Kamal et al., Endocrinol Diabetes Res 2019, 5:3

Endocrinology & Diabetes Research

Research Article | A SCITECHNOL JOURNAL

The Prevalence of Metabolic Syndrome among Type 2 Diabetic Patients according to NCEP ATP III and IDF at Baba GurGur Diabetic Center, Kirkuk, Iraq

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Abstract

Background: Metabolic syndrome (MetS) is a cluster of metabolic abnormalities that strongly associated with the development of cardiovascular disease (CVD) and type 2 diabetes mellitus T2DM. There are an increasing number of metabolic syndrome (MetS) patients worldwide, and there is no exception in Iraq. Regardless of which criteria are used for diagnosis of metabolic syndrome, the first concern is early detection of cardiovascular complication and early intervention.

Aim: The purpose of this study is to assess the prevalence of clinical and biomarker component of metabolic syndrome using NCEP ATP III (2005), IDF (2006) among Iraqi sample of patients with type II diabetes.

Patients and methods: Four hundred-six, type 2 diabetic patients attending Baba GurGur Diabetic Center in K1 Hospital/ Northern Oil Company –Kirkuk, from 1st April till 30th June, were subjected randomly to this descriptive cross-sectional study with mean age of 54.8740 ± 9.648. Clinical and biochemical data were collected and the data was analyzed in order to identify prevalence of MetS in these patients.

Results: The result showed that there was statistically significant relation between sex and MetS in both Definitions [NCEP ATP 111and IDF] with p value (0.000). The overall prevalence of MetS among the studied sample was 51.2% and 48.9% in both definitions respectively. The frequency of metabolic Syndrome component was higher for Low HDL Cholesterol and there was a highly statistically significant relation between low HDL among female vs. male with p value (0.000). High frequencies of MetS were between the age group 50-59 years. Regarding BMI, diabetic patients with BMI (25-29.9) and (30-39.9) having highest frequency of Mets.

Conclusion: The prevalence of MetS and its components using NCEP-ATPIII and IDF criteria amongst a sample of T2DM Iraqi patients was high. Early diagnosis and proper management is requested for metabolic syndrome to prevent cardiovascular complication.

Keywords: Prevalence; Metabolic Syndrome; Type 2 Diabetes

Introduction

Metabolic syndrome (MetS) is a cluster of metabolic abnormalities including abdominal obesity, elevated blood pressure [systolic or diastolic blood pressure], elevated fasting blood glucose, and atherogenic dyslipidaemia [elevated triglyceride levels and low high-density lipoprotein cholesterol levels (HDL-c)] that strongly associated with the development of cardiovascular disease (CVD) and type 2 diabetes mellitus T2DM [1].

Various definitions of metabolic syndrome have been published and several iteration of this definition suggested and revised. Diagnostic criteria of MetS were introduced by different communities between 1998 and 2009, including the World Health Organization (WHO) in 1998 [2]. The National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (NCEP-ATP III) in 2002 [3]. The American Heart Association, National Heart, Lung and Blood Institute (AHA/NHLBI); International Diabetes Federation (IDF) in 2005 [4,5]. Regardless of which criteria are used, the first concern is early detection of cardiovascular complication and early intervention [6]. Metabolic syndrome in recent years has been receiving great attention due to its major burden on public health, the non-communicable diseases such as comprising cancers, cardiovascular disease, diabetes, and chronic lung diseases, were preventable by recognizing the altering behavioral or intermediate risk factors like hypertension, pre-diabetic status, obesity and MetS [7]. MetS is reported as an important etiologic factor in the development of certain types of cancers [8]. The prevalence of MetS varies around the world often coincide with the obesity prevalence. There is a wide difference in prevalence based on age, gender, race/ethnicity, and the criteria used for diagnosis. MetS affects 20% or more of the population of the USA and nearly 25% of the population of Europe. South-east Asia has a lower prevalence of MetS but is rapidly animated towards higher rates similar to the western world; there are also gender- and race-based variations in MetS. The prevalence of MetS in African-American women is 57% higher than in African-American men and 26% higher in Hispanic women compared with Hispanic men [9]. With the awful economic development, change in life style in human community and modernization, metabolic syndrome prevalence obviously increasing in the Arab World including Iraq due to rapid demographic and epidemiological changes in these countries. There has been a recent concern about chronic non-communicable diseases (NCDs) in Iraq. Diabetes and obesity prevalence in Iraq has increased as six-fold from 1980 to 2014, there is more than 4.2 million obese adult in 2014 [10].

