Research Article

The prevalence of metabolic syndrome among chronic disease patients in Alwazarat health center at Prince Sultan Military Medical City, Riyadh, Saudi Arabia, 2014

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Abstract

Background: The presence of metabolic syndrome (MS) results in heart attacks twice the time in people with MS and in thrice the time the chances of experiencing a heart attack or stroke in those with MS when compared with normal individuals. Identifying individuals with MS appropriately and managing them at early stages are important.

Objective: To measure the prevalence of MS using the NECP/ATP III and the WHO criteria and compare the differences between the two criteria in assessing the prevalence of disease in addition to identifying the different factors associated with MS among chronic disease patients in primary health care.

Materials and Methods: A cross-sectional study was carried out at chronic disease clinics in Alwazarat primary care center during the period between February and March 2014. It included a sample of 250 patients attending the chronic disease clinics. A questionnaire was designed to interview the patients and collect the information regarding their socioeconomic status, smoking habits, physical activity, and history of diabetes mellitus (DM), hypertension, and dyslipidemia. Information about their body mass index, blood pressure measurement, and the laboratory tests were recorded in a different checklist.

Result: The prevalence of MS among the patients based on the NECP/ATP III and the WHO criteria was 36% and 39.1%, respectively. On the basis of both the criteria together (NECP/ATP III and the WHO), the prevalence of MS was 29.3%. High fasting blood sugar was the highest prevalent component of MS based on the NECP/ATP III criteria (96.3%), followed by low HDL-cholesterol level (82.7%) and abdominal obesity (76.5%), while the highest prevalent component of MS based on the WHO criteria, in addition to impaired glucose level, was obesity (59.1%), followed by high triglycerides level (53.2%), and low HDL-cholesterol level (40.9%). Obesity, ex-smoking, and history of DM, hypertension, and dyslipidemia together were significantly associated with MS.

Conclusion: This study showed that there is no significant difference between the WHO criteria and NECP/ATP III criteria for the diagnosis of MS. The approach to the management of all cardiovascular risk factors as MS must be considered.

KEY WORDS: Metabolic syndrome, dyslipidemia, WHO criteria, NECP/ATP III criteria, Saudi Arabia

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Introduction

The aggregation of multiple cardiovascular risk factors was first observed by Kylin, early in the twentieth century, when he described a syndrome involving hypertension, hyperglycemia, and hyperuricemia.[1] In the 1940s ,Vague wrote about abdominal obesity and fat distribution and their relation to diabetes mellitus (DM) and other disorders.[2] Then, Avogaro and

Crepaldi submitted an abstract at the European Association for the Study of Diabetes annual meeting, in 1965, which also reported a syndrome that involved hypertension, hyperglycemia, and obesity.[3] A further significant improvement in the subject occurred after the 1988 Banting Lecture was given by Gerry Reaven. He described "a cluster of risk factors for diabetes and cardiovascular disease" and named it "Syndrome X."[4] The insulin resistance approach brought in by him was found to be his key contribution. In 1989, Kaplan renamed the syndrome as "The Deadly Quartet,"[5] and in 1992, it was again renamed as "The Insulin Resistance Syndrome."[6] It is now agreed that the well-established term "metabolic syndrome (MS)" remains the most usual description of this cluster of metabolic abnormalities.[7]

There are several definitions for the MS. The National Cholesterol Education Program (NCEP/ATP III) and the World Health Organization (WHO) definitions are the most widely used. Current ATP III criteria define the MS as the presence of any three of the following five traits: abdominal obesity, defined as a waist circumference >102 cm in men and >88 cm in women; serum triglycerides, ≥150 mg/dL or 1.7 mmol/L; serum HDL cholesterol, <40 mg/dL (1 mmol/L) in men and <50 mg/dL (1.3 mmol/L) in women; blood pressure (BP), ≥130/85 mm Hg; and fasting plasma glucose, ≥110 mg/dL or 5.6 mmol/L.[8]

The factors for the finding of MS involve insulin resistance and two other risk factors from high BP, raised triglycerides, low HDL, increased body mass index (BMI) or increased waist:hip ratio, and microalbuminuria, which is on the contrary to the ATP III criteria. The existence of type 2 DM is also involved in the finding of MS, similar to the ATP III criteria.

