Impact of metabolic syndrome's components on the development of cardiovascular disease in a Jordanian cohort with metabolic syndrome

Fares H. Haddad, JBED, FRCP (Edin), Shaher M. Mahafza, MD, JBIM.

ABSTRACT

الأهداف: لتقييم اختلافات الجنس في انتشار داء السكري وتصلب الشرايين (التاجية والدماغية)، ومكونات المتلازمة الاستقلابية (MS) في مجموعه من المرضى الأردنيين المصابين بداء المتلازمة الاستقلابية (MS)، وتقييم تأثير عدد مكونات المتلازمة الاستقلابية (MS) على انتشار داء السكري، وتصلب الشرايين التاجية (IHD)، والحوادث الوعائية الدماغية.

الطريقة: أجريت دراسة على مجموعة من المرضى الذين انطبقت عليهم معايير البرنامج الوطني لثقافة الكولسترول (NCEP) ومعايير اللجنة الثالثة لعلاج البالغين في المرضى المصابين بداء المتلازمة الاستقلابية (ATPIII)(MS). تم إجراء هذه الدراسة في عيادات الباطنية والغدد الصماء في مدينه الحسين الطبية – عمان، ومستشفى الأمير راشد العسكري – إربد – الأردن، خلال الفترة مابين ديسمبر 2006م وحتى ديسمبر2007م. قُسم المرضى إلى مجموعتين وذلك طبقاً للجنس، وإصابتهم أو عدم إصابتهم بداء السكري، كما تم قياس ومقارنة متوسط مكونات المتلازمة الاستقلابية (MS)، ونسبة المجاميع الفرعية الشاذة والأخطار النسبية لحدوث أمراض الشرايين التاجية (IHD) أو أمراض الأوعية الدماغية.

النتائج: شملت الدراسة ثلاثمائة وسبعة وخمسون مريضاً منهم (207 ذكر) و (150 أنثى). النوع الثاني من داء السكري كان موجوداً في 226 مريض (132 ذكرا). لم يكن هناك اختلاف بين المجموعات فيما يتعلق بمحيط الخصر، ضغط دم الانقباضي أو الانبساطي (SBP–DBP)، ولا حتى مستوى السكر الصيامي (FBS). مستوى الدهنيات كان سيئ في مجموعة الإناث عنه في مجموعة الذكور، أي مستوى عالي من الدهنيات الثلاثية، ومستوى منخفض من الكولسترول عالي الكثافة. تميزت مجموعة الذكور بوجود أكثر لمكونات المتلازمة الاستقلابية (MS) من مجموعة الإناث. كانت مجموعة الذكور المصابة بداء السكري لديها أمراض الشرايين التاجية (CCVD) والدماغية بنسبة أكبر (RR=1.88, 95% CI: 1.01–3.59) لم يكن هناك اختلاف في انتشار أمراض الشرايين التاجية والدماغية (CCVD) سواء في مجموعة الإناث المصابة بداء السكري، والمجموعة الغير مصابة بداء السكري، أو بين مجموعة الذكور والإناث المصابين بداء المتلازمة الاستقلابية (MS). هناك زيادة في انتشار داء السكري وأمراض الشرايين التاجية والدماغية كلما ازداد عدد مكونات المتلازمة الاستقلابية (MS). داء السكري هو المكون الأقوى لتوقع حصول أمراض الشرايين التاجية والدماغية RR=1.8–CCVD و RR=2.18–IHD لأمراض الشرايين التاجية IHD لوحدها.

خاتمة: إن الإناث المصابة بالمتلازمة الاستقلابية (MS) لديها اسوأ مستويات للدهنيات بالمقارنة مع مجموعة الذكور المصابين بالمتلازمة الاستقلابية (MS)، ومجموعة الذكور المصابة بداء السكري لها اسوأ المضاعفات من حيث أمراض القلب. يزداد انتشار داء السكري وأمراض الشرايين التاجية والدماغية كلما زاد عدد مكونات المتلازمة الاستقلابية (MS).

