

Risk Factors of Metabolic Syndrome among Clinic Patients in Gaza - Palestine

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Received September 25, 2013; Revised November 16, 2013; Accepted November 22, 2013

Abstract Metabolic syndrome is a term, which refers to a combination of medical disorders that are associated with a higher risk for cardiovascular disease and diabetes. The syndrome is more common in female than males. This study was conducted to estimate the prevalence of the metabolic syndrome among patients with cardiovascular diseases in Gaza and to examine the association between traditional risk factors for the non-communicable diseases and each of the component of the metabolic syndrome. We used the Adult Treatment Protocol III National cholesterol Education Programme of America (ATPIII) indicators for diagnosis and determination of metabolic syndrome. The syndrome was met if an individual had three or more criteria: waist circumference >102cm in men and >88cm in women, fasting plasma glucose ≥ 110 mg/dl, Blood pressure $\geq 130/85$ mmhg, serum Triglycerides ≥ 150 mg/dl and serum HDL cholesterol <40mg/dl in male and <50mg/dl in female. Statistical analysis was performed using SPSS version 20. The prevalence of metabolic syndrome was 59.5%, without difference between male and female. The main risk factors for metabolic syndrome were high blood pressure (78.8% for systolic and 73.8% for diastolic Blood Pressure), large waist circumference (67.9%), high Triglycerides (78.6%), and high fasting blood sugar (86.4%). HDL cholesterol was protective but not statistically significant. The risk factors of metabolic syndrome in both sexes in descending order were as follows, high fasting blood sugar, large waist circumference, high Triglycerides, high Blood Pressure, and low HDL cholesterol. We conclude that high level of prevalence of metabolic syndrome in our study population indicates the need for an active health programme to reduce the factors influencing the prevalence. Therefore, preventive interventions must be taken seriously.

Keywords: metabolic syndrome, prevalence and risk factors, cardiovascular disease, Gaza, Palestine

Cite This Article: Amal Jamee, Yehia Abed, and Hassan Abutawila, "Risk Factors of Metabolic Syndrome among Clinic Patients in Gaza - Palestine." *American Journal of Cardiovascular Disease Research* 1, no. 1 (2013): 20-24. doi: 10.12691/ajcdr-1-1-5.

1. Introduction

Metabolic syndrome (MS) is a cluster of abnormalities, with high socioeconomic cost that is considered epidemic worldwide; it is defined by interconnected factors that directly increase the risk of cardiovascular disease and diabetes [1]. Genetic factors and environmental factors such as sedentary, lifestyle and waster dietary, habits contribute to its development [2]. Metabolic syndrome was described by Reaven in 1988[3], also called as syndrome X [1], the insulin resistance syndrome [4], Deadly quarter [5]. There was the variety of definition for MS, these include WHO, European Group for the study of insulin resistance, and National cholesterol education programme Third Adult Treatment Panel III (NCEP-ATP III) [6]. The most recent definition is from the international diabetes federation and from the American heart association / National heart association, lung and blood institute AHA/AHLBI [7,8,9,10]. The IDF definition, with its differing thresholds for WC according

to ethnic group, is likely to become the international norm, as several international bodies support it [11]. MS is more common among adult population of the world; the syndrome is more common in female than male. According to serial studies, its prevalence is between 8-24.2% in male, in addition 7% to 46.5% of adult female were diagnosed with MS [12,13,14]. In Botina study (Finland and Sweden) and based on recent WHO definition, initiated in 1990 with a median follow-up of 6.9 years among 4483 subject, aged 30-70 years, with type 2 diabetes, showed that Patients with MS are twice as likely to die from cardiovascular disease. They are three times as likely to have a heart attack or stroke, compared with people without the syndrome [15].

According to NCEP-ATP III definition the presence of three out to five risk factors including increase waist circumference(WC as indicator of central obesity), low level of high density lipoprotein (HDL), high triglyceride (TG), elevated blood pressure (BP) and impaired fasting glucose (FBS). When associated together, they are with increased risk of cardiovascular disease [15,16]. The syndrome is not benign as it is associated with elevated

risk not only of type 2 diabetes (five –fold) but also of cardiovascular disease (two-three fold) [17]. People with MS have a five hold greater risk to develop typ2 diabetes and are in higher risk of morbidity and mortality from cardiovascular disease, for this a combination of each risk factors which compose MS interact in a synergic manner to accelerate the development of atherosclerosis [18]. In USA which is a developed country MS is about 20%-30% [6], while in some Asian countries like Indian and Iran higher prevalence rate have been reported [19,20]. Our study access to estimate the prevalence of MS among patient with cardiovascular disease, and the association between traditional risk factors and MS based on the Adult Treatment Panel criteria III (NCEP-ATP III).