Apart from the standard clinical diagnosis, a distinct analysis of the glucose status is done as per the WHO criteria, which sets as a drawback.

The WHO clinical criteria for MS comprise insulin resistance, identified by one of the following: type 2 DM, impaired fasting glucose, impaired glucose tolerance or for those with normal fasting glucose levels (<6.1 mmol/L), glucose uptake below the lowest quartile for the background population under investigation with hyperinsulinemic and euglycemic conditions. In addition, the presence of any of the following:

- antihypertensive medication and/or high BP (≥140 mm Hg systolic or ≥90 mm Hg diastolic BP);
- plasma triglycerides ≥ 1.7 mmol/L;
- HDL-cholesterol <0.9 mmol/L in men or <1.0 mmol/L in women;
- BMI > 30 kg/m^2 and/or waist:hip ratio >0.9 in men and >0.85 in women;
- Urinary albumin excretion rate ≥ 20 μg/min or albumin: creatinine ratio ≥ 3.4 mg/mmol.[9]

On the basis of the definition applied and the study area, it was found that the prevalence of MS in Saudi adults ranged from 16% to 40%. A reduction in the missed cases might happen by the application of the consensus definition.[10]

The presence of metabolic syndrome (MS) results in heart attacks twice the time in people with MS and in thrice the time the chances of experiencing a heart attack or stroke in those with MS when compared with normal individuals.[11] In addition, almost 200 million people, globally, reveal DM, and 80% of them will die from cardiovascular disease (CVD)[9]; so, there is an overwhelming moral, medical, and economic imperative to identify those individuals with MS early, so that lifestyle interventions and treatment may prevent the development of DM and/or CVD.[12]

The aim of this study is to determine the impact of identifying MS and manage the condition from a holistic approach.

Materials and Methods

This cross-sectional study was conducted in Alwazarat primary health-care center that is part of the medical services of the Ministry of Defense of Saudi Arabia. It occupies the main region in Riyadh, where the majority of ministries and two other hospitals are present nearby. Approximately, 250,000 people are present, including the majority of military personnel, ministry of defense staff, and their dependent families. About 40 clinics are being operated each day in sessions starting from 8 a.m. to 4 p.m. The staffs of general practitioners, including from senior house officers to senior family medicine consultants of both genders manage the clinic. A total of 9,200 patients registered in the chronic diseases clinic (six clinics), Alwazarat primary health-care center. These clinics work in two shifts (morning from 8 a.m. to 12 p.m. and afternoon from 1 p.m. to 4 p.m.). The data were collected during the period between February 2014 and March 2014.

The population of the study included the patients who were registered in the chronic diseases clinics of Alwazarat primary health-care center. All the patients aged 20 years and older were included in the study, and only female subjects who were pregnant were excluded. It was estimated that a sample of 202 patients will be sufficient to represent a statistical significance of 95% confidence interval and at a power of 80%, as calculated by Epi Info Program using the prevalence of 16% (the lowest reported prevalence of MS in Saudi Arabia)[10] . In order to compensate for drop out or incomplete data, this sample was increased to 225 patients.

The sample was chosen by simple random technique. Every working day (Sunday–Thursday), two patients were randomly chosen from each of the six clinics (one from the morning shift and one from the afternoon shift). Thus, a total of 12 patients were chosen per day and 60 per week. So, almost 1 month was needed to complete the sample selection.

The data collection sheet included three parts. The first part contained the sociodemographic data. The second part included a check list about the smoking habits (smoking cigarette or shisha, ex-smoker defined as quit smoking for more than 1 year), physical activity (defined as doing regular exercise for 5, 3, or 1 day per week for 30 min), history of DM and hypertension, any medication for the treatment of DM, hypertension, or dyslipidemia. The last part contained the results of measurement including measurement of BP, BMI, waist circumference, fasting blood glucose and fasting HDL,

triglycerides, cholesterol, and albumin:creatinine ratio. The NCEP/ATP III and the WHO definitions were utilized to determine the criteria to diagnose MS.