Objectives: To assess the gender differences in the prevalence of diabetes, composite cardiovascular disease, and the components of metabolic syndrome (MS) in a Jordanian cohort with MS. Secondly, to evaluate the impact of number of MS components on prevalence of diabetes, ischemic heart disease (IHD), and stroke.

Methods: We carried out a cohort study among participants who fulfilled the National Cholesterol Education Program (Adult Treatment Panel III) criteria for MS recruited from December 2006-2007 from Endocrine Outpatient Clinics of the King Hussein Medical Centre, Amman, and Prince Rashid Military Hospital, Irbid, Jordan. Patients were divided into groups according to gender, presence, or absence of diabetes, and were evaluated for MS components, presence of IHD, and stroke.

Results: Three hundred and fifty-seven patients (207 males and 150 females) were included, type 2 diabetes was present in 226 (132 males) patients. No intergroup differences were found on waist circumference, systolic blood pressure, diastolic blood pressure, or fasting blood sugar. Female group was having a worst lipid profile, higher triglyceride levels and low high density lipoprotein. Metabolic syndrome components were more in males. Diabetic males have more composite cardiovascular disease (CCVD) [relative risk (RR)=1.88, 95% confidence interval: 1.01-3.59]. No difference in prevalence of CCVD between female subgroups neither between the 2 genders with MS. The prevalence of diabetes mellitus, IHD, and stroke increased with increasing number of MS components. Diabetes was the strongest predictor for development of CCVD (RR=1.8) and IHD (RR=2.18).

Conclusions: Females with MS have the worst lipid profile compared to the males, diabetic males have the worst CCVD end point. The prevalence of diabetes and IHD correlates with the number of MS components.

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From the Endocrine & Diabetes Division, Department of Internal Medicine (Haddad), King Hussein Medical Center, Amman, and the Department of Internal Medicine (Mahafza), Prince Rashid Military Hospital, Irbid, Jordan.

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Address correspondence and reprint request to: Dr. Fares H. Haddad, Endocrine & Diabetes Division, Department of Internal Medicine, King Hussein Medical Center, PO Box 967, Amman 11118, Jordan. Tel/Fax. +962 (6) 5857113. E mail: haddf@hotmail.com

Metabolic syndrome (MS) in a phenotypic clinical entity that is associated with increased risk of cardiovascular disease (CVD). It is now established that this syndrome predicts the development of type 2 diabetes mellitus (DM) and CVD.[1] In 1988, Reaven[2] introduced the concept of syndrome X for the clustering of cardiovascular risk factors such as hypertension, glucose intolerance, high triglycerides (TG) and low high density lipoprotein (HDL) concentration.[2] In 1998, World Health Organization (WHO) proposed a unifying definition for the syndrome and choose to call it MS rather than the 'insulin resistance syndrome'.[3] The Third Report of the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATPIII) included clinical diagnosis guidelines for MS. Compared with the findings from earlier studies and WHO guidelines the new ATPIII define criteria measured in clinical practice.[1,3,4] The study results based on the Third National Health and Nutrition Examination Survey (NHANES III), indicate that approximately one fourth of the United States (US) adults, 20 years old or older meet the diagnostic criteria for MS.[5] The prevalence of MS depends on age, ethnic background, and gender. It rises linearly from 20-50 years old and plateaus thereafter. Looking at various studies around the world, which included population samples, aged from 20-25 years old and upwards, the prevalence varies from 8% (India) to 24% (US) in men and from 7% (France) to 46% (India) in women.[5-9]

