (Al-Qahtani *et al.,* 2006). They suggested that such high prevalence in a relatively young age group, as a predictor for a rise in the prevalence of the MetS over the next coming years. The present study included younger (20-45 years old) and only healthy subjects which was not the case in the previous two studies. This could explain the lower prevalence of the MetS in the present study (8%). Fifty% of the studied women who had the MetS were between 41-45 years old (which accounted only to 19% of the whole studied women). "Advancing age probably affects all levels of pathogenesis, which explains why prevalence of the MetS rises with advancing age" (Reis *et al.,* 2008). Similar to our findings, Al-Qahtani and co-workers reported that the most common component of the MetS was central obesity (44% as compared to 46% in the present study) followed by reduced HDL (36% as compared to 29% in the present study) (Al-Qahtani *et al.,* 2006). One of the interesting results in the present study was that out of five women, there were three with at least one component of the MetS (59% of the studied women). This is quite alarming in this healthy young group of women. Most of these women had central obesity. Furthermore, all of the studied women who were identified with the MetS had central obesity. Therefore, these young women with central obesity are at higher risk of developing the MetS in their later lives. This would increase their risk of having type 2 diabetes (five-folds) (Grundy *et al.,* 2004) and CVD (two to four-folds) than healthy women ((Isomaa *et al.,* 2001; Lakka *et al.*,2002; Malik *et al.,* 2004; Ninomiya *et al.,* 2004).

Conclusion and recommendations

To conclude, the presence of the MetS along with the high prevalence of central obesity in this young healthy group is quite alarming. Timely measures to reduce obesity in this group may reduce the incidence of future cardiometabolic disorders. One of the limitations in this study was the cross sectional study design. Therefore, the causative nature of the association cannot be established. On the other hand, the strengths of the study were that, only healthy women were included in the study, pre-menopausal status was hormonally confirmed by measuring FSH and blood pressure was measured in a standardized manner. Our data suggest the need for improved detection of the MetS in the Saudi population. Moreover, measures to reduce obesity among our population are urgently warranted. These will include educational campaign to increase the awareness among the population about the harmful effects of obesity and the importance of adopting a healthy life style. This will reduce the prevalence of many other associated diseases along with the MetS, where central obesity is considered as one of its main pathological causes.

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