Prevalence of Metabolic Syndrome Among Qassim University Personnel in Saudi Arabia

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Abstract:

Objective: to estimate the prevalence of metabolic syndrome among Qassim university personnel in Saudi Arabia using the definition proposed by NCEP ATPIII.

Methods: a cross sectional study that included all male university staff of different ages and careers. 560 individuals participated in this study with a response rate of 85%. For all participants, the data collected were sociodemographic characteristics, past history or receiving medication for diabetes or hypertension, smoking habits, physical activity, and measurements necessary to identify metabolic syndrome.

Results: Prevalence of metabolic syndrome was 31.4%. The prevalence was found to show a steady increase with increasing age, BMI and serum cholesterol. General obesity measured by BMI was the most common component associated with the syndrome where 75% of participants suffered from overweight and obesity. Participants with high-density lipoprotein below protective level constituted 73.6%, while those with total cholesterol and triglyceride above clinically normal level constituted 60.0% & 46.4% respectively. Fasting plasma glucose and hypertension was the least common. After adjustment, factors found to be associated with metabolic syndrome were being a Saudi national, smoking, not doing regular exercise, being obese, having total serum cholesterol above 180 mg/dl, and age groups above 40 years.

Conclusion: Almost a third of the university personnel have metabolic syndrome and therefore they are at higher risk for both cardiovascular disease and diabetes mellitus. Similar studies are required among a wider range of subjects to assess the scope of the problem in Saudi Arabia.

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Introduction

Metabolic syndrome represents the presence of a combination of interrelated risk factors including central obesity, insulin resistance, dyslipidemia and hypertension [1,2]. Subjects with metabolic syndrome have substantially increased risk for developing type 2 diabetes mellitus and cardiovascular diseases (CVD) [3,4]. Also, the overall mortality is higher among patients with metabolic syndrome, particularly the mortality associated with CVD[5]. This increase in CVD disease risk appears to be independent of other important and potentially confounding factors such as smoking and elevated low-density lipoprotein cholesterol (LDL-C) levels[3]. The adverse effects of metabolic syndrome are manifested across the whole spectrum of blood glucose level status (i.e., patients having normal blood glucose levels, those having impaired fasting blood glucose and those with frank diabetes mellitus) [3,4,5].

Worldwide, published studies on the prevalence of metabolic syndrome are limited. Among Arab populations, metabolic syndrome has not been widely studied, but the available data suggest that it is an increasingly common problem [6-11].

There are several working definitions for metabolic syndrome proposed by World Health Organization, the 2001 National Cholesterol Education Program Adult Treatment Panel III (NCEP ATPIII), European Group for the Study of Insulin Resistance (EGIR), and the International Diabetes Federation[1]. The existence of different definitions makes it difficult to compare data from around the world and between different populations [12,13]. However, The NCEP description of metabolic syndrome is considered to be the most applicable tool for clinical and epidemiological practices [1].

This study aimed to estimate the prevalence of metabolic syndrome using the definition proposed by NCEP among adult males working in Qassim University in Saudi Arabia.

Methods

Design, Setting and Study Population

This study was conducted in Qassim University in Saudi Arabia during winter months of 2006. Duration of data collection extended for a period of about 3 months.

History taking, clinical examination and laboratory investigation were done by the University's Staff Health Center. The Center employs general practitioners having postgraduate degree in internal medicine and provides outpatient medical care to the University staff and, to a lesser extent, preventive care. Most basic lab investigations and X-ray facilities are available. Patients requiring further investigation or advanced levels of clinical care are referred to nearest specialty hospital(s) in the region.

All male employees of Qassim University working on the main campus were eligible to participate in the study. This included all age categories and Saudi and non-Saudi employees. To improve participation, a timetable was prepared and announced to define specific appointment for each group of staff (academic, administrative) and for each college of affiliation. Although participation was voluntary, staff members were actively encouraged to go through the clinical screening process to identify risk factors of metabolic syndrome. An invitation letter was sent to each employee explaining the purpose of the study and its benefit on his health. The letter included a suggested appointment date and time. Those not showing up for their appointment were contacted by phone and rescheduled for another appointment.

