Original paper

Prevalence of Metabolic Syndrome among Patients with Type Two Diabetes Mellitus Attending Imam Hussein Medical City in Karbala

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Abstract

Background: The Metabolic syndrome is a cluster of risk factors that is responsible for the risk of coronary heart disease and stroke.
Objective: To determine the prevalence of Metabolic syndrome and its components among type two diabetes patients.
Patients and methods: Across sectional study was conducted between February to August 2020 among 394 patients with type two diabetes were randomly selected in diabetic center of Imam AL Hussein Medical City in Karbala, Iraq. The demographic, clinical, and biochemical parameters were studied after obtaining informed consent from each patient. Metabolic syndrome was diagnosed according to the criteria of National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III).
Result: The prevalence of metabolic syndrome was 92.7%. A total of 394 patients were included in the study,285(72.3%) were females with mean age (51.77±9.56) years. The most prevalent component of metabolic syndrome was elevated triglyceride (87.3%); followed by abdominal obesity (80.2%) and elevated blood pressure (71.6%).
Conclusion: A high prevalence of metabolic syndrome among type 2 diabetic patients; which proposing that diabetic patients are at increased risk of cardiovascular disease and other complications.
Keywords: Metabolic syndrome; National cholesterol education program, Type 2 Diabetes, Karbala .

Introduction

A metabolic syndrome is a group of cardiometabolic risk factors, which is responsible for big health and socio-economic costs in most countries mainly for the resulting morbidity and mortality from non-communicable diseases, including, obesity, type two diabetes, cardiovascular disease, cancer, and mood disorders[1].
The metabolic syndrome was primarily demonstrated in 1998 by Ravens which is called syndrome X. Later on, it was named insulin resistance syndrome, multi metabolic syndrome, or metabolic syndrome[2].
The main components associated with the metabolic syndrome include raised blood pressure, dyslipidemia (raised triglycerides and lowered high- density lipoprotein cholesterol), raised fasting glucose, and central "abdominal" obesity[3,4].
The available guide indicates that in most countries, 20% to 30% of the adult population and about 70–80% of patients with diabetes mellitus (DM) can be identified as having Metabolic syndrome[5–7].
Factors, such as high socioeconomic status, low physical activity, smoking, history of diabetes in the family, obesity, and sedentary lifestyle all affect the prevalence of the Metabolic syndrome [8].
The mortality rate of individuals with metabolic syndrome due to myocardial infarction and cardiac arrest is twice more than the general population[9]. Some studies showed that individuals with metabolic syndrome are two times more likely to die, regardless of the cause; three times more likely to have a heart attack and/or stroke;

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and five times more likely to develop type two diabetes[10].

Diabetes mellitus is a disease, that is associated with a disorder in the body's metabolism and energy utilization from carbohydrates, lipids, and proteins[11,12]. Type two diabetes mellitus is identified by, a relative lack of insulin due to pancreatic B-cell dysfunction and insulin resistance in target organs[13].

A strong combination exists between metabolic syndrome and incidence of diabetes mellitus[14]. The combination of type two diabetes and metabolic syndrome potentiates the cardiovascular disease associated with each of the two conditions[15].

Many diagnostic criteria have been adopted to diagnose metabolic syndrome developed by different organizations but there are three definitions criteria that are most popular and commonly used for the diagnosis of Metabolic syndrome [16], these included WHO, NCEP ATP III, and IDF[16,17].

Definition criteria of NCEP ATP III for metabolic syndrome became prevalent because of its simplicity and feasibility since its components can be decided routinely and in research settings[18].

In this study, National Cholesterol Education Program and Adult Treatment Panel (NCEP ATP III) diagnostic criteria were the ones selected, due to their easy applicability and strong clinical evidence[10].

This study aims to determine the prevalence of metabolic syndrome and its components among patients with type 2 diabetes attending Imam Al-Hussein medical city in Karbala and to identify the most common associated risk factors of metabolic syndrome.