Through the workshop, the researcher trained four nurses who were divided to cover both the shifts and both the sections, about how to measure the waist circumference and BP. The waist circumferences were measured by locating the top of right iliac crest and then a measuring tape placed in a horizontal plane around the abdomen at the level of iliac crest. The tape measure was parallel to the floor and not compressing the skin. The measurement was done at the end of a normal expiration.[13] The patient should not smoke or consume caffeine1 h before measuring the BP. The patient was in a quiet room for 5 min. The BP was measured while the patient sat with the back supported and legs uncrossed. An appropriate cuff size was chosen, and the arm was supported to the heart level and not covered with clothes. The BP was measured using automatic BP measuring device. The height and weight were measured with light clothes and no shoes, and the BMI was calculated by dividing weight in kilograms (kg) by height in meter squared (m^2) (kg/m^2). Then, the patient went to the laboratory where the blood samples for measuring glucose, HDL, total cholesterol, and triglycerides were taken by a nurse. The patient was fasting for 12 h. If the patients were not fasting, they took an appointment in the next day to do the investigations. All of these measurements were filled in the data collection sheet by the researcher. For the laboratory results, they were taken from the computer system once they were available. After that, they were collected, coded, and entered to a personal computer.

A written permission from the Joint Program of Family and Community Medicine and ethical approval from the local Ethical committee were obtained before the conduction of the research. A written individual consent was taken before taking part in the study, and the patient knew the result of his\her investigation and measurements.

The data were collected and analyzed using SPSS software, version 20. Continuous variables were presented as mean and standard deviation (SD). Categorical variables were presented as frequency and percentage. For bivariate analysis, χ^2-test was applied to test for the association and/or difference between the categorical variables. The significance was determined at $p < 0.05$.

Result

The study included 225 patients. Their age ranged between 32 and 86 years with a mean ± SD of 55.6 ± 12.7 years. Table 1 summarized their baseline characteristics. Slightly more than half the number of them was men (52.4%). Almost two-third (68.4%) men were nonsmokers, whereas 12.9% and 17.8% were current or ex-smokers, respectively. Almost two-thirds of them (63.6%) were physically inactive, whereas only 10.7% practiced regular activities for 30 min in 5 days or more per week. History of DM, hypertension, and dyslipidemia were reported among 87.1%, 59.1%, and 57.3% of the participants, respectively. Family history of DM, hypertension, and obesity were reported among 67.6%, 27.6%, and 28.9% of them, respectively.

From Table 2, it is clear that the men showed significant higher diastolic BP (76.67 ± 8.68 mm Hg versus 70.58 ± 8.69 mm Hg), higher waist circumference (99.68 ± 14.09 cm versus 92.50 ± 17.17 cm), and lower BMI (25.63 ± 4.74 kg/m^2 versus 28.78 ± 66.8 kg/m^2) than women.

Prevalence of Metabolic Syndrome

As evident from Figure 1, the prevalence of MS among patients based on NECP/ATP III criteria was 36%. Figure 2 shows that the prevalence of MS based on the WHO criteria

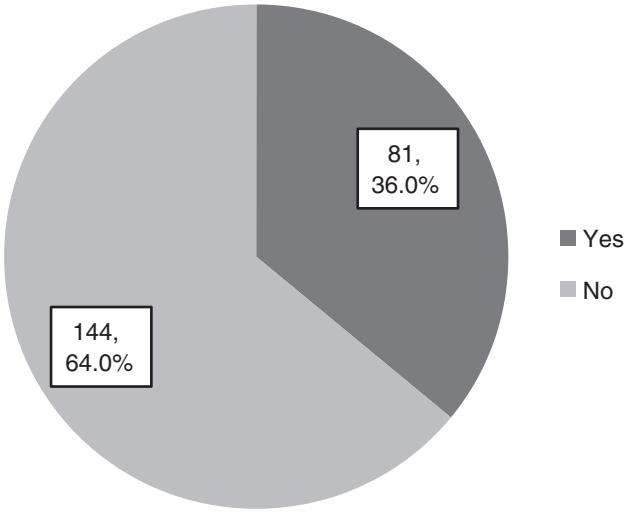

Figure 1: Prevalence of the MS based on the NECP/ATP III criteria among the studied patients registered in the chronic diseases clinics in Alwazarat primary health-care center, Riyadh.