Definition of Metabolic Syndrome

According to the NCEP (Adult Treatment Panel III) report [13], a person is considered to have metabolic syndrome if he has any three of the following:

1. Abdominal obesity: waist circumference > 102 cm in men and > 88 cm in women
2. Hypertriglyceridaemia: Triglyceride (TG) level ≥ 150 mg/dl (1.69 mmol/l).
3. Low high-density lipoprotein cholesterol (HDL-C) level: < 40 mg/dl (1.04 mmol/l) in men and < 50 mg/dl (1.29 mmol/l) in women.
4. High blood pressure: ≥ 130/85 mmHg or use of anti-hypertensive medication.
5. High fasting glucose: ≥ 110mg/dl (6.1 mmol/l) or use of hypoglycemic medication.

Data Collection and Measurements

Each participant was interviewed using a structured questionnaire that recorded his age, occupation, nationality; past history of diabetes, hypertension and any other chronic diseases;

whether he was taking any medication for the treatment of diabetes or hypertension; family history of diabetes, hypertension and other chronic diseases; and smoking habits and physical activity.

After the interview, the participant's body weight and height were recorded in light clothes and no shoes. Body mass index (BMI) was calculated as weight in kilograms (kg) divided by height in meter squared (m^2). Waist circumference was measured midway between the iliac crest and the lower costal margin. Blood pressure was recorded by using a standard mercury sphygmomanometer after the subject had been seated for at least 5 minutes. Two readings were taken with 5 minutes interval and their mean was recorded.

For biochemical investigations, a venous blood sample was taken in the morning after a twelve hours fasting for the determination of plasma glucose, triglycerides, total and high-density lipoprotein cholesterol concentrations. A person was regarded as having impaired fasting glucose if he had fasting plasma glucose of 6.1 – 6.9 mmol/L (110-125 mg/dl). Subjects with fasting plasma glucose ≥ 7.0 mmol/L (126 mg/dl) and those using medication to control diabetes were considered as having diabetes. Similarly, participants reporting current use of anti-hypertensive drugs were regarded as being hypertensive regardless of their blood pressure reading. The interviews and medical examination and the lab tests were conducted by the Health Center's staff, who received prior orientation training in the study's objectives and procedures.

Ethical Considerations

The study proposal was scrutinized and approved by the Medical Research Center of Qassim College of Medicine. Raw data were treated with strict confidentiality and used only for research purposes. Participants were informed about the results of their clinical examination and lab investigations. Essential and relevant health education messages were delivered to each individual and the necessary medical action was taken if required. Those having negative tests were reassured and motivated to continue or adopt healthy behaviors and to have regular periodic medical check-up.

Data Analysis

All questionnaires were coded and entered into an electronic database. Data analysis was carried out using Statistical Package for Social Sciences (SPSS) version 11.5. Frequency distributions with numbers and percentages of all variables were produced. The prevalence of the metabolic syndrome and its components using NCEP ATPIII criteria was identified. Comparisons were done by different socio-demographic and clinical profile of participants using 2-sided independent t-test, chi-square test or Fisher's exact test. Multiple logistic regression analysis was performed to estimate adjusted odds ratios for known and hypothetical risk factors of metabolic syndrome. The independent variables considered were nationality (Saudi or non-Saudi), job category (academic or administrative), age, smoking, physical activity, obesity, and total serum cholesterol.

Results

Socio-demographic and Clinical Characteristics

After all possible efforts to encourage participation, the response rate turned to be (85%). A total of 560 employees participated in this study. The socio-demographic and clinical profiles of the participants are presented in tables (1) and (2). Saudi nationals constituted 59.3% of participants. Those having an administrative occupation were slightly more than those with academic career (56.4% versus 43.6% respectively). More than one third of participants (37.1%) were in the age group of 40-49 years, while those below 30 years constituted only 16.4%. Current smokers were 10% and regular exercise was practiced by only 7.9% of the participants.

The number of participants diagnosed with hypertension was almost three times greater than those with high fasting plasma glucose (39.3% and12.1% respectively). It also appears that dyslipidemia was common among participants. Almost half of participants (46.4%) had a triglyceride level of $\geq$150mg/dl, while three quarters of participants had the serum high density lipoprotein cholesterol (HDL-C) lower than the protective level (40mg/dl). Total serum cholesterol above the clinically significant cut off value (180 mg/dl) was found in 60% of participants.

Participants were classified into six groups based on their BMI. No individual was found in the upper (obese-3) group having a BMI higher than 40, while about one quarter were in the

normal weight category; the rest of participants (75.0%) was either overweight or obese. Central obesity measured by waist circumference was observed in 30.7% of participants.