Patients and methods

A hospital-based cross-sectional study. It was conducted between the first of February to the thirteen of August 2020 on patients with type two diabetes attending the diabetic center of Imam AL Hussein Medical City in Karbala, Iraq. All previously diagnosed type two diabetes patients who are being followed up at diabetic center were eligible to the study. All patients aged over 20 years, clinically determined type two diabetes mellitus, and with duration of diabetes at least one year were included in the study.

Pregnant, lactating mothers and patients with other chronic illnesses including symptomatic heart failure, myocardial infarction within the last 6 months, acromegaly, clinically apparent hypothyroidism, hypogonadism, nephrotic syndrome, chronic kidney disease, and chronic liver disease were excluded from the study. In addition, patients on chronic steroid use, blood lipid-lowering therapy, oral contraceptive use, and antipsychotic drugs were excluded from the study as well.

Data were collected by direct interview with the patients using a semi-structured questionnaire, which was used to obtain demographic and medical information such as (age, gender, marital status, occupation, duration of diabetes, smoking status, treatment status, educational level, physical activity, and others). Anthropometric measurements including waist circumference (cm), weight (Kg), and height (m) were then measured. Waist circumference (WC) was recorded by placing a fiber-glass measuring tape around the waist midway between the last rib and iliac crest with the subject in the standing position. Weight was measured on standardized electronic weighing machine and height was measured by a mechanical wall-mounted stadiometer. Body mass index (BMI) was calculated by dividing weight (kg) by the square of the height (m2).

History of hypertension and use of medications for hypertension was asked to each patient (which used as diagnostic criteria for hypertension in this study) and for those having no history of hypertension, blood pressure was checked. Blood Pressure (BP) was measured after participants had sat quietly for at least five minutes with feet on the floor, and arm supported at heart levels, their blood pressure measurements were done using a mercury sphygmomanometer

and Littman binaural stethoscopes were used for the auscultatory technique.

All chemical analyses were performed in the laboratory of Imam Al Hussein medical city and the same method of biochemical analysis was used throughout the study period. Overnight fasting venous blood samples were collected to measure (HDL-C), (LDL-C), serum Triglyceride, and glucose. Smokers individual categorized as daily smokers in those who smoke at least one cigarette per day[17]. The patients classified as physically active were those who practiced physical activities for a time more than or equal to 150 minutes per week[19].

According to the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III), the criteria for the diagnosis of metabolic syndrome include individuals with any three or more of the following five components:

1.Abdominal obesity (waist circumference >102 cm for male
and >88 cm for female).

2.Triglycerides (TGs) >=1.7 mmol/L (150mg).

3.HDL cholesterol <1.03 mmol/L (40mg) for male and <1.29 mmol/L(50mg) for female.

4.Systolic BP >=130 mmHg and/or Diastolic BP >= 85 mmHg

5.Fasting Plasma Glucose >=6.1 mmol/L (110mg).

However, all participants have previously diagnosed with type two diabetes under management and, therefore, were classified as hyperglycemic irrespective of the level of fasting blood glucose at the time of sampling[20].

Ethical approval on study conduction was obtained from the Iraqi Ministry of Health Department of the Arab Board for Health Specialization and from Imam Hussein medical city, Karbala health directorate in January 2020. Then a letter of permission was given to the head department in the diabetic center. Further, A verbal informed consent was obtained from each patient after explanation about the purpose of the study, their right to participate or to a draw at any time if they don't want, and their confidentiality.

The recorded data were entered into a Microsoft Excel spreadsheet and then exported to the data editor of SPSS Version 20.0. Continuous variables were expressed as Mean ± standard deviation (SD) and categorical variables were summarized as numbers (No.) and percentages Simple frequencies and cross-tabulation were done. Chi-square test and Fisher's exact test were used for data analysis. A p-value less than 0.05 was considered statistically significant.