Study done in Erbil city in 2015, prevalence of metabolic syndrome in the studied sample was 30.6%. It was higher in females (45.5%) than males (16.3%) [11]. Although the country is undergoing an epidemiological transition with an increasing burden of chronic NCDs There is inadequate information about accurate estimates of MetS. Diabetes mellitus (DM) Diabetes is one of the major causes of early illness and death worldwide and related complications are associated with long-term damage and failure of various organ systems, it induces micro vascular and macro vascular disease. Obesity, particularly abdominal obesity associated with resistance to the effects of insulin on peripheral glucose and fatty acid utilization, often leading to type 2 diabetes mellitus. Obesity is the most important modifiable risk factor for type 2 diabetes sedentary lifestyle; hypertension, dyslipidemia and genetic susceptibility are important contributors to the risk of developing diabetes in adults. Identification of individuals at risk for diabetes is important, as lifestyle modification predominantly exercise and weight loss, successfully decreases the development of diabetes. Evidence supported that nearly 70%–80% of the population with DM was diagnosed with MetS [12]. In several cohorts, the risk of diabetes increased with increasing number of components of the metabolic syndrome [13].

The research aim is to identify the prevalence of clinical and biomarker component of metabolic syndrome in type 2 Diabetes and its impact on disease progression.

Methodology

Ethical issues

Official agreements were taken from Baba GurGur Diabetic center-K1 hospital- Northern Oil Company before establishing the study.

Study design and setting

A descriptive cross-sectional study was carried out in Baba GurGur Diabetic Center which is located in the K1 Hospital/Northern Oil Company, Kirkuk city. It is receive patients from all parts of Kirkuk governorate and plays an important role in teaching, research and health services providing for attending patients.

Study sample and sampling techniques

A 406 randomly selected sample from patients attending diabetic center and the estimation was based on single population at that area.

According to IDF criteria patients were classified as having metabolic syndrome if they had abdominal obesity (waist circumference of ≥ 94 cm for men and ≥ 80 cm women) plus two of any of the following components

- Serum triglycerides ≥ 150 mg/dL (1.7 mmol/L) or drug treatment for elevated triglycerides.
- Serum high-density lipoprotein (HDL) cholesterol<40 mg/dL (1 mmol/L) in men and<50 mg/dL (1.3 mmol/L) in women or drug treatment for low HDL cholesterol.
- Blood pressure ≥ 130/85 mmHg or drug treatment for elevated blood pressure.
- Fasting plasma glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L) or drug treatment for elevated blood glucose constitute 225 patients.
- According to theNCEP/ATP IIIcriteria: patients were classified as having MetS according ATP III criteria which define the metabolic syndrome as the presence of any three of the following five traits.
- Abdominal obesity, defined as a waist circumference ≥ 102 cm (40 in) in men and ≥ 88 cm (35 in) in women.
- Serum triglycerides ≥ 150 mg/dL (1.7 mmol/L) or drug treatment for elevated triglycerides.
- Serum high-density lipoprotein (HDL) cholesterol<40 mg/dL (1 mmol/L) in men and<50 mg/dL (1.3 mmol/L) in women or drug treatment for low HDL cholesterol.
- Blood pressure ≥ 130/85 mmHg or drug treatment for elevated blood pressure.
- Fasting plasma glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L) or drug treatment for elevated blood glucose they were 236 patients. A specific special questionnaire form was distributed to them after receiving their written consent and the data was collected by interviewing with the study patients after complete explanation of the main objectives of the study.

Study period

The study was conducted during the period from 1st April till 30th June.

Data collection tool

Certain designed prepared questionnaire form has been conducted by the investigator utilizing a recent updated related literature to the study subject included four parts.

Part 1: Demographic and social behavioral characteristics of the studied patients like (age, sex, smoking, alcohol, physical activity, duration of the disease) and educational level according to Iraqi cultural office 2010. They classified to the following educational level: A-primary (illiterate and primary school), B-Secondary (secondary and intermediate school), C-Tertiary (university and higher education).