2. Material and Methods

The study design is a cross sectional study conducted at cardiology clinic in Gaza strip- Palestine, with agreement of HELSINKI ethical committee of research. We reported the prevalence of MS using the original criteria for the syndrome (NCEP-ATP III), in 163 patients (66 males and 97 female) aged 20-83 years, during their follow-up visit to the cardiologic clinic. MS is present if three or more of the following criteria are met: abdominal obesity (WC \geq 102 cm for male and 88 cm for female), elevated plasma TG level \geq 150 mg /dl, decrease HDL cholesterol level ($<$ 40 mg /dl in male , $<$ 50 mg / dl in female), elevated BP \geq 130/85mmhg and elevation of glucose level \geq 110g/dl. Statistical analysis was performed using statistical package for social science version 20. Medical examinations were completed by cardiologist and the laboratory results were performed in private licensed

laboratory. The chi-square test was used to examine difference in the prevalence of different categorical variable. The differences between means were tested by t-test. The prevalence of metabolic syndrome was calculated for all population for both sexes and for all age group using odds ratio and confidence interval of each risk factor. P value less than 0.05 was considered as statistically significant.

3. Results

A total of 163 participants with cardiovascular disease, were included in this study. Table 1 shows the characteristics of the study population by sex. Hypertension (HTN) was present in 89% of study population, without major difference between male and female. Diabetes (DM) was found in 44.2% of study population with higher percentage in female than male (48.5% vs. 37.9%) respectively, but this difference did not reach a statistical significant level (P value 0.182). Cigarette smoking was seven time higher in male than female (25.8%, 3.1%) respectively. Also 42.9%, of study population have high cholesterol level, with higher percentage among female (48.5%) than males (34.8). Coronary artery diseases (CAD) are 54.5% among males and 50.5% among females. Among 69.3% of study population have body mass index (BMI) more than 30kg/m, 22.1% are classified overweight (25-29.9 kg/m²), and only 8.6% have normal weight (18.5-24.9 kg/m²), obesity were more common in Female than male (76.3%vs.59.1%), contrary overweight were more common in male than female (31.8%vs.15.5%).

Table 1. Characteristics of the study population by sex

Characteristics of patients	Males		Females		Total		P value
	Number	percent	Number	percent	Number	percent	
Hypertension	58	87.9	87	89.7	145	89	0.717
Diabetes	25	37.9	47	48.5	72	44.2	0.182
Cholesterol >200(mg/dl)	23	34.8	47	48.5	70	42.9	0.085
Coronary artery disease	36	54.5	49	50.5	85	52.1	0.613
Smoking	17	25.8	3	3.1	20	12.3	0.000
BMI(18.5-24.9 kg/m ²) Normal	6	9.1	8	8.2	14	8.6	0.039
BMI(25-29.9 kg/m ²) Overweight	21	31.8	15	15.5	36	22.1	
BMI (\geq 30 kg/m ²) Obesity	39	59.1	74	76.3	113	69.3	

Our findings demonstrate that, 59.5% of the attendants of cardiology clinic are diagnosed with metabolic syndrome. This prevalence was higher among male than female (62.1% vs. 57.7%), and the difference did not reach a statistical significant level (P = 0.575) as shown in Table 2. The prevalence of the syndrome increases by increase age group, it is 28.6% in the younger patient

(40years and less), and reaches up to 62.4% for the oldest age group. There is statistical significant relationship between the age group and the prevalence of the metabolic syndrome (Pvalue 0.014). In other words, the metabolic syndrome among cardiac patients increases with increase of age.

Table 2. prevalence of Metabolic syndrome by sex and age group

		Metabolic syndrome				Total		Pvalue
		Presence		Absence		NO	%	
		NO	%	NO	%			
gender	Male	41	62.1	25	37.9	66	100	0.575
	Female	56	57.7	41	42.3	97	100	
Age group	20-40y	4	28.6	10	71.4	14	100	0.014
	41-55y	33	71.7	13	28.3	46	100	
	56-83y	60	58.3	43	41.7	103	100	
	Total	97	59.5	66	40.5	163	100	

To continue the summary of our estimations for the measurement of the metabolic syndrome risk factors in both sexes. We conclude in [Table 3](#), that the mean age in male is 58.23 years vs. 55.9 years in females, and the Waist Circumference (WC) for male is 107.52 cm, and 113.43 cm for female. For this risk factor, the difference was statistically significant (P value < 0.001), while for the other indicators there was no significant difference between male and female. Minor sex differences were reported in both systolic, diastolic blood pressure and Triglycerides, males reported higher Diastolic BP and TG values, while females reported higher fasting blood sugar. The level of High-density cholesterol was the same in both sexes.