In Tunisia, the prevalence of MS using the International Diabetes Federation (IDF) criteria for a cohort >40 years of age was found to be 45.5%; 55.8% in women, and 30.0% in men (p<0.001), higher than the rates of 28.7% (WHO) and 24.3% (NCEP ATPIII) using the previous definitions.[10] The age-adjusted prevalence of the MS in Arab Americans was 23% by the ATP III definition and 28% by the WHO definition.[11] Arabs living in "Israel" had a MS rate of 48% according to the criteria of the U.S. NCEP.[12] The prevalence of MS in Saudi Arabia was 39.3%. The age adjusted prevalence in males was 37.2% and crude prevalence was 40.9%, while females have a higher prevalence of 42% and crude prevalence of 41.9%.[13] The age-adjusted prevalence of MS in West Bank of Jordan as defined by the WHO was 17%.[14] The estimated prevalence of MS in a small military cohort in Jordan using the ATPIII was 15.3% and increases with age being 26.7% in subjects >40 years.[15] In a cross-sectional study in north of Jordan that included a random sample of 1121 aged ≥25 years to estimate the prevalence of MS using the ATPIII criteria was 36.3%, the prevalence being higher in female (40.9%) than males (28.7%), the study also showed that the prevalence increased significantly with age.[16]

In a previous study by our group we showed an increase prevalence of CVD in a cohort of patients with MS, this prevalence being higher in the diabetic subgroup.[17] In this study, we aim to identify the differences in prevalence of composite cardiovascular disease (CCVD) [ischemic heart disease (IHD) and stroke] and DM in both male and female cohort with MS. And whether diabetics with MS have higher CCVD and to assess the impact of number of MS components on the prevalence of DM, IHD, and stroke.

Methods. Patients were recruited over one year (December 2006 to December 2007) from the outpatient clinics of Endocrine Division in King Hussein Medical Centre, Amman, and Prince Rashid Military Hospital, Irbid in north of Jordan. Patients with 3 or more of the following MS components based on the NCEP/ATP III were included:[4] 1. Waist circumference of ≥102 cm in men and ≥88 cm in women, 2. hypertension defined as a systolic blood pressure (SBP) of ≥130 mm Hg and a diastolic blood pressure (DBP) of ≥85 mmHg and/or by history of hypertension, 3. raised plasma TG of ≥150 mg/dL, 4. low high-density lipoprotein cholesterol (HDL-C) levels (≤40 mg/dL in men and ≤45 mg/dL in women), and 5. fasting plasma glucose concentration of ≥110 mg/dL or with diabetes. Patients with less than 3 components or type 1 diabetes were excluded. The anthropometric measures were taken at first clinical visit by measuring the body weight to the nearest kilograms and height and waist circumference to the nearest centimeter by non-stretchable measuring tape. Systolic blood pressure and DBP was taken after 10-15 minutes of rest in sitting position from the right arm with a mercury sphygnomanometer. Blood was extracted after 12 hours of fast for fasting blood sugar (FBS), total cholesterol (TC), TG, HDL, and low density lipoprotein (LDL) and analyzed on the same day by Hitachi 751 apparatus, Boehringer Mannheim GmbH, Germany. The cohort was divided into 2 groups according to gender and each group into 2 other groups according to the presence or absence of overt diabetes. The endpoints in the comparison group were the presence or absence of IHD, stroke, or composite endpoint of all events CVD. The APTIII components were studied and compared among all groups to elicit any differences in the MS components or in the prevalence of DM, IHD, and stroke. Informed verbal consent was obtained from all patients. The study was approved by the Royal Medical Services Human Research Ethics Committee.

Statistical analysis used descriptive analysis, t-student and chi-square for comparing means and difference between 2 percentages, odds ratio, and relative risk (RR) using the Epinfo version 6. A p value of <0.05 was considered significant.

Results. A total of 357 patients fulfilled the criteria of MS according to ATPIII.[4] The mean age was 52.9±7.56 SD (range 30-70) years. There were 207 males and 150 females, and 226 type 2 diabetic patients (already known diabetics on the medical treatment) with a mean age of 54.15±7years. One hundred and thirty-two patients were male diabetics with a mean age of 54.3±7.34 and 94 were female diabetic patients with a mean age of 54±6.8. When comparing males versus females (Non DM and DM group, **Table 1**), there were no statistical differences in the age, waist circumference, and FBS. Although SBP and DBP were slightly higher in males nevertheless, these did not reach statistical difference. The mean TG level for females was significantly higher than males. The HDL-C level was also significantly lower in female group than males. There was no significant difference in CCVD between male and female groups for the whole sample. The number of MS components was significantly higher in males. Both groups were subdivided into DM and non DM groups (**Table 2**). The diabetic group was older than non diabetics group (54.15±7 versus 50±7.9 years,

Table 1 - Demographic features, mean number of components of MS and prevalence of CCVD and its components in both genders.