Results

A total of 394 patients were included in the study. The results of the current study revealed that three-quarters of the study participants aged below 60 years with a mean age of 51.77±9.56 years (as shown in table-1). Females represented 72.3% of the total study population (female to male ratio was 2.62:1). More than one-quarter of the study sample was illiterate (28.6%) while college or higher education constituted one-fifth of the study population. From the total 394 participants, 341(86.5%) are of urban residence. Whereas, 261 (66.2%) were housewives, and 360 (91.3%) of the total participants were physically inactive. The majority of the diabetic patients (58.6%) reported using oral hypoglycaemic drugs while insulin was used by (30.7%).

The mean and standard deviation of the different components of metabolic syndrome among patients are shown in table 2.

The study measurements showed that fasting blood sugar was elevated in 99.7% of the study population. The proportion of patients with elevated blood pressure or on antihypertensive drugs or previously diagnosed hypertension was 71.6%. The proportion of abdominal obesity was 80.2% of the total study population. The measurements also showed that 87.3% of the study participants had elevated fasting triglycerides levels, whereas HDL levels were

normal in only one-third of the study population (32.5%) as illustrated in table-3.
According to the distribution of the number of components of metabolic syndrome, the results concluded that 39.4% of patients had five components of metabolic syndrome, 36.3% had four components and 17% had three components (figure-1). These give rise to 92.7% of the total study participants meet the criteria of metabolic syndrome (figure-2).

Table 1. Socio-demographics characteristics and some health-related variables of the study population.

Characteristics	**Categories**	**Total=394 No. (%)**
Age in years	< 30	3(0.8)
	30-39	30(7.6)
	40-49	144(36.5)
	50-59	119(30.2)
	≥ 60	98(24.9)
	Mean ±SD	51.77±9.56
Gender	Male	109(27.7)
	Female	285(72.3)
	Female to male ratio	2.62:1
Marital status	Married	390(99)
	Divorced/Widow	4(1)
Education	Illiterate	113(28.6)
	Read and write/Primary school	137(34.8)
	Secondary school	66(16.8)
	College or higher education	78(19.8)
Residence	Urban	341(86.5)
	Rural	53(13.5)
Occupational status	Employed	45(11.4)
	Unemployed	46(11.7)
	Retired	42(10.7)
	Housewife	261(66.2)
Smoking	No	356(90.4)
	Yes	38(9.6)
Physical activity	No physical activity	360(91.3)
	Walk 30min/day	29(7.4)
	Walk >30min/day	5(1.3)
Type of treatment	Oral hypoglycaemic drugs	231(58.6)
	Insulin	121(30.7)
	Oral and insulin	42(10.7)
Duration of diabetes (years)	Mean ±SD	9±5.14
Family history of Diabetes	Yes	351(89.1)
	No	43(10.9)
History of hypertension	Yes/On treatment	198(50.3)
	No	196(49.7)

Table 2. The mean and standard deviation of the component of metabolic syndrome.

Components	**Mean ±SD**
Waist circumference(cm)	
Female	102.96±13.79
Male	106.61±8.36
Systolic blood pressure(mmHg)	126.71±12.08
Diastolic blood pressure(mmHg)	80.61±7.44
FBS(mg/dl)	222.27±73.81
Triglycerides(mg/dl)	207.42±70.67
HDL(mg/dl)	
Female	45.19±8.61
Male	40.81±5.81

The analysis of data revealed that there were no gender differences in the components of metabolic syndrome apart from waist circumference, BMI and HDL (p=0.01, 0.0001, and 0.0001 respectively) as illustrated in table -4.

The analysis of data concluded that the patients with metabolic syndrome had significantly higher mean age than patients with no metabolic syndrome. The study also revealed that gender, duration of treatment, family history of diabetes, and history of hypertension had no significant difference among patients with metabolic syndrome and those without metabolic syndrome (as revealed in table-5).

Table 3. Proportions of the component of metabolic syndrome among the study population.