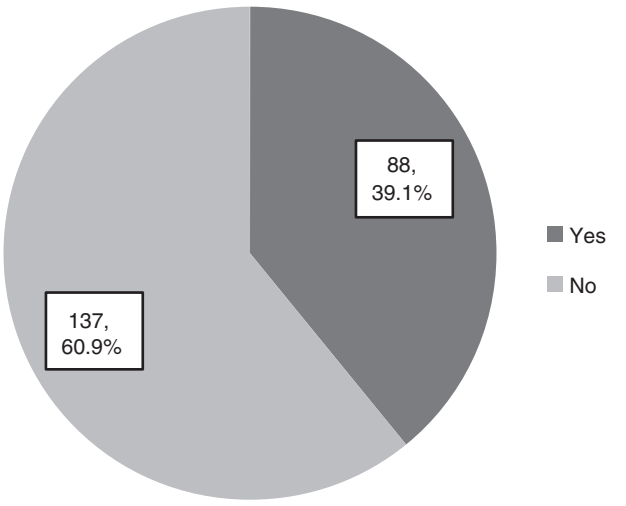

Figure 2: Prevalence of the MS based on the WHO criteria among the studied patients registered in the chronic diseases clinics in Alwazarat primary health-care center, Riyadh.

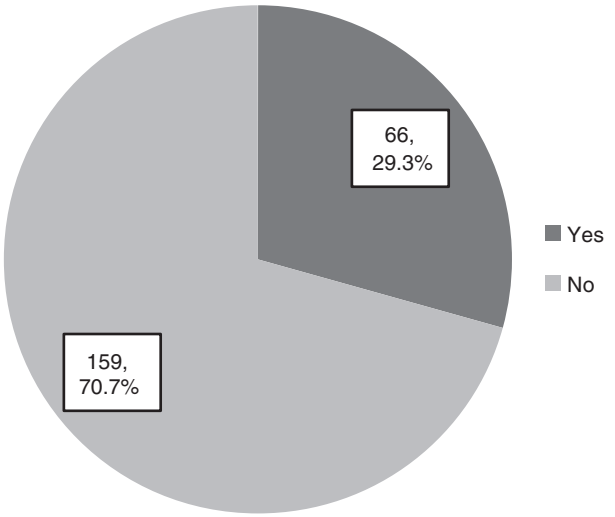

Figure 3: Prevalence of the MS based on both the NECP/ATP III and the WHO criteria among the studied patients registered in the chronic diseases clinics in Alwazarat primary health-care center, Riyadh.

was 39.1%. On the basis of both the criteria together (NECP/ATP III and the WHO), the prevalence of MS was 29.3%, as shown in Figure 3.

Components of Metabolic Syndrome

Table 3 presents the prevalence of different components of MS based on the NECP/ATP III criteria. High fasting blood sugar was the highest prevalent component (96.3%), followed by low HDL-cholesterol level (82.7%) and abdominal obesity (76.5%).

The highest prevalent component of MS based on the WHO criteria, in addition to impaired glucose level was obesity (59.1%), followed by high triglycerides level (53.2%) and low HDL-cholesterol level (40.9%), as shown in Table 4.

Factors Associated with Metabolic Syndrome

Metabolic Syndrome (Based on NECP/ATP III Criteria)

From Table 5, it is realized that ex-smokers reported a higher prevalence rate of MS (47.6%) when compared with nonsmokers (26.4%) and current smokers (17.2%). The difference was statistically significant (p = 0.032). Obese patients (BMI > 30 kg/m^2) were more likely to develop MS than nonobese patients (<30 kg/m^2) (61.5% versus 22.4%). The difference was statistically significant (p < 0.001). Other studied factors (sex, age, physical activity, medical, and family histories) were not significantly associated with MS based on the NECP/ATP III criteria.

Metabolic Syndrome (Based on the WHO Criteria)

Table 6 demonstrates that patients with history of DM, hypertension, and dyslipidemia together reported a higher prevalence rate of MS (52.1%) when compared with people with only hypertension (6.2%), only DM (33.3%), and with hypertension and dyslipidemia (16.7%). The difference was statistically significant (p = 0.005). Other studied factors (sex, age, smoking, physical activity, and family histories) were not significantly associated with MS based on the WHO criteria.