Demographic features	Females (n=150)	Males (n=207)	Total (n=357)	*P*-value
Age (year)	52.6 ± 7.7	52.9 ± 7.5	52.9 ± 7.56	0.49
Waist circumference (cm)	104.4 ± 9.9	103.9 ± 14.4	104.1 ± 12.6	0.34
SBP (mm Hg)	142.7 ± 14.1	145 ± 16.2	144.1 ± 15.5	0.08
DBP (mm Hg)	87.7 ± 9.1	89.4 ± 11.4	88.7 ± 10.5	0.065
FBS (mg ldL)	165.5 ± 83.4	161.9 ± 78.8	163.4 ± 80.7	0.34
TG (mg ldL)	261.2 ± 107.6	237.1 ± 112.3	247.2 ± 110.8	0.021
HDL-C (mg ldL)	37.5 ± 7.9	43.2 ± 11.4	40.8 ± 10.5	<0.0001
Diabetes (%)	94 (62.2)	132 (63.7)	226 (63.1)	0.5
CCVD (%)	35 (23.2)	43 (20.8)	78 (21.8)	0.58
IHD (%)	27 (18)	35 (16.9)	62 (17.4)	0.81
Stroke (%)	8 (5.3)	8 (3.9)	16 (4.5)	0.51
No. of MS components	3.9 ± 0.75	4.1 ± 0.77	4.06 ± 0.77	0.0023

SBP - systolic blood pressure, DBP - diastolic blood Pressure, FBS - fasting blood glucose,
TG - triglyceride, HDL-C - high density lipoprotein cholesterol, CCVD - composite cardiovascular disease,
IHD - ischemic heart disease, MS - metabolic syndrome

Table 2 - Components of MS and complications for the diabetes mellitus and non diabetes mellitus group, and gender groups.

Characteristics	Male (n=207)			Female (n= 150)			*P*-value Male versus Female	
	Non DM group n=75	DM group n=132	*P*-value DM versus non DM	Non DM group n=56	DM group n=94	*P*-value DM versus non DM	DM groups	Non DM groups
Age(year)	51.1 ± 7.53	54.3 ± 7.34	0.01	49.1 ± 8.4	54 ± 6.8	0.0012	0.31	0.26
Waist circumference	103.4 ± 12.8	104.2 ± 15.2	0.34	104 ± 11.9	104.9 ± 8.5	0.34	0.38	0.389
SBP	142.8 ± 17.2	146.2 ± 15.6	0.07	142.3 ± 13.3	142.9 ± 14.6	0.40	0.055	0.43
DBP	87.1 ± 9.5	90.8 ± 12.2	0.012	87.1 ± 9.3	88.1 ± 9	0.27	0.034	0.48
FBS	113.6 ± 31.3	189.3 ± 84.4	<0.0001	113.8 ± 22.6	196.2 ± 91.1	<0.0002	0.27	0.48
TG	213.4 ± 67.6	250.5 ± 129.4	0.01	269.2 ± 133.8	256.4 ± 97.2	0.24	0.35	0.0006
HDL-C	44.2 ± 10.9	42.7 ± 11.7	0.179	37.55 ± 8.9	37.47 ± 7.4	0.47	<0.0009	0.0001
CCVD (%)	10 (13.3)	33 (25)	0.0467	9 (16.1)	26 (27.7)	0.0515	0.65	0.66
IHD (%)	6 (8)	29 (22)	0.0099*	7 (12.5)	20 (21.3)	0.17	0.90	0.39
Stroke (%)	4 (5.3)	4 (3)	0.22	2 (3.6)	6 (6.4)	0.21	0.18	0.48
No. of MS components	3.84 ± 0.7	4.3 ± 0.75	<0.002	3.6 ± 0.62	4.1 ± 0.76	<0.0001	0.014	0.025