Part 2: Lipid profile including (triglyceride, high density lipoprotein) Five milliliter fasting blood sample was collected in plane test tubes, and serum was extracted. The extracted serum was investigated for Glucose and lipid profile levels using Bio systems A25.

Triglycerides, HDL-c, LDL-c, total cholesterol was determined by specific enzymatic method, and glucose was determined by glucose oxidase method.

Part 3: Anthropometric measures were collected according to who steps manual.

A-Weight was measured in kilograms (kg) using the WHO weighing scale at a precision of 0.1 kg.

B-Height was measured using standiometer while weight was recorded after measuring the patient bare-footed and with light clothes using a weight balance. On the other hand, the height measurement is recorded to the nearest 0.1 cm.

C-Waist circumference (WC) in centimeter was measured at the midpoint between the lowermost rib and the iliac crest.

D-Body mass index (BMI) which was calculated by dividing weight (kg) by height squared (m2).

Part 4: Blood pressure was measured using a sphygmomanometer and recorded in the sitting position in the right arm. Two readings were taken 5 min apart, and the mean of the two was taken as blood pressure.

Inclusion criteria

All patients with signs and symptoms of diabetics type 2.

Exclusion criteria

Pregnant, lactating mothers, patients with history of other chronic diseases and patients on treatment for lipid lowering and patients age less than 20 years, and diabetes's type 1.

Reliability of the questionnaire form

The data was presented to (4) experts in different fields, they were (2) Clinical physicians, (1) Community physicians and (1) statistical experts.

Statistical analysis of data

The information regarding each participant was transferred into a code sheet and the data entry was done using a computer Pentium IV and the statistical analysis was calculated by mine tab program/2016.

All the statements with Yes and No answer, number and percent will be calculated.

Chi-square test was used to detect the relation between the studied variables and the level of significance is taken at level 5% (P<0.05).

Results

The study sample was 406 patients with Type II Diabetes Mellitus (T2DM) with mean age of 54.8740 ± 9.648, out of them (211-51.91%) were male while the remaining (195-48.02%) were female. The ratio between male/female was

According to NCEP-ATP111 definition

The sample was classified into 236 T2DM patients with Metabolic Syndrome criteria (102–43.2% male, and 134-56.8% female) while 170 T2DM patients without Metabolic syndrome (MetS) Criteria (109–64.1% male, and 61–35.9% female). Another classification was done using IDF Definition, the sample was classified into 225 DM patients with MetS criteria (98–43.5% male, 127–56.5% female) and the remaining 181 patients without MetS criteria (113–61.9% male, 68–38.1% female) respectively. There is a statistically significant relation between sex and MetS in both Definitions [NCEP – ATP 111 and IDF) with p value (0.000). The prevalence of MetS among female was 56.8% in NCEP- ATP 111 and 56.5% in IDF. The overall prevalence of MetS among the studied sample was 51.2% and 48.9% in both of NCEP-ATP111 and IDF respectively (Table 1).

	DM with Mets				DM without Mets				
Gender	NCEP		IDF		NCEP		IDF		P-Value*
	No.	%	No.	%	No.	%	No.	%	
Male	102	43.2	98	43.5	109	64.1	113	61.9	
Female	134	56.8	127	56.5	61	35.9	68	38.1	0
Total	236	100	225	100	170	100	181	100	
P*-Value	0.942				0.661				

Table 1: Sex distribution of sample study according Metabolic Syndrome in NCEP-ATP III and IDF. *x2-test was use.

Variable	NCEP					P-value*	IDF					P- value*
	Male		Female				Male		Female			
					Total						Total	
	No.	%	No.	%			No	%	No	%		
Waist Circumference	102	43.2	134	56.8	236	0.001	98	43.6	127	56.4	225	-
NCEP → Male>102	-	-	-	-	-	-	-	-	-	-	-	0.006
Female>88	-	-	-	-	-	-	-	-	-	-	-	-
IDF→ Male>94	-	-	-	-	-	-	-	-	-	-	-	-
Female>80	-	-	-	-	-	-	-	-	-	-	-	-
Increase	71	44.6	88	55.4	159	0.098	78	49.3	80	50.7	158	-
TG ≥ 150	-	-	-	-	-	-	-	-	-	-	-	0.817
Low HDL	35	25.9	100	74.1	135	0.000*	36	26.7	99	73.3	135	-
M<40, F<50	-	-	-	-	-	-	-	-	-	-	-	0.000*

Increase	105	54.4	88	45.6	193	0.111	102	54.2	86	45.8	188	0.126
BP ≥ 130-85	-	-	-	-	-	-	-	-	-	-	-	-

Table 2: Prevalence of component metabolic syndrome among sample study. *x2-test was use.