Metabolic Syndrome (Based on Both the NECP/ATP III and the WHO Criteria)

From Table 7, it is realized that ex-smokers reported a higher prevalence rate of MS (45.2%) when compared with nonsmokers (28.6%) and current smokers (10.3%). The difference was statistically significant (p = 0.006). Patients with history of DM, hypertension, and dyslipidemia together reported a higher prevalence rate of MS (42.5%) when compared with people with only hypertension (6.3%), only DM (25.0%), and with hypertension and dyslipidemia (16.7%). The difference was statistically significant (p = 0.020). Other studied factors (sex, age, physical activity, and family histories) were not significantly associated with MS based on both the NECP/ATP III and the WHO criteria.

Discussion

This study estimates the prevalence of MS among patients aged older than 20 years who attended chronic diseases clinics, Alwazarat primary health-care center in PSMC, Riyadh, in 2014, using the NCEP-ATP III and the WHO criteria. It was found that the prevalence of MS among patients, based on the NECP/ATP III criteria, was 36%, and the prevalence of MS based on the WHO criteria was 39.1%. On the basis of both the criteria together (NECP/ATP III and the WHO), the prevalence of MS was 29.3%.

Al-Nozha et al.[14] found that the MS is highly prevalent in male and female subjects in KSA. The overall prevalence of MS in Saudi Arabia is affecting slightly more than one-third of the Saudi population. In accordance with their results, this study revealed that the prevalence of MS among the study population, based on the NECP/ATP III criteria, was 36%, while its prevalence was 39.1% based on the WHO criteria and 29.3% based on both the criteria together. These alarming figures place a large proportion of the Saudi community at increased risk for the development of coronary artery disease (CAD), DM, and hypertension.

The MS is considered a risk factor for incident CAD, as has been shown by several studies.[11,15–19] In addition, researchers established association with other disorders including fatty liver disease, polycystic ovary syndrome, sleep-disordered breathing, and chronic kidney disease.[20–23]

In a study conducted to estimate the prevalence of MS among the employees of Qassim University in Saudi Arabia using the NCEP-ATP III criteria, a prevalence of 31.4% was reported.[24]

Al-Qahtani et al [13] found an age-adjusted prevalence of MS to be 20.8% among the military personnel. Ford et al.[25] found an age-adjusted prevalence of MS to be 23.9% using the data

Table 1: Baseline characteristics of the studied patients registered in the chronic diseases clinics in Alwazarat primary health-care center, Riyadh

Baseline characteristics	Frequency	Percentage
Sex		
Males	118	52.4
Females	107	47.6
Age (years)		
≤50	83	36.8
51–60	60	26.7
61–70	49	21.8
>70	33	14.7
Smoking		
Current smoker	29	12.9
Nonsmoker	154	68.4
Ex-smoker	42	18.7
Physical activity		
Regular activities for 30 min in 5 days or more per week	24	10.7
Regular activities for 30 min in 3 days per week	44	19.6
Regular activities for 30 min in for 1 day per week	14	16.2
No regular activities	143	63.6
Medical history[a]		
DM or taking medication for DM	196	87.1
Hypertension or taking medication for hypertension	133	59.1
Dyslipidemia or taking medication for dyslipidemia	129	57.3
Family history[b]		
DM	152	67.6
Hypertension	62	27.6
Obesity	65	28.9
None	60	26.7

[a]Some patients were diagnosed with DM, HTN, and dyslipidemia.
[b]Some patients revealed more than one family history of DM, HTN, and obesity.

Table 2: Gender differences in the laboratory investigations and physical examinations among the studied patients registered in the chronic disease clinic of Alwazarat primary health-care center, Riyadh

	Males (*µã*= 118) mean ± SD	Females (n = 107) mean ± SD	*Á*
Triglycerides (mmol/L)	1.61 ± 1.03	1.43 ± 0.72	0.134
HDL cholesterol (mmol/L)	1.21 ± 0.93	1.41 ± 0.94	0.111
Fasting blood glucose (mmol/L)	7.96 ± 4.80	7.41 ± 2.73	0.295
SBP (mm Hg)	125.90 ± 13.28	122.87 ± 12.85	0.084
DBP (mm Hg)	76.67 ± 8.68	70.58 ± 8.69	<0.001
Waist circumference (cm)	99.68 ± 14.09	92.50 ± 17.17	0.001
BMI (kg/m^2)	25.63 ± 4.74	28.78 ± 66.8	<0.001
Serum albumin: creatinine ratio (mg/mmol)	4.43 ± 12.32	3.09 ± 6.11	0.309