*Odd ratio = 3.27 (CI: 1.2-9.21), RR = 2.75 (CI: 1.19-6.31), F - female, M - male
DM - diabetes mellitus, SBP - systolic blood pressure, DBP - diastolic blood Pressure, FBS - fasting blood glucose,
TG - triglyceride, HDL-C - high density lipoprotein cholesterol, CCVD - composite cardiovascular disease,
IHD - ischemic heart disease, MS, metabolic syndrome, DM - diabetes mellitus

p=0.0088) The male diabetics were significantly older than non diabetic group and were having a significantly higher TG level as well as higher DBP readings. Fasting blood sugar was also much higher in the diabetic sub group (*p*=0.011), but 15% of the non diabetic males were having a FBS >110 mg/dl. There were no differences in waist circumference, SBP, and HDL-C between the 2 groups. The prevalence of CCVD was higher in the male diabetics than non diabetics [RR=1.88, 95% confidence interval (CI): 1.02-3.59 and for IHD the RR is 2.75, 95% CI: 1.19-6.31]. There was no statistical difference in the prevalence of stroke between the 2 groups. The mean number of MS components in the diabetic subgroup was significantly higher than the non diabetic subgroup. The female diabetics were again significantly older than the non diabetic group (**Table 2**). Fasting blood sugar was much higher in the diabetic sub group, and 20.7% of the non diabetic females were having a FBS >110 mg/dl. There were no differences in the other MS components between the 2 groups (**Table 2**). The prevalence of CCVD was higher in the female diabetics than non diabetics but did not reach statistical significance (RR is 1.72, 95% CI: 0.87-3.4). Prevalence of IHD was higher in the diabetic females that again do not reach statistical significance (RR=1.70, 95% CI: 0.77-3.77, *p*=0.176). There was no statistical difference in the prevalence of stroke between the 2 groups. The mean number of MS components was significantly higher in the diabetic subgroup than non DM group. There were 95 patients with 3 MS components, 145 patients with 4 MS components and 117 patients with 5 components. Prevalence of diabetes, IHD, stroke, and CCVD in relation to number of MS components are shown in **Tables 3 & 4**. Ischemic heart disease and stroke frequency increased with the increasing number of MS as well. Although there were more females with waist circumference above reference range than males and high percentage of patients with HDL levels below reference range, nevertheless, this did not seem to increase the RR for IHD, stroke, or CCVD (**Table 5**). For the diabetic group however, there was an 80% increase risk of CCVD and 118% increase in RR of IHD versus non diabetic group, the RR was not significantly increased for stroke (**Table 6**).

Table 3 - Prevalence of diabetes, IHD, stroke, and CCVD in relation to number of MS components according to gender.

Parameters	Three MS components		Four MS components		Five MS components	
	Males (n=47)	Females (n=48)	Males (n=80)	Females (n= 65)	Males (n=80)	Females (n=37)
Diabetes (%)	46.8	45.8	53.7	60	83.7	89.2
IHD (%)	12.8	14.6	21.2	16.9	15	24.3
Stroke (%)	2.1	2	5	7.7	3.7	5.4
CCVD (%)	15	16.75	26.2	24.6	18.7	29.7

CCVD - composite cardiovascular disease, IHD - ischemic heart disease, MS - metabolic syndrome

Table 4 - Prevalence of diabetes, IHD, stroke, and CCVD in relation to number of MS for the whole group, and the mean levels of MS components.

Parameters	Three MS components (n=95)	Four MS components (n=145)	Five MS components (n=117)
Percentage			
Diabetes	46.3	56.5	85.5
IHD	13.7	19.3	17.9
Stroke	2.1	6.2	4.3
CCVD	15.8	25.5	22.2
Mean levels			
Waist circumference (cm)	102.1	103.8	106.3
Systolic blood pressure (mm Hg)	137	145.2	147.7
Diastolic blood pressure (mm Hg)	84.5	89	91.7
Fasting blood Sugar (mg/dl)	141.9	153.2	193.4
Triglyceride (mg/dl)	207.5	246.3	280.2
High density lipoprotein (mg/dl)	46.4	41.4	34.9

CCVD - composite cardiovascular disease, IHD - ischemic heart disease, MS - metabolic syndrome

Table 5 - Rates, RR, and OR for CCVD (Stroke or IHD) by each component of MS among both genders.