Table 2 Show that the frequencies of metabolic Syndrome component was higher for Low HDL Cholesterol (M>40 mg/dl, F>50 mg/dL) and there was a highly statistically significant relation between low HDL among female 74.11% vs. male 25.91% in NCEP and 26.7% female vs. 73.3% for male in IDF with p value (0.000) both for NCEP-ATPlll and IDF. Regarding the waist circumference, the result show that there was a statistically significant relation between male and female in IDF and NCEP-ATPlll with p value n (0.006) 0.001) respectively. There was no significant relation between female (55.4%) and male (44.61) concerning the level TG which constitute a higher level above the (150 mg/dl) in both MetS definitions' NCEP-ATP111 and lDF with p value (0.098, 0.08 l) respectively. The same results were found regarding Blood pressure (systolic ≥ 130 and/or diastolic ≥ 85 mmHg) with no statistically significance between male and female with higher percentage among male (54.4%) comparison female in (45.6%) in both two definitions with p value (0.111, 0.126) respectively.

		NCEP ATP III					IDF				
Variable		MetS		No MetS		P value*	MetS		No MetS		P-value*
		No.	%	No.	%		No.	%	No.	%	
1. Age (years)	20-29	2	0.8	3	1.7	0.408	0	0	5	2.7	0.012
M ± SD=54.87 ± 9.648	30-39	9	3.8	15	8.8	0.035	9	4	20	11.1	0.006
	40-49	53	22.4	42	24.7	0.598	54	24	33	18.3	0.159
	50-59	85	36.1	61	35.9	0.978	84	37.3	70	38.7	0.782
	60-69	78	33.1	45	26.5	0.155	70	31.2	48	26.5	0.311
	≥ 70	9	3.8	4	2.4	0.41	8	3.5	5	2.7	0.652
	Total	236	100	170	100	-	225	100	181	100	-
2-Sex	Male	102	43.2	109	64.1	-	98	43.6	113	62.4	-
	Female	134	56.8	61	35.9	0	127	56.4	68	37.6	0
	Total	236	100	170	100	-	225	100	181	100	-
3-BMIKG/m2=M ± SD	<24.9	12	5.1	18	10.5	0.036	8	3.6	20	11.1	0.003
Female → 31.94 ± 6.026	-	-	-	-	-	-	-	-	-	-	-
Male → 30.08 ± 4.43 KG/	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
IDF=M ± SD	-	-	-	-	-	-	-	-	-	-	-
Female → 32.93 ± 5.98	-	-	-	-	-	-	-	-	-	-	-
Male → 31.752208 ± 4.008.	-	-	-	-	-	-	-	-	-	-	-
	25-29.9	61	25.9	73	43.6	0	59	26.2	73	40.3	0.003
NCEPATP111=M ± SD	30-39.9	142	60.7	73	43.6	0.001	133	54.2	82	45.3	0.006
Female=32.75 ± 6.07	>40	21	8.9	6	3.5	0.032	25	11.1	6	3.3	0.003
Male=31.82 ± 4.17	Total	236	100	170	100	-	225	100	181	100	-
4-Educational level	primary	149	63.1	78	45.9	-	122	54.2	70	38.6	0.002
	-	-	-	-	-	-	-	-	-	-	-

	secondary	39	16.5	45	26.5	0.015	42	18.7	58	32.1	0.002
	-	-	-	-	-	-	-	-	-	-	-
	University and above	48	20.4	47	27.6	0.086	61	27.1	53	29.3	0.629
	Total	236	100	170	100	-	225	100	181	100	-

Table 3: Demographi distribution of study sample associated with Metabolic Syndrome according to NCEP-ATP111 and IDF among T2DM patient in Baba GurGur Diabetic Center. *x2-test was use.