Table 3: Prevalence of components of the MS based on the NECP/ATP III criteria among the studied patients registered in the chronic diseases clinics in Alwazarat primary health-care center, Riyadh

	Frequency	Percentage
Abdominal obesity	62	76.5
High triglycerides	52	64.2
Low HDL cholesterol	67	82.7
High BP	15	18.5
High fasting blood glucose	87	96.3

Table 4: Prevalence of the components of the MS based on the WHO criteria among the studied patients registered in the chronic diseases clinics in Alwazarat primary health-care center, Riyadh

	Frequency	Percentage
High triglycerides	47	53.2
Low HDL-cholesterol	36	40.9
High BP and/or hypertensive medications	8	9.1
Obesity	52	59.1
High urinary albumin excretion rate	12	13.6

Table 5: Factors associated with the MS based on the NECP/ATP III criteria among the studied patients registered in the chronic diseases clinics in Alwazarat primary health-care center, Riyadh

	MS (NECP/ATP III)		χ^2 (p)
	No (μ = 144), μ (%)	Yes (μ = 81), μ (%)	
Sex			
Male	74 (62.7)	44 (37.3)	0.18 (0.672)
Female	70 (65.4)	37 (34.6)	
Age (years)			
≤50	50 (60.2)	33 (39.8)	1.67 (0.638)
51–60	38 (63.3)	22 (36.7)	
61–70	35 (71.4)	14 (38.6)	
>70	21 (63.6)	12 (36.4)	
Smoking			
Current smoker	24 (82.8)	5 (17.2)	6.90 (0.032)
Nonsmoker	98 (63.6)	56 (36.4)	
Ex-smoker	22 (52.4)	20 (47.6)	
Physical activity			
Regular activities for 30 min in 5 days or more per week	11 (45.8)	13 (54.2)	4.17 (0.243)
Regular activities for 30 min in 3 days per week	30 (68.2)	14 (31.8)	
Regular activities for 30 min in 1 day per week	10 (71.4)	4 (28.6)	
No regular activities	93 (65.0)	50 (35.0)	
Medical history			
DM	33 (68.8)	15 (31.3)	7.12 (0.212)
Hypertension	12 (75.0)	4 (25.0)	
DM + hypertension	22 (68.8)	10 (31.3)	
DM + dyslipidemia	28 (63.6)	16 (36.4)	
Hypertension + dyslipidemia	10 (83.3)	2 (16.7)	
All	39 (53.4)	34 (46.6)	
Family history			
None	38 (63.3)	22 (36.7)	3.52 (0.742)
DM	43 (63.2)	25 (36.8)	
Hypertension	7 (70.0)	3 (30.0)	
DM + hypertension	12 (54.5)	10 (45.5)	
DM + obesity	21 (60.0)	14 (40.0)	
Hypertension + obesity	2 (66.7)	1 (33.3)	
All	21 (77.8)	6 (22.2)	
BMI (kg/m^2)			
≤30	114 (77.6)	33 (22.4)	33.80 (<0.001)
>30	30 (38.5)	48 (61.5)	

Table 6: Factors associated with the MS based on the WHO criteria among the studied patients registered in the chronic diseases clinics in Alwazarat primary health care center, Riyadh