Table (3) presents selected clinical characteristics among study participants. It appears that the means for most values are within the clinical normal limits except for serum total cholesterol and serum triglycerides which have mean values of 194 mg/dl and 167.2mg/dl respectively – slightly away from the limits for normal values. However, standard deviations around the mean - are high, which indicates high variability among study participants. This variation is particularly manifested in fasting serum plasma glucose and serum triglycerides.

Table (1). Distribution of Study Participants by Socio-demographic Characteristics.

Characteristics	Number (Percent)
Nationality	
Saudi Citizen	332 (59.3)
Non-Saudi expatriate	228 (40.7)
Nature of Job	
Academic	244 (43.6)
Administrative	316 (56.4)
Age Group	
<30 yrs	92 (16.4)
30-39 yrs	132 (23.6)
40-49 yrs	208 (37.1)
50+ yrs	128 (22.9)
Currently Smoking	56 (10.0)
Currently doing regular exercise	156 (7.9)

Table (2). Prevalence of Some Clinical Characteristics among Study Participants.

Characteristics	Number (Percent)
Hypertension (Blood pressure ≥ 135/85 mmHg)	220 (39.3)
High Fasting Plasma Glucose(≥ 110 mg/dl)	68 (12.1)
Serum Lipid Profile	
Total Cholesterol (≥ 180 mg/dl)	336 (60.0)
Triglyceride (≥ 150 mg/dl)	260 (46.4)
High-density Lipoprotein (≤ 40 mg/dl)	412 (73.6)
Obesity Based on Body Mass Index (kg/m2)	
Underweight (BMI < 18.5)	2 (0.4)
Normal weight (BMI = 18.5 - 24.9)	138 (24.6)
Overweight (BMI = 25 - 29.9)	309 (55.2)
Obese-Category 1 (BMI = 30 - 34.9)	107(19.1)
Obese-Category 2 (BMI = 35.0 - 39.9)	4 (0.7%)
Waist Circumference> 102 cm	172 (30.7)

No participants was found to have BMI ≥ 40.0 kg/m2

Table (3). Mean Values for Some Clinical attributes among Study Participants.

Characteristics	Mean (Standard Deviation)	Coefficient of Variation
Fasting Plasma Glucose (mg/dl)	98.0 (37.0)	37.76%
Serum Lipid Profile		
Total Cholesterol (mg/dl)	194.0 (52.0)	26.8%
Triglyceride (mg/dl)	167.2(102.9)	61.54%
High-density Lipoprotein (mg/dl)	36.1 (9.9)	27.42%
Waist Circumference (cm)	98.9 (12.4)	12.54%
Weight (kg)	80.2 (9.7)	12.09%
Body Mass Index (kg/m2)	27.3 (3.3)	12.09%

Prevalence of Metabolic Syndrome Criteria

Table (4) displays the distribution of metabolic syndrome criteria by age group, BMI category and total serum cholesterol level. It is alarming to note that almost 95% participants have one or more criteria of metabolic syndrome. Only 32 (5.7%) participants had no criteria, 152 (27.1%) had one criterion, 200 (35.7%) had two criteria, 108 (19.3%) had three criteria, while those 68 (12.1%) participants had four or more criteria.

The prevalence of metabolic syndrome – based on the presence of three or more criteria – was 31.4% and showed an increase with increasing age. The lowest age group (<30 yrs) showed the lowest prevalence (13.0%), while the highest age group (50+ yrs) showed the highest prevalence (46.9%).

A similar relationship exists between BMI and prevalence of metabolic syndrome. The normal weight group had the lowest prevalence of 20.0%, overweight participants had a prevalence of 26.9, while the obese group had the highest prevalence of 58.6%. Although there were only two participants in the underweight category, neither manifested any criteria of metabolic syndrome.

The prevalence of metabolic syndrome also increased with increasing values of total serum cholesterol. The prevalence rate was 23.2% in subjects with serum cholesterol equal or less than 180 mg/dl, and 36.9% in subjects with serum cholesterol more than 180 mg/dl.

Table (5) displays the prevalence of metabolic syndrome criteria by age group and BMI. It is obvious that age is an important risk factor of metabolic syndrome. Prevalence of hypertension, waist circumference and fasting plasma glucose increased steadily with increasing age. However, serum triglyceride and high density lipoprotein are constantly high across all age groups.

Table (4). Prevalence (%) of Criteria for Metabolic Syndrome and Their 95% Confidence Limits.