Table 3. Components of the metabolic syndrome distribution (According to NCEP ATPIII by gender)

Components of Metabolic syndrome	Mean		Pvalue
	Male	Female	
Waist Circumference (cm)	107.52	113.43	0.008
Systolic blood pressure (mmHg)	134.56	135.06	0.864
Diastolic blood pressure (mmHg)	84.12	82.23	0.296
Triglycerides (mg/dl)	195.47	189.91	0.706
High density cholesterol (mg/dl)	48.02	48.03	0.984
Fasting blood sugar (mg/dl)	129.4	142.8	0.221

Also we computed the Odds ratio and the confidence interval of overall sample with MS, by comparing the measurement of each component of the MS for the normal and the abnormal level ([Table 4](#)). In our study 86.4% of participants with high-level of FBS had MS vs. 32.9% with normal FBS, this difference is statically significant OR 12.9 CI 95 % (5.9-28.4). For WC 67.9% of patients with undesirable waist had MS vs. 15.4% with normal waist OR 11.6 CI 95% (3.8-35.8). Also 87.3% of patients who had higher BP had MS vs. 45.4% with normal BP, the difference among hypertensive and none is statistically significant, OR (CI) is 8.3 (3.4-19.9), then the study shows that 78.6% of general population with high TG had MS vs. 30.8% with normal level of TG OR (CI) 8.3 (4-16.6). Finally, 62.4 percentages with high level of HDL cholesterol had MS vs. 56.4% with normal level, and the difference did not reach a statistical significant level.

Depending on ATPIII criteria most of those with MS had, three components of the syndrome 33.1%, while 22.1% had four and 4.3% had five components. We conclude in our study that a risk factors of MS based on value of OR in our sample is in descending order are as follow high FBS, Large waist circumference, high BP, high level of TG, and low HDL cholesterol level.

Table 4. Prevalence of different factors that define metabolic syndrome (According to ATPIII definition)

Component of MS	level	MS%	Pvalue	OR (95% CI)
Fasting blood sugar (mg/dl)	<110	32.9%	0.000	12.9 (5.9-28.4)
	≥110	86.4%		
Waist Circumference (cm)	Normal	15.4%	0.000	11.6 (3.8-35.8)
	Abnormal	67.9%		
Blood pressure (mmHg)	<130/85	45.4%	0.000	8.3 (3.4-19.9)
	≥130/85	87.3%		
Triglycerides G (mg/dl)	<150	30.8%	0.000	8.3 (4-16.6)
	≥150	78.6%		
High density cholesterol (mg/dl)	Normal	56.4%	0.440	1.3 (0.9-2.3)
	Abnormal	62.4%		

Then we examined the relationship between MS and the related risk factors. [Table 5](#) shows that Patients with diabetes were three times likely to have MS than patient without diabetes and this difference is statistically significant (Pvalue less than 0.001). The same table demonstrated positive association between the occurrence of MS and increase in BMI. Over weight patients were likely to have MS than patient with normal weight (41.7 vs. 23.1), while obese patients reported a highest percentage 69.9%, this association reach a high statistical significant level (Pvalue <0.001). In patients with hypertension, MS was present two times higher than patients without HTN (62.1%). In addition, both total cholesterol and LDL cholesterol level were higher in patients with metabolic syndrome. There is no difference in the presence of MS in patients with coronary artery disease or not, and Smoker's patients have high metabolic syndrome, all these risk factors did not reached a statistical significant level. In other words, patients with MS are more likely to be diabetics (75%), hypertensive (62.1%), and have BMI more than (25 kg/m²).