Table 3 High frequencies of MetS in T2DM patients were between the age group 50-59 years (36.1%-NCEP, 38.7%-IDF) Followed by the age group 60-69 years (33.1%-NCEP, 26.5%-IDF) and there was no significant relation between these two age group and MetS with P value (0.978, 0.155) respectively. However there was a statistical significant relation between the age group 30–39 years and MetS in NCEP-ATPll1 and IDF with p value (0.035 and 0.006) respectively. Regarding BMI, Table 3 show that diabetic patients with BMI (25- 29.9) and (30-39.9) having the highest percentage of Mets with significant P value (0.000) in NCEP and (0.003) in IDF while the lowest percentage of MetS were found in none-obese T2DM with BMI>24.9, for NCEP-ATPll1 (5.1%) and 3.6% for IDF which show a significant relation in both NCEP – ATPll1 and IDF definitions with p value (0.036, 0.003) respectively.

For education level, there was a high significant relation with MetS and percentage of primary educated patients was 63.1% with p value (0.001) in NCEP and (0.002) in IDF in comparison to second and third groups graduation of education.

		NCEP ATP IIII					IDF				
Variable		**MetS**		**No MetS**		**P- value***	**MetS**		**No MetS**		**P- value***
		No.	**%**	**No.**	**%**		**No.**	**%**	**No.**	**%**	
Smoking	Yes	28	11.9	6	3.5		25	11.1	9	4.9	
	No	208	88.1	164	96.5	0.003	200	88.9	172	95.1	0.026
	Total	236	100	170	100		225	100	181	100	
Alcohol	Yes	5	2.1	2	1.2		6	2.6	1	0.6	
	No	231	97.9	168	98.8	0.412	219	97.4	180	99.4	0.104
	Total	236	100	170	100		225	100	181	100	
Physical activity	Yes	44	18.6	16	9.4		27	12	33	18.2	
	No	192	81.4	154	90.6	0.01	198	88	148	81.8	0.039
	Total	236	100	170	100		225	100	181	100	
Duration of DM	<5 years	169	71.6	106	62.4		148	65.7	120	66.3	
	>5 years	67	28.4	64	37.4	0.05	77	34.3	61	33.7	0.912
	Total	236	100	170	100		225	100	181	100	

Table 4: Social variables distribution of study sample associated with Metabolic Syndrome according to NCEP-ATP111 and IDF among T2DM patients. *x2-test was use.

Table 4 shows that prevalence of MetS in T2DM patients consistently increasing with smoking, physical inactivity with NCEP-ATP111 and IDF. There is close relation between smoking and high prevalence of MetS with significant p value (0.003) using NCEP-ATP111 and p value=0.026 using IDF. Also there is association between practicing physical activity regularly and prevalence of metabolic syndrome. Using NCEP-ATP111 and IDF, 81.4% and 88% of diabetic patients with Mets not practicing exercise regularly with statically significant p value (0.010) and (0.039) respectively. Concerning alcohol consumption and durations of Diabetes Mellitus there is no statically significant relation with prevalence MetS in both diagnostic criteria of MetS (Figures 1 and 2).

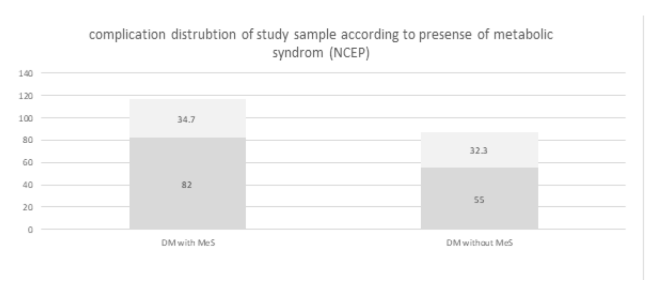

Figure 1: Prevalence of complication in patients with type 2 diabetes mellitus and metabolic syndrome is higher 34.7% compared to 32.2% patients with type 2 diabetes mellitus without metabolic syndrome according to NCEP-ATP111.