Characteristics	Number of criteria for metabolic syndrome Percent of participants (95% confidence limits)			
	≥1 (n=528)	≥2 (n=376)	≥3 (n=176)	≥4 (n=68)
Age Groups				
< 30 yrs (n=92)	95.7 (91.5-99.8)	43.5 (33.3-53.6)	13.0 (6.2-19.9)	
30-39 yrs (n=132)	93.9 (89.9-98.0)	60.6 (52.3-68.9)	27.3 (19.7-34.9)	15.2 (9.0-21.3)
40-49 yrs (n=208)	92.3 (88.7-95.90	73.1 (67.0-79.1)	32.7 (26.3-39.1)	13.5 (8.8-18.1)
50+ yrs (n=128)	96.9 (93.9-99.9)	81.3 (74.5-88.0)	46.9 (38.2-55.5)	15.6 (9.3-21.9)
Obesity (BMI)				
Normal # (n=140)	91.4 (86.8-96.1)	42.9 (34.7-51.1)	20.0 (13.4-26.6)	2.9 (0.1-5.6)
Overweight (n=309)	94.5 (92.0-97.0)	74.1 (69.2-79.0)	26.9 (21.9-31.8)	12.3 (8.6-16.0)
All Obese (n=111)	97.3 (94.3-100.3)	78.4 (70.7-86.0)	58.6 (49.4-67.7)	23.4 (15.5-31.3)
Total Serum Cholesterol				
≤ 180 mg/dl (n=224)	92.9 (89.5-96.2)	58.9 (52.5-65.4)	23.2 (17.7-28.7)	8.9 (5.2-12.7)
>180 mg/dl (n=336)	95.2 (93.0-97.5)	72.6 (67.9-77.4)	36.9 (31.7-42.1)	14.3 (10.5-18.0)
Total (n=560)	94.3 (92.4-96.2)	67.1 (63.3-71.0)	31.4 (27.6-35.3)	(9.4-14.8)

 # Include normal and underweight. (Only 2 participants were in the underweight category).

Table (5). Prevalence of Metabolic Syndrome Criteria by Age Group & BMI.

Characteristics	Hypertension	Waist circum. >102cm	Fasting Glucose ≥ 110 mg/dl	Triglyceride ≥ 150 mg/dl	HDL ≤ 40 mg/dl
Age Groups					
< 30 yrs (n=92)	16 (17.4%)	8 (8.7%)	4 (4.3%)	40 (43.5%)	72 (78.3%)
30-39 yrs (n=132)	44 (33.3%)	44 (33.3%)	12 (9.1%)	52 (39.4%)	112 (84.8%)
40-49 yrs (n=208)	76 (36.5%)	76 (36.5%)	48 (23.1%)	96 (46.2%)	140 (67.3%)
50+ yrs (n=128)	84 (65.6%)	44 (33.4)	4 (3.1)	72 (56.3%)	88 (68.8%)
P Value	**0.00**	**0.00**	**0.00**	**0.048**	**0.00**
Obesity (BMI)					
Normal # (n=140)	44 (31.4%)	0 (0%)	16 (11.4%)	64 (45.7%)	52 (37.1%)
Overweight (n=309)	129 (41.7%)	97 (31.4%)	32 (10.4%)	141 (45.6%)	70 (22.7%)
All Obese (n=111)	47 (42.3%)	75 (67.6%)	20 (18.0%)	55 (49.5%)	26 (23.4%)
P Value	**0.07**	**0.00**	**0.29**	**0.41**	**<0.01**
Total	**220 (39.3%)**	**172 (30.7%)**	**68 (12.1%)**	**260 (46.4%)**	**412 (73.6%)**

 # Include normal and underweight. (Only 2 participants were in the underweight category).

Prevalence of Metabolic Syndrome by Socio-demographic and Clinical Characteristics

Analysis of metabolic syndrome prevalence by socio-demographic and clinical characteristics is shown in Table (6). Prevalence of metabolic syndrome varied significantly between age groups and job categories. Older participants and those in the academic career had significantly higher prevalence of metabolic syndrome than younger people and than those with administrative jobs. It appears that factors associated with obesity such as body mass index and practicing regular exercise are also associated with metabolic syndrome. Higher body mass index and not practicing regular exercise are significantly linked with metabolic syndrome development. Additionally, higher total serum cholesterol is also associated with higher prevalence of metabolic syndrome.