Subheading?	Number	Diabetes	CCVD	IHD	Stroke	RR for CCVD	OR
			n (%)				
Waist circumference							
Males (>102cm)	92 (44.4)	61 (66.3)	22 (23.9)	19 (20.6)	3 (3.9)	1.11	1.15
Females (>88cm)	98 (65.3)	61 (62.2)	26 (26.5)	20 (20.4)	6 (6.1)	(0.68-1.81)	(0.57-2.33)
p-value	0.00009	0.5	0.6	0.96	0.2		
Fasting Glucose (>110mg/dl)							
Males	154 (74.4)	123 (79.9)	38 (24.7)	33 (21.4)	5 (3.2)	1.00	1.01
Females	118 (78.7)	87 (73.7)	29 (24.6)	22 (18.6)	7 (5.9)	(066-1.53)	(056-1.82)
p-value	0.09	0.2	0.9	0.57	0.2		
Systolic blood pressure (>130 mmHg)							
Males	154 (74.4)	104 (67.5)	34 (22)	28 (18.2)	6 (3.9)	1.18	1.23
Females	112 (74.7)	69 (61.6)	21 (18.7)	16 (14.3)	5 (4.5)	(0.72-1.92)	(0.64-2.36)
p-value	0.43	0.31	0.5	0.39	0.5		
Diastolic blood pressure (>85 mmHg)							
Males	1 32 (63.8)	92 (69.7)	33 (25)	27 (20.4)	6 (4.5)	1.27	1.34
Females	87 (58)	56 (64.4)	18 (20.7)	14 (16.1)	4 (4.6)	(0.71-2.27)	(0.62-2.90)
p-value	0.27	0.4	0.46	0.41	0.61		
Triglyceride (>150 mg/dl)							
Males	170 (82.1)	106 (62.3)	31 (18.2)	25 (14.7)	5 (2.9)	1.29	1.38
Females	132 (88)	86 (65.1)	31 (26.5)	23 (17.4)	8 (6.1)	(0.83-2.01)	(0.76-2.50)
p-value	0.13	0.6	0.26	0.52	0.18		
High density lipoprotein							
Males (≤40 mg/dl)	100 (48.3)	55 (55)	16 (16)	14 (14)	2 (2)	1.55	1.73
Females (≤45 mg/dl)	129 (86)	82 (63.6)	32 (24.8)	25 (19.4)	7 (5.4)	(0.90-2.66)	(0.85-3.57)
p-value	0.000	0.18	0.1	0.28	0.16		

CCVD - composite cardiovascular disease, IHD - ischemic heart disease, MS - metabolic syndrome, RR - relative ratios, OR - odds ratios

Table 6 - Odd ratios and RR for the development of CCVD (IHD and stroke) in diabetic and non diabetic group with MS.

Parameters	Diabetic group n=226	Non diabetic group n=131	RR	OR	*P*-value
	n (%)				
CCVD	59 (26.1)	19 (14.5)	1.8 (1.1-2.88)	2.08 (1.14-3.84)	0.01
IHD	49 (21.7)	13 (9.9)	2.18 (1.23-3.8)	2.51 (1.26-5.11)	0.0047
Stroke	10 (4.4)	6 (4.6)	0.97 (0.36-2.6)	0.96 (0.31-3)	0.6

CCVD - composite cardiovascular disease, IHD - ischemic heart disease, MS - metabolic syndrome, RR - relative ratios, OR - odds ratios

Discussion. Several studies have demonstrated that the presence of MS was associated with an increased risk of CVD.[9,18-23] In a cross-sectional study from the NHANES III, the MS was significantly associated with self reported myocardial infarction and stroke.[24]