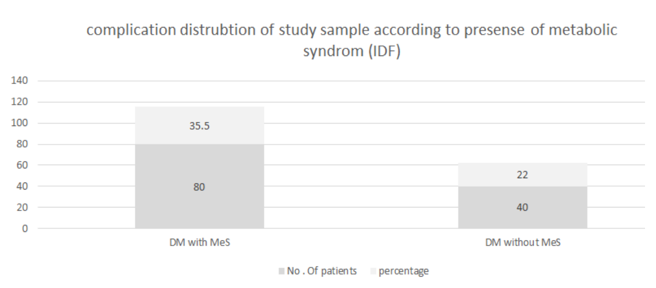

Figure 2: Prevalence of complication in patients with type 2 diabetes mellitus and metabolic syndrome is higher 35.5% compared to 22% in the patients with type 2 diabetes mellitus without metabolic syndrome according to IDF.

Discussion

The metabolic syndrome associated with an increased risk of type 2 diabetes, cardiovascular diseases and is associated with all-cause and cardiovascular mortality. In spite of the increasing prevalence, limited studies have been done on the MetS in Iraq. The overall prevalence of MetS in the study was 51.2% using the NCEP-ATPIII criteria whereas 48.9% in IDF. Previous study pointed out lower prevalence among Iraqi T2DM population (38.7%) [14]. Also lower prevalence of MetS was reported in T2DM patients in Bosnia and Herzegovina (47.91%) [15], in Ethiopian hypertensive patients were (40.7%) and (39.3%) using NCEP-ATPII and IDF criteria respectively [16]. Conversely higher rate of MetS reported in Ghana 58% [17]. Also, higher rate of MetS than the finding of this study was reported among diabetic patient 66% based on IDF criteria [18]. Other previous studies also reported higher prevalence of MetS in Nepalese T2DM patients, (73.9%) and (66.8%) according to NCEP ATP III and IDF definitions, respectively [19]. These differences in the prevalence of MetS can be explained by the reciprocal action of genetic and environmental agents, rapid modernization and comprise unhealthy lifestyle which predispose individuals to different risk factors of MetS [20]. In the current study slightly higher prevalence of MetS (51.2%) was observed by NCEP-ATP III definition in comparison to IDF (48.9%) It could related to the relative flexibility of the NCEP-ATP III criteria in which abdominal obesity is not required as a prior condition for the diagnosis. The current study showed that the prevalence is higher in women. Male/female ratio of the sample was 1:1. Females showed higher prevalence of MetS which is statically significant with male p value (0.0000) in study sample, and the prevalence using NCEP ATP III was (56.8%), while with IDF was (56.5%), this figure similar to previous Iraqi study (14). However, the prevalence of metabolic syndrome in male and female with T2DM in Ireland was higher in men (24.6%) than in women (17.8%) [21] Also in Finland and Sweden was 84% for male and 78% for female [22]. The reason may be due to sedentary lifestyle of women in our country as most of them were housewives or it could be due to genetic or age of the studied populations and on application of different investigation methods [23]. In this study, low HDL followed by waist circumference or central obesity were most prevalent components of the MetS with NCEPATP111 and IDF. In females, lowered HDL was the most common component (74.1%) for NCEP-ATP111 and (73.3.4%) for IDF, followed by central obesity (56.8%) and (56.4%) for NCEP-ATP1111 and IDF respectively. Numerous earlier studies reported that low HDL-C levels are associated with the metabolic syndrome and diabetes [4]. In males, hypertriglyceridemia (55.4%) for NCEP-ATP111 and (50.7%) for IDF was the most common component followed by hypertension (45.6%) and (45.8%) for NCEP-ATP1111 and IDF respectively. In the current study low HDL and Central obesity were the only components that showed statistically significant difference between males and females with agreement to Ghana study [17], and the AL Lawati study in Oman [24] in which low HDL was the most common risk factor. This result not matching local Iraqi study on T2DM patient in which, the most common risk factor for MetS was hypertension followed by obesity [14]. While hypertension is the least prevalent component of MetS in this study which agree with Nepal study [19]. Finding is not surprising given the observation that central obesity plays a key role in the development of the MetS and appears to precede the appearance of the other MetS components. Visceral fat deposits contribute to insulin resistance more than subcutaneous fat and lead to hyper insulin. Moreover high insulin level predispose for hypertension, increasing VLDL production in the liver leading to hypertriglyceridemia and consequently a decrease in HDL [25] Persons with impaired glucose tolerance and type 2 diabetes, have hypertriglyceridemia as well as increased HDL catabolism, leading to lowered HDL levels In our study, Mean and SD age of study population is 54.87 ± 9.64, MetS patients frequency were obviously increased in the age groups of ≥ 40 