Table (7) shows the unadjusted and adjusted odds ratios for some selected risk factors associated with metabolic syndrome among participants. Being in the older age group (40 years and above), being a Saudi national, smoking, not doing regular exercise, obesity and having total serum cholesterol above 180 mg/dl are associated significantly with metabolic syndrome. After controlling for all other variables, the job category was not found to be associated with metabolic syndrome. Association between metabolic syndrome and age increased steadily with increasing age, whereas the significant association was only observed with age groups of 40-49 years and ≥ 50 years. A strong association was also found between obese persons who have a BMI $\geq$ 30 kg/m^2 and having metabolic syndrome, however the overweight category was not significantly associated with metabolic syndrome.

Discussion

This study estimates the prevalence of metabolic syndrome among employees of Qassim University in Saudi Arabia using the NCEP-ATPIII criteria. The prevalence of the syndrome (31.4%) in the study population was found to conform to the rates found in other studies, both in Saudi Arabia and elsewhere. Using the NCEP-ATPIII criteria, Al-Nozha *et al* [11] in a household study that included a big sample of 17.293 subjects of both males and females between 30-70 years of age found an overall age-adjusted prevalence of 39.3%. In Al-Nozha study prevalence of metabolic syndrome among females was significantly higher than among males and significantly higher in urban than in rural areas. The leading factors contribution to the metabolic syndrome in Al-Nozha study was low high density lipoprotein . Al-Qahtani et al [10] found an age-adjusted prevalence of 20.8% among military personnel. Ford et al [14] found an age-adjusted prevalence of 23.9% using the data from a nationally representative sample of American citizens derived from a cross-sectional health survey. Alexander *et al* [15] found a prevalence of 43.5% among subjects older than 50 years from the data derived from the same survey as Ford *et al*. Japer

et al [8] found a prevalence of 23% among Arab Americans in their study in 2004. Meigs *et al* [16] studied a large multi-ethnic cohort demographically representative of the US population and found an overall prevalence of the syndrome in 24% of the general population, with an inter-ethnic variation of 21-31%. Villegas *et al* [17] found a prevalence of 20.7% among Irish middle-aged men and women. Using the WHO definition of metabolic syndrome, Abdul-Rahim *et al* [7] found a prevalence of 17% among the Palestinians in the West Bank. Al-Lawati *et al* [6] in their study of the prevalence of the syndrome among Omani adults found a prevalence of 21%.

In our study, the prevalence of metabolic syndrome (based upon presence of 3 or more criteria) among employees of Qassim University was 31.4%. The prevalence showed a steady increase with increasing age, BMI and serum cholesterol. General obesity measured by BMI was the most common component of the syndrome where 75% of participants suffered from overweight and obesity. Dyslipidemia was also very common. Participants with high-density lipoprotein below protective level constituted 73.6%, while those with total cholesterol and triglyceride above clinically normal level constituted 60.0% and 46.4% respectively. Fasting plasma glucose and hypertension were the least common. Older individuals and those with higher BMIs were found to have a higher concentration of the factors. This observation was evident across all groups of participants whether having one or more factors.

Table (6). Prevalence of Metabolic Syndrome by Socio-demographic & Clinical Characteristics.

Characteristics	Prevalence (Percent)	P-value*
Nature of Job		
Academic	37.7	0.006
Administrative	26.6	
Nationality		
Saudi	28.9	0.138
Non-Saudi	35.1	
Smoking		
Non-smoker	30.2	0.068
Smoker	42.9	
Physical Activity		
Not doing regular exercise	35.6	0.001
Doing regular exercise	20.5	
Obesity		
Normal (BMI < 25.0)1	20.0	<0.001
Overweight (BMI:25.0-29.9)	26.9	
Obese (BMI ≥30.0)2	58.6	
Age group		
< 30 yrs	13.0	<0.001
30-39 yrs	27.3	
40-49 yrs	32.7	
≥ 50 yrs	46.9	
Total serum cholesterol		
≤ 180 mg/dl	23.2	0.001
> 180 mg/dl	36.9	

**P-value indicates statistical significance of the difference between categories.*
1 Only 2 participants had BMI < 18.5
2 only 4 participants had BMI 35.0=39.9; no participants had BMI≥40.0

Table (7). Unadjusted and Adjusted Odds Ratios of Metabolic Syndrome for Selected Socio-demographic & Clinical Characteristics.