Variable	Categories	No. (%)
FBS	Normal	1(0.3)
	High	393(99.7)
Blood pressure	Normal	196(49.7)
	Elevated	198(50.3)
Elevated blood pressure or on antihypertensive drugs or previously diagnosed hypertension	No	112(28.4)
	Yes	282(71.6)
Abdominal obesity	No	78(19.8)
	Yes	316(80.2)
Triglycerides	Normal	50(12.7)
	High	344(87.3)
HDL	Normal	128(32.5)
	Low	266(67.5)

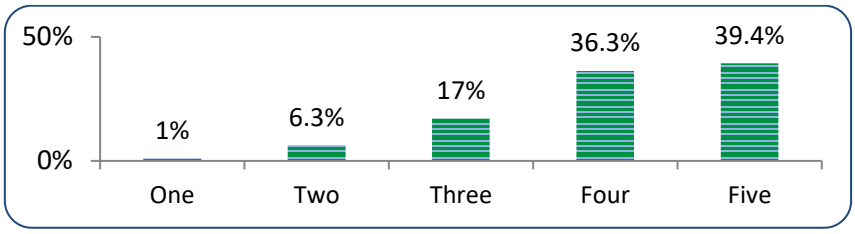

Figure 1. Distribution of the number of components of metabolic syndrome.

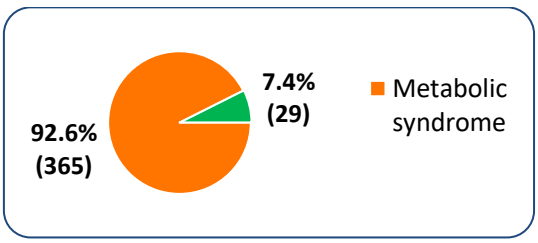

Figure 2. The prevalence of metabolic syndrome among the study participants.

Table 4. Gender difference in relation to components of metabolic syndrome.

Independent variables	Gender: No. (%)		P value
	Female (n=285)	Male (n=109)	
Waist circumference	102.96±13.79	106.61±8.36	0.010*
Systolic	127.26±12.58	125.28±10.56	0.144
Diastolic	80.63±7.42	80.55±7.53	0.923
Fasting blood pressure	222.77±73.85	220.97±74.04	0.829
HbA1c	9.38±1.84	9.30±1.87	0.709
BMI	32.54±5.90	29.47±5.41	<0.001*
Triglycerides	204.11±58.23	216.08±95.67	0.133
HDL	45.19±8.62	40.81±5.81	<0.001*
S. cholesterol	207.47±48.54	213.54±52.85	0.279
LDL	124.91±26.86	123.90±30.17	0.748

Table 5. The association of metabolic syndrome with the socio-demographic characteristics and some health correlates of the study participants.

Independent variables	With METs No. (%) (n=365)	No METs No. (%) (n=29)	P value
Age (mean ±SD)	**51.96±9.75**	**49.41±6.53**	0.169
Gender			
Female	267(93.7)	18(6.3)	0.199
Male	98(89.9)	11(10.1)	
Marital status			
Married	361(92.6)	29(7.4)	-
Divorced/widow	4(100)	0	
Education			0.003*
Illiterate	112(99.1)	1(0.9)	
Read and write/Primary school	126(92)	11(8)	
Secondary school	58(87.9)	8(12.1)	
College or higher	69(88.5)	9(11.5)	
Residence			0.760
Urban	313(91.8)	28(8.2)	
Rural	52(98.1)	1(1.9)	
Occupational status			-
Employed	29(64.4)	16(35.6)	
Unemployed	45(97.8)	1(2.2)	
Retired	42(100)	0	
Housewife	249(95.4)	12(4.6)	
Smoking			0.507
No	331(93)	25(7)	
Yes	34(89.5)	4(10.5)	
Physical activity			-
No physical activity	332(92.2)	28(7.8)	
walk 30min/day	28(96.6)	1(3.4)	
walk >30min/day	5(100)	0	
Type of treatment			<0.001*
Oral	226(97.8)	5(2.2)	
Insulin	98(81)	23(19)	
Oral and insulin	41(97.6)	1(2.4)	
Duration of treatment (years)	9.09±5.23	7.86±3.64	0.214
Family history of diabetes			0.180
Yes	323(92)	28(8)	
No	42(97.7)	1(2.3)	
History of hypertension			0.078
Yes	188(94.9)	10(5.1)	
No	177(90.3)	19(9.7)	