Table 5. Relation between Metabolic syndrome and cardiovascular risk factors (Among study population)

Risk factors	Metabolic syndrome				Total		Pvalue
	Presence		Absence		No	%	
	No	%	No	%			
Diabetes							0.001
YES	54	75	18	25	72	100	
NO	43	47.3	48	52.7	91	100	
BMI (18.5-24.9) normal	3	23.1	10	76.9	13	100	0.000
BMI (25-29.9) overweight	15	41.7	21	58.3	36	100	
BMI >30 obese	79	69.9	34	30.1	113	100	
Hypertension							0.059
YES	90	62.1	55	37.9	145	100	
NO	7	38.9	11	61.1	18	100	
Total Cholesterol							0.161
≤200 mg/dl	51	54.8	42	45.2	93	100	
≥200 mg/dl	46	65.7	24	34.3	70	100	
Low density Cholesterol							0.171
≤100 mg/dl	31	52.5	28	47.5	59	100	
≥100 mg/dl	66	63.5	38	36.5	104	100	
Coronary artery disease							0.852
YES	50	58.8	35	41.2	85	100	
NO	47	60.3	31	39.7	78	100	
Smoker							0.593
YES	13	65	7	35	20	100	
NO	84	58.7	59	41.3	147	100	

4. Discussion

Metabolic syndrome is a global problem, approximately around a quarter of the world's adult population has MS [21], and one fourth of the adult European population was estimated to have MS [22]. In the Middle East, the MS affect about one in four people and the prevalence increase with age [22]. Our results for this study showed that according to ATP III definition, the prevalence of MS among Patients with cardiovascular disease, aged 20-83 years in Gaza is 59.5% and the prevalence increases as age increases. The syndrome is more prevalent among male participants 62.1%. The most common abnormalities in our population study were high blood pressure (87.3%), high blood sugar (86.4%), high Triglycerides (78.6%) and increase waist circumference (67.9%). Our prevalence data is higher than other studies in Jordan, Turkey, Tunisia, Saudi, and Iran, (36.3%, 33.9%, 24.3%, 21%, and 34.7% respectively). The prevalence of the syndrome was less in these countries, and it was higher among females. These studies showed low HDL cholesterol and increases Waist circumference are the two essential components [20,23,24,25,26]. However, our findings come in according with a study found In Rabin center (Israel) among 20,000 subjects, between the year 2000 and 2010 with age range 20-80 years reported a prevalence of MS according to the ATP III was 18.2% with high prevalence in male than female [27]. In Palestine, a study conducted in 2005 to determine the prevalence of MS and other atherosclerotic cardiovascular disease risk factors, among sample of 342 Palestinian in East Jerusalem, the syndrome was found in 33.6% participants with no significant difference between sexes [7]. In USA, the studies, estimated that MS affected 25% of adults, and it is more prevalent in white male than in female [28,29]. As known in different studies, the prevalence of MS increase more dramatically as BMI increase, In our study 69.3% of study population have BMI>30kg/m² and MS was present 2 and 3 times higher in adults with overweight and obese than normal weight (41.7%,69.9%, 23.1%) respectively. This result is the same found in NHANES (National Health and Examination survey, 2003-2006), where 34% of people had MS and overweight in male and female were found respectively to be more than 6 and 5.5 times as likely to met the criteria for MS compared to underweight and normal weight [30,31]. In addition it has been shown that, a higher prevalence of MS is present among hypertensive's patients, than in general population [32]. Our findings reveal that 62.1% of hypertensive patients met this syndrome, and most of study population with MS had three components (33.1%), while 22.1% had four and 4.3 had all five components. In a cross sectional analysis published in 2004, among 4753 Greek adult participants older than 18years, reported the prevalence of MS as 23.6%, most of those with MS had three component of the syndrome (62%), while 29% had four and 10% had all five components [33]. In addition, our study showed that half of study populations have coronary artery disease and 58.8% met the syndrome, the same data from 37 studies involving more than 170,000 patients have shown that MS doubles the risk of Coronary artery disease [34]. Our findings may be explained by to the recent urbanization in

our society, as majority of male are driving cars that have replaced pedal, walking, people become more sedentary, limited exercise facilities and consuming more calories through non- healthy fast food, large sitting at computer for long hours.

5. Conclusion

As the syndrome does not have a known single cause, it is able to manage it, to delay the appearance of the syndrome or its manifestation. A national and international prevention programs to combat obesity, diabetes, Hypertension Dyslipidemia, smoking and related co morbidity and change in lifestyle, especially with respect to nutrition, and physical activity. In Gaza (Palestine), the MS merits strategies for screening, early identification, the components of the MS in all the social levels and more aggressive clinical approach management of high-risk groups.

Statement of Competing Interest

The authors have no competing interest.

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