Characteristics	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95%CI) *
Nature of Job		
Academic (Ref.)		
Administrative	0.60 (0.42-0.86)	1.36 (0.27-2.56)
Nationality		
Saudi (Ref.)		
Non-Saudi	1.33 (0.93-1.91)	0.53 (0.28-1.01)
Smoking		
Non-smoker (Ref.)		
Smoker	1.74 (0.99-3.05)	3.03 (1.53-6.00)
Physical Activity		
Not doing regular exercise (Ref.)		
Doing regular exercise	0.47 (0.30-0.72)	0.51(0.31-0.84)
Obesity		
Normal (BMI < 25.0) (Ref.)		
Overweight (BMI:25.0-29.9)	1.45 (0.91-2.39)	1.37 (0.79-2.37)
Obese (BMI ≥30.0)	5.65 (3.23-9.90)	6.42 (3.44-11.97)
Age group		
< 30 yrs (Ref.)		
30-39 yrs	2.50 (1.22-5.12)	2.05 (0.93-4.51)
40-49 yrs	3.24 (1.65-6.34)	2.96 (1.38-6.33)
≥ 50 yrs	5.88 (2.92-11.83)	7.53 (3.30-17.18)
Total serum cholesterol		
≤ 180 mg/dl (Ref.)		
> 180 mg/dl	1.94 (1.32-2.83)	1.85 (1.19-2.88)

** Odds ratio are adjusted for all the variables shown in this table, using binary logistic regression*

After controlling for their confounding effects, all studied socio-demographic and clinical factors except nature of the job were found to be significantly associated with metabolic syndrome. Expatriates were less likely to have metabolic syndrome than their Saudi counterparts, although the difference was marginally significant (adjusted odds ratio: 0.53; 95% confidence limits: 0.28, 1.01). Smoking, not doing regular exercise, frank obesity, having total serum cholesterol above 180 mg/dl, and older age (above 40 years) were all significantly associated with metabolic syndrome.

Our study, though not representative of the population of Saudi Arabia, brings forth some striking results. It is obvious that prevalence of metabolic syndrome is alarmingly high among our study population. Equally alarming is the fact that the prevalence of risk factors for metabolic syndrome and its associated diseases (diabetes and hypertension) is very high: smoking is common and proportion of those doing regular exercise is low. After controlling for the effects of age, job category, smoking, exercise and blood cholesterol level, it is obvious that native Saudi citizen are at a higher risk of developing metabolic syndrome.

The components of the metabolic syndrome, such as central obesity and diabetes mellitus, are particularly common amongst the Saudi population – as shown by various other studies. It is projected that the prevalence of these diseases is rising at a faster rate in Saudi Arabia than in other parts of the world [18]. Therefore, it is vital to conduct nationwide research studies to obtain more specific and representative data. However, available evidence is strong enough to suggest that immediate intervention health programs must be developed to encourage healthier lifestyles, improve dietary habits, promote physical activity and exercise and discourage smoking among Saudi citizens.

The response rate in our study was satisfactory (85 %). Non-response may be due to,

among other factors, the low level of health awareness (or consciousness about one's own health) among university employees. It also indicates that those participating in the study were either more health conscious than the non-participants, or that they had a suspicion about their being completely healthy, or both. We believe, however, that the former is a more likely reason for participation, which leads to the conjecture that our results might be over-estimate of actual situation (because of over-representation of high risk population in our study).

Another limitation of the study is related to the recruitment of the subjects. Although invitation to participate was forwarded to every personnel; however, the participation was voluntary and those who participated are expected to be those who are more health conscious or those who already have information about their health condition and participated for rechecking and reassurance.

In addition, it is worth noting that the subjects in our study were exclusively males. Therefore the gender difference in the estimation of metabolic syndrome prevalence could not be assessed. Also, the role of predicting factors associated with metabolic syndrome that vary between sexes such as body mass index and waist circumference could not be evaluated.

The prevalence of metabolic syndrome in the general Saudi population is likely to be less than the estimated prevalence in the present study since the population of this study was older in age than the general population where the majority of participants were above 30 years of age. Moreover, participants of this study were academics and holding administrative careers with more expected sedentary life style which have a direct influence on most criteria of metabolic syndrome

This study has shown that almost a third of the university personnel have metabolic syndrome and therefore they are at higher risk for both cardiovascular disease and diabetes mellitus. Similar studies are required among a wider range of subjects to assess the scope of the problem in Saudi Arabia.

Physician at primary health care should be motivated to identify the problem and implement necessary remedial and preventive measures focusing on weight control, increased physical exercise, stopping smoking, controlling dyslipidemia, hypertension and diabetes. General population should be educated to raise their consciousness toward their health and the value of screening. They should be oriented toward the risks of obesity, physical inactivity and smoking. Control of this syndrome among population is of vital importance and requires the attention of all health professionals.

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