years in both men and women. The age group 50-59 years and 60-69 years had the highest frequency of MS which was predicted and adopted by another study [14]. This figure can be explained by the aging process that has its effect on MetS due to increased frequency of death of individuals who were most susceptible to obesity related mortality such as CAD and cerebrovascular events. IN this study, and other studies reported that there is a sharp decline of the prevalence at very high age group [14,17]. In the current study the mean BMI of females was (31.94 ± 6.026 KG/m2) Vs. (30.08 ± 4.43 KG/m2) of male with statically significant difference (P=0.001), (Table 3). Metabolic syndrome significantly associated with Body mass index, diabetic patients with BMI (25-29.9) and (30-39.9) having the highest percentage of Mets with significant P value (0.000 in NCEP and 0.003 in IDF) with highest frequency of MetS (60.7%) for NCEP and (54.2%) using IDF in those with 30-40 BMI, while lowest frequency of MetS was found in diabetics who are non-obese (5.1%) and (3.6%) using NCEP-ATP111 and IDF respectively. Despite the strong relation between obesity and higher prevalence of MetS, yet this study found some of the sample with normal weight has MetS in both definition criteria p value (0.036) using NCEP –ATP111 and (0.003) with using IDF this corresponds to result of Iraqi T2DM patients study [14]. The prevalence of obesity in association with type II diabetes varies among different racial groups. Sixty to eighty percent of North Americans, Europeans or Africans with type II diabetes and close to 100% of patient with T2DM among Pima Indian have obesity, while only 30% of Chinese patient with T2DM are obese. It well known fact that many individuals with type II diabetes who do not meet BMI criteria for obesity have mainly abdominal distribution of fat, producing high waist to hip ratio. Increases in visceral adiposity correlated with insulin resistance level [25]. There was a significantly higher prevalence of MetS amongst the diabetics with low educational status, a finding similar to a study done in Erbil city Sherzadet al in non-diabetic patient [11]. There was a significantly higher prevalence of MetS amongst the diabetics with low educational status (Table 3). Primary education level diabetics had higher prevalence 63%, compared to secondary school and university, also there is significant p value (0.001) and (0.002) using NCEP-ATP111 and IDF respectively. This could be due to their ignorance of good dietary habits as well as irregular exercising and physical inactivity which has strong relation with prevalence of MeTS in our study using both NCEP-ATP111 and IDF criteria for MeTS. This study found close relation between smoking and high prevalence of MetS with significant p value (0.003) using NCEP-ATP111 and p value (0.026) using IDF. Also there was association between alcohol consumption and high prevalence but without statically significant difference in both diagnostic criteria of MetS because the frequency of alcoholic diabetics was low in the study [26,27]. The relation between smoking and alcohol consumption with MetS prevalence not correspond to Erbil study in non-diabetic individuals [11]. In this study, durations of illness were not associated significantly with MetS which is contrary to previous studies which reported that participants who had diabetes for over 5 years were found to have an 11.3 times risk of developing MetS [12] or other studies findings in which the prevalence of MetS decreased along with an increase in the duration of diabetes [28]. Regarding complications, the large number of diabetics with complications has MetS. It has been established that MetS is founder of complications sequence and progression in diabetics [29]. This figure in our study is similar to previous Iraqi study [14] and Ethiopian study [12].

Conclusion

The prevalence of MetS and its components using NCEP-ATPIII and IDF criteria amongst a sample of T2DM Iraqi patients was high. Female gender, increased age, high BMI, was significantly associated with MetS. The most prevalent component was low HDL-C followed by central obesity. Low education status, physical inactivity and smoking also have significant predictive effects on metabolic syndrome in the type 2 diabetic patient. Education on healthy life style modification and proper glycemic control should be provided to control and reduce diabetes-related morbidity and mortality.

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