	MS (the WHO)		χ^{l} ä(Á)
	No (μ = 137), μ (%)	Yes (μ = 88), μ (%)	
Sex			
Male	75 (63.6)	43 (36.4)	0.74 (0.389)
Female	62 (57.9)	45 (42.1)	
Age (years)			
≤50	48 (57.8)	35 (42.2)	1.45 (0.693)
51–60	35 (58.3)	25 (41.7)	
61–70	33 (67.3)	16 (32.7)	
>70	21 (63.6)	12 (36.4)	
Smoking			
Current smoker	23 (79.3)	6 (20.7)	5.0 (0.082)
Nonsmoker	91 (59.1)	63 (40.9)	
Ex-smoker	23 (54.8)	19 (45.2)	
Physical activity			
Regular activities for 30 min in 5 days or more per week	11 (45.8)	13 (54.2)	3.05 (0.384)
Regular activities for 30 min in 3 days per week	27 (61.4)	17 (38.6)	
Regular activities for 30 min in 1 day per week.	10 (71.4)	4 (28.6)	
No regular activities	89 (62.2)	54 (37.8)	
Medical history			
DM	32 (66.7)	16 (33.3)	18.78 (0.005)
Hypertension	15 (93.8)	1 (6.2)	
DM + hypertension	22 (68.8)	10 (31.3)	
DM + dyslipidemia	22 (51.2)	21 (48.8)	
Hypertension + dyslipidemia	10 (83.3)	2 (16.7)	
All	35 (47.9)	38 (52.1)	
Family history			
None	34 (56.7)	26 (43.3)	5.73 (0.454)
DM	44 (64.7)	24 (35.3)	
Hypertension	7 (70.0)	3 (30.0)	
DM + hypertension	10 (45.5)	12 (54.5)	
DM + obesity	21 (60.0)	14 (40.0)	
Hypertension + obesity	3 (100)	0 (0.0)	
All	18 (66.7)	9 (33.3)	

from a nationally representative sample of American citizens derived from a cross-sectional health survey. Alexander et al.[26] found a prevalence of MS to be 43.5% among subjects older than 50 years from the data derived from the same survey as Ford et al. Jaber et al.[27] found a prevalence of 23% among Arab Americans in their study in 2004. Meigs et al.[28] studied a large multiethnic cohort demographically representative of the US population and found an overall prevalence of the syndrome in 24% of the general population, with an interethnic variation of 21%–31%. Villegas et al.[29] found a prevalence of 20.7% of MS among Irish middle-aged men and women. Using the WHO definition of MS, Abdul-Rahim et al.[30] found a prevalence of 17% of MS among the Palestinians in the West Bank. Al-Lawati et al.,[31] in their study of the prevalence of the syndrome among Omani adults, found a prevalence of 21%.

Increased body weight plays the most important role. The observed prevalence of the MS in NHANES-III was 5% among the subjects of normal weight, 22% among the overweight, and 60% among the obese.[32] Moreover, a number of findings indicate that obesity (the cardinal feature of the MS) as an independent factor for causing renal dysfunction.[32] It is likely that the prevalence of MS will probably increase in the coming years owing to the rapidly increasing prevalence of obesity among adults in Saudi Arabia. In our study, the prevalence of obesity defined by BMI > 30 kg/m^2 was 59.1%. In Qassim, the prevalence of MS showed a steady increase with increasing age and BMI.[24] However, in this study, MS, regardless of the

Table 7: Factors associated with the MS based on the NECP/ATP III and the WHO criteria among the studied patients registered in the chronic diseases clinics in Alwazarat primary health-care center, Riyadh

	MS (both)		χ^{i} ä(Á)
	No (μ = 159), μ (%)	Yes (μ = 66), μ (%)	
Sex			
Male	84 (71.2)	34 (28.8)	0.03 (0.875)
Female	75 (70.1)	32 (29.9)	
Age (years)			
≤50	56 (67.5)	27 (32.5)	2.82 (0.420)
51–60	40 (66.7)	20 (33.3)	
61–70	39 (79.6)	10 (20.4)	
>70	24 (72.7)	9 (27.3)	
Smoking			
Current smoker	26 (89.7)	3 (10.3)	10.21 (0.006)
Nonsmoker	110 (71.4)	44 (28.6)	
Ex-smoker	23 (54.8)	19 (45.2)	
Physical activity			
Regular activities for 30 min in 5 days or more per week.	13 (54.2)	11 (45.8)	4.00 (0.261)
Regular activities for 30 min in 3 days per week.	33 (75.0)	11 (25.0)	
Regular activities for 30 min in 1 day per week.	11 (78.6)	3 (21.4)	
No regular activities	102 (71.3)	41 (28.6)	
Medical history			
DM	36 (75.0)	12 (25.0)	13.41 (0.020)
Hypertension	15 (93.8)	1 (6.3)	
DM + hypertension	26 (81.3)	6 (18.8)	
DM + dyslipidemia	30 (68.2)	14 (31.8)	
Hypertension + dyslipidemia	10 (83.3)	2 (16.7)	
All	42 (57.5)	31 (42.5)	
Family history			
None	45 (75.0)	15 (25.0)	4.08 (0.665)
DM	47 (69.1)	21 (30.9)	
hypertension	7 (70.0)	3 (30.0)	
DM + hypertension	14 (63.6)	8 (36.4)	
DM + obesity	22 (62.9)	13 (37.1)	
Hypertension + obesity	3 (100)	0 (0.0)	
All	21 (77.8)	6 (22.2)	

diagnostic criteria used, was not significantly associated with the patient's age.