This study looked into the impact of MS on the development of CCVD in a cohort that is fulfilling the criteria of MS, it found that diabetics were having a higher risk of developing CVD (mainly IHD) with the same level and number of components of MS. It also showed no difference between males and females with MS on prevalence of diabetes CCVD, IHD, or stroke, this comes in contrast to the study by Oda et al,[25] who found that the correlations among cardiovascular risk factors were marginally stronger in women than in men and suggest that the existence of one additional risk factor may increase the risk of CVD more steeply in women than in men. The study revealed 3 important aspects: First, there were more MS components in males

than females. Secondly, females were having a worst lipid profile namely lower HDL levels, and this was also more prevalent in this group and hypertriglyceridemia (hTG), and thirdly, females were rather more obese substantiated by a higher percentage of waist circumference range thing that support previous cross-sectional studies, the estimated overweight prevalence in Jordan was 37.9% for males versus 33.7% for females, the obesity rates was 14.4% for males and 23.4% for females.[26,27] Despite the fact that more females were having higher BMI reflected by higher waist circumference nevertheless, no increase in relative risk of CCVD or IHD noted implying a multifactorial impact of MS components rather than single component effect and this also applies to all components of MS (**Table 5**). Isolated DBP was significantly higher in males versus females only for the diabetic subgroup, the mean SBP was higher in diabetic males than females not reaching a statistical significance (p=0.055) but imposes clinical implications regarding management and manipulations to correct risk factors.

This study also showed that there was a directly proportional increase in the mean level of the parameters of MS with increasing number of the components, and an inverse relationship of HDL that falls with more number of MS components (**Table 4**). Again, the number of MS components had an impact on the prevalence of diabetes being 85% in those with 5 components versus those with 3 components. This pattern was evident for CCVD, IHD, and stroke as well (**Table 4**). Despite the increasing number of MS components in males and the worst lipid profile in females, the prevalence of CCVD (IHD and stroke) also does not show significant difference between gender groups, this might be explained by the fact that patients with MS present several additional hemodynamic, inflammatory, and psychological risk markers, which could contribute to the poor cardiovascular prognosis of these subjects.[28] Patients with MS show an increase hazard risk for stroke and vascular events with ethnic and gender differences.[29] We failed to show such difference as the stroke patients were under-represented in this study, because of the preferential referral to the neurological division with stroke unit facilities. This was considered a limitation to this study.

In a previous study, we showed that there was a steady increase in the number of MS components with increasing age (by decades) , the difference in age between DM and non DM group was not a detrimental factor in explaining the increase number of MS components in DM group, It seems that diabetes per se exerts an additional factor to the development of IHD and CCVD.[17] Actually, diabetes was the strongest risk factor of all components to predict CCVD in males with a 175% increase risk. This comes in agreement with 2 recent studies suggesting that MS was not associated with an increased risk of CVD but was associated with a 4-fold increased risk of diabetes. Impaired fasting glucose alone had a much higher risk more than 18-fold. In British Regional Heart Study, MS was associated with a modestly increased risk of CVD and a more than 7-fold increased risk of diabetes. These new analyses of 2 prospective studies have found that the MS is not associated with cardiovascular risk in the elderly.[30,31] And although it was associated with risk of diabetes, it was found that impaired FBS alone was a strong indicator.[30,31]

We conclude that females with MS have the worst lipid profile in comparison with males. Diabetic males are having the worst CVD composite end point. The prevalence of diabetes and IHD correlates with the number of MS components. The unique difference of worst lipid profile (low HDL and high TG) and high rates of abnormal waist circumference in females warrants further research and should be considered in the design of intervention strategies.

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Ethical Consent

All manuscripts reporting the results of experimental investigations involving human subjects should include a statement confirming that informed consent was obtained from each subject or subject's guardian, after receiving approval of the experimental protocol by a local human ethics committee, or institutional review board. When reporting experiments on animals, authors should indicate whether the institutional and national guide for the care and use of laboratory animals was followed.