Discussion

The prevalence of the metabolic syndrome is increasing worldwide including the middle east region[21]. In the current study, the prevalence of metabolic syndrome is 92.7%, this is higher or similar to the worldwide prevalence which is varying between 45.8% and 96.3% according to the NCEP ATP III criterion [22–24].

Female represented 72.3% of the total study population, in concordant with some studies done in Arab and other Middle Eastern countries which appeared that metabolic syndrome was more in females than males[25,26].

The high number of women could be attributed to two reasons; first one is the time that we have collected the sample, it was at morning which was the most suitable time for housewives to attend, in comparison to the males who they were busy in their work. Secondly, women seemed to care more about their health so they attend the clinic more for check up.

A large number of the patients lie within the age group 40-49 years while the least number was below 40 years, this study was similar to other Sudanese studies where the large fraction of the patients lie in the age group (40-49 years)[27].

Approximately, 90% were obese or overweight and the obese where more than double overweight. This differs from a study in China on type two diabetes patients estimated that (60.5%) of Chinese adult were overweight, (23.9%) were obese[28]. This might also reflects the rapid increase of overweight and obesity among Iraqi population. An issue that is almost ignored or not considered by policy makers and needs a real and rapid steps to combat and control it.

The majority of patients were using oral hypoglycemic drugs as reported in similar studies[29–31].

The classification of HbA1C between patients as a measure of glycemic control appeared (51.7%) patients were poor glycemic control while (22.8%) patients had a fair glycemic control; these mostly due to irregular follow up visit to the clinic, no complaint to medications, unhealthy diet, and low physical activity.

When the components of the metabolic syndrome were analyzed separately in this study, elevated levels of fasting blood sugar, triglyceride, waist circumference were found among patients. This study showed that FBS was elevated in 99.7% of the study population, this result is higher than that obtained in a study performed in Bangladesh [32]. The proportion of abdominal obesity (waist circumference) was 80.2% of the total study population which was higher than the study done in Hilla, Iraq[33].

Resulta of this study showed that 87.3% of the patients had elevated fasting triglycerides levels which were lower than the Malaysia study which found that 92.9% of patients with type two diabetes mellitus had elevated triglycerides[10].

Regarding HDL, levels were low in two-third of the study population which was higher than the study performed in India that showed (46.7%) of the study population were lower in HDL level[34].The abnormal lipid may be due to insulin resistance which led to decrease the inhibition of lipolysis in adipose tissue, leading to more fatty acid drift and more very low-density lipoprotein (VLDL) secretion thus causing high triglyceride and low HDL level [35]. As expected, dyslipidemia was common among participants individuals. Thus, strategies targeted at lowering triglycerides levels and increasing HDL-cholesterol may be important in reducing the risk of metabolic syndrome in diabetic patients.

The blood pressure levels found in the current study patients were less than those obtained in other studies, where elevated blood pressure was observed in 90.4% of patients [10,36]. The reasons could be a difference in the parameter used to assess the blood pressure in different ethnographic populations.

About 75% of study patients had at least 4 components of metabolic syndrome which were higher than those found among diabetic patients in the study done in central India[23].

Conclusion

Metabolic syndrome is highly prevalent in participant patients with type two diabetes by using NCEP/ATP III criteria. When metabolic syndrome was diagnosed, the majority of individuals showed high levels of fasting blood sugar, abdominal obesity, and triglycerides. The importance of individual follow-up or through therapeutic groups provided by health units should be

emphasized, aiming to prevent the onset of more comorbidities that compromise the health and quality of life of this population. Further studies are needed by different diagnostic criteria and larger samples to identify the prevalence of metabolic syndrome and its components among diabetic patients.

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