Given that the prevalence of overweight and obesity exceeds 70% in the KSA[33] and that overweight and obese individuals are at a substantially higher risk of revealing MS, these results have important public health implications. Strategies to combat the increasing prevalence of overweight and obesity that also target those with elevated risk factor profiles, including sedentary habits and low cardiorespiratory fitness, are likely to be the most effective in improving the health of the population. The finding in this study that the MS increases significantly among obese patients when compared with normal/overweight categories supports results from NHANES III, in which the odds ratios (ORs) for MS was 25.2 (19.3–32.9) in obese class I and 67.7 (40.5–113.3) in obese class II and III participants, when compared with normal weight subjects.[34] In addition, in another study conducted in the United States, the odds of MS increases across obese categories (OR = 30.6) when compared with normal weight categories.[35] However, in this sample, it is also noteworthy that almost 40% of obese patients did not reveal MS, whereas around one-quarter of nonobese subjects showed MS. Thus, although there is a robust relationship between the level of obesity and the presence of multiple risk factors, there is a considerable variability in the presence of MS within BMI categories. The idea that some obese individuals appear

healthy and display none of the traditional risk factors for chronic disease, including dyslipidemia and insulin resistance, has been reported previously.[36–38]

In a study conducted by Katzmarzyk et al. in the United States,[35] they indicated that the risk of CVD mortality was significantly higher in obese men, regardless of whether they showed MS, than in normal weight men without MS, while the higher risk of all-cause mortality in obese men was limited to those with MS (OR = 1.55, 95%CI = 1.14–2.11). In addition, there was a higher risk of CVD mortality in overweight men with MS (OR = 1.80, CI = 1.10–2.97), but there was no higher risk of CVD mortality in healthy overweight men. Although indirect, these results support the existence of "metabolically normal" obese individuals, which suggests that weight loss is of particular importance for overweight individuals with two or more CVD risk factors.[39] To sum, the results indicate that weight loss should be promoted in all obese individuals but should be more aggressively pursued among overweight and obese individuals accompanied by other risk factors.

Interestingly, this study revealed that ex-smokers showed higher significant rate of MS when compared with nonsmokers and even current smokers. The explanation of this finding could be owing to the possibility that patients who were at risk of CVD/MS owing to other risk factors, such as obesity and dyslipidemia, stopped smoking. However, this finding needs further investigation included full details of smoking (type, frequency, and duration).

Our study, although not representative of the entire adult population of Saudi Arabia, as they are chronic patients, brings forth some striking results. It is obvious that prevalence of MS is high among our study population. In fact, that the prevalence of risk factors for MS and its associated diseases (DM and obesity) are very high.

The components of the MS, such as DM and central obesity, are, particularly, common among the Saudi population, as shown by various other studies.[13,14] It is projected that the prevalence of these diseases is rising at a dramatic rate in Saudi Arabia than in the other parts of the world.[40] 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 program for MS must be developed to encourage healthier lifestyles, improve dietary habits, promote physical activity and exercise, and discourage smoking among Saudi citizens.

Conclusion

In conclusion, this study has shown that there is no significant difference between the WHO criteria and the NECP/ATP III criteria for diagnosis of the MS. The prevalence of MS among the study population, based on the NECP/ATP III criteria, was 36%, while its prevalence was 39.1% based on the WHO criteria and 29.3% based on both the criteria together. More than one-third of the patients attended chronic diseases clinics, Alwazarat primary health-care center in PSMC, Riyadh, in 2014, showed MS. Therefore, they are at a higher risk for both CVDs and MS. MS was more prevalent among obese patients, ex-smokers, and patients with DM, hypertension, and dyslipidemia together.

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