

## Original Research Article

# Prevalence of metabolic syndrome in type 2 diabetes mellitus presenting to tertiary health care centre

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## ABSTRACT

**Background:** Diabetes is a syndrome of hyperglycemia and disturbances of carbohydrate, fat and protein metabolism associated with absolute or relative deficiencies in insulin secretion. Association of metabolic abnormalities represents a highly atherogenic state promoting the formation and growth of atheroma plaques in arteries. Hyperinsulinaemia/insulin-resistance and the underlying consequences are associated with presence of cardiovascular risk factors even in the absence of diabetes. Present aim is to study the prevalence of Mets in type 2 DM.

**Methods:** 100 patients with known diabetes were included. Data was collected with predesigned and pretested questionnaire. Data collected was history, clinical examination and investigations like CBC, KFT, LFT and lipid profile USG abdomen.

**Results:** A total of 100 known type 2 diabetics were enrolled in this study. Forty-eight (48%) were females and fifty-two (52%) were males. The mean age of the study participants was 55.2 years. Seventy-seven (77%) were diagnosed to have Mets. Frequency of Mets increased with age. Risk of fatty liver in Mets was 10 times than that those with fatty liver in diabetes (odds ratio -10.65 with  $p < 0.005$ ). Low HDL was most frequent factor 83.11% and was equally distributed in both sexes. Hypertension was second most frequent factor 81.81% and was more prevalent in female.

**Conclusions:** The prevalence of the metabolic syndrome in type 2 DM is high in both genders and increases with age thus posing a potential high cardiovascular risk. The modifiable risk factors should be a focus point in the management of type 2 DM.

**Keywords:** Cardiovascular risk factors, Diabetes mellitus type II, Metabolic syndrome

## INTRODUCTION

The metabolic syndrome (Mets) consists of cardiovascular risk factors that is characterized by, atherogenic dyslipidemia, insulin resistance, central obesity and hypertension.<sup>1</sup> The presence of the metabolic syndrome (Mets) is associated with an increased risk of stroke, myocardial infarction and coronary heart disease in both males and females.<sup>2</sup> Rapid urbanization and acquisition of western life style have resulted in an

increased calorie intake and decreased physical activity; two of the major contributors, towards the development of diabetes and metabolic syndrome.<sup>3</sup>

Asian Indian men and women have a higher incidence and mortality rate from CVD than Caucasian men and women. Both Mets and T2DM are heterogeneous and complex conditions due to interplay between genetic and environmental factors operating differentially in different populations. The International Diabetes Federation (IDF),

World Health Organization (WHO) and the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP-III) proposed working definitions for metabolic syndrome, based on the traits like overall obesity, central obesity, dyslipidemia as characterized by elevated levels of triglycerides and low levels of HDL cholesterol, hyperglycemia, and hypertension. The main objective of this study is to determine the prevalence of Mets according to modified NCEP-ATP (III) which could effectively predict the presence of the Mets in T2DM. Hence to determine the prevalence of Mets and formulating preventive strategies remains contentious.

## METHODS

The present study carried out in department of General Medicine in tertiary health care centre who presented to the diabetic clinic or were admitted to the medical ward for glycemic control, from January 2015 to June 2016. The present study included a total of already diagnosed 100 patients of Type 2 Diabetes mellitus.

### Inclusion criteria

- Adult type2 diabetes.
  - a. were treated with oral hypoglycemic agents only.
  - b. were treated with oral hypoglycemic agents only but required insulin during an acute illness.
  - c. whose diabetic state has been controlled on diet but previously on oral hypoglycemic agents.
- Age>20 years.

### Exclusion criteria

- All type 1 diabetics as well as young type 2 diabetics (age <20 years).
- Patients with renal failure or with ascites due to any cause.
- Patients with secondary hypertension, hepatobiliary disease.

The Institute's Ethics Committee approved the study protocol. Informed and written consent will be obtained from all the participants after explaining the procedure. Initial evaluation included a detailed history and clinical examination to exclude any systemic disease. Data collected using a pretested questionnaire. Waist circumference and blood pressure were measured. Patient underwent other investigations like CBC, KFT, LFT and lipid profile USG of renal and hepatobiliary system.

### NCEP: ATP III (2001) criteria for the diagnosis of metabolic syndrome

- Abdominal obesity (waist circumference): men > 90 cm; women >80 cm.
- Triglycerides >150 mg/dl or specific medication

- HDL cholesterol: men < 40 mg/dl; women < 50 mg/dl or specific medication
- Blood pressure >130/ >85 mmHg or taking antihypertensive medicines
- Fasting glucose >100 mg/dl or specific medication or previously diagnosed type 2 diabetes mellitus. Diagnosis of metabolic syndrome is made when 3 or more of the risk determinants shown above are present.

## RESULTS

A total of 100 known type 2 diabetics were enrolled in this study. (48%) were females and (52%) were males. The mean age of the study participants was 55.2±7.6 years ranging from 29 to 78 years. The prevalence of metabolic syndrome was noted to increase from 12.5% among participants aged 30 through 39 years to 90% in participants aged >70 (Figure 1).

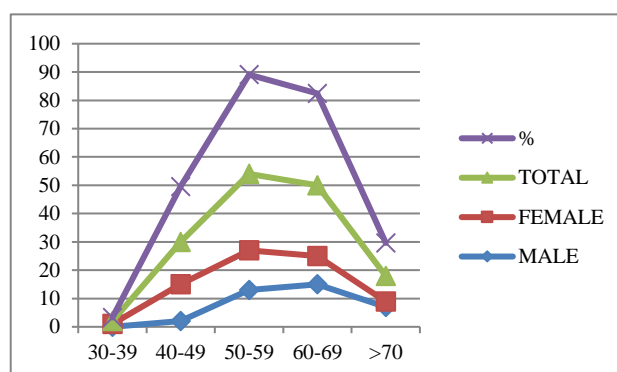


Figure 1: Line graph showing metabolic syndrome in different age groups.

Out of 100 participants seventy-seven (77%) were diagnosed to have metabolic syndrome by applying the NCEP: ATP (III) definition of Mets. Of the 48 females 40 (51.95%) were found to have Mets while 37 (48.05%) of the 52 male participants were having the syndrome.

Table 1: Number of the patients fulfilling different criteria of metabolic syndrome among patients having the syndrome (n=77).

	3 Criteria		4 Criteria		5 Criteria	
	No.	%	No.	%	No.	%
Male (n=37)	17	45.94	13	35.14	7	18.92
Female (n=40)	18	45	20	50	2	5
<b>Total (n=77)</b>	<b>35</b>	<b>45.45</b>	<b>33</b>	<b>42.85</b>	<b>9</b>	<b>11.68</b>

Nine (11.68%) participants fulfilled all 5 criteria for metabolic syndrome. Thirty-three (42.85%) of all the participants had four criteria of metabolic syndrome. Three criteria were fulfilled by thirty-five (45.45%) of all the participants. Of the 52 males, 7 (18.92%) had all 5

components of metabolic syndrome, 13 (35.14%) had 4 criteria while 3 criteria were present in 17 (45.94%). Of the 56 females, 2 (5%) had all 5 criteria while 20 (50%) patients had 4 criteria of metabolic syndrome and 18 (45%) participants had 3 criteria (Table 1).

**Table 2: Prevalence of the components of the metabolic syndrome in patients diagnosed to have metabolic syndrome (n=77).**

	Total (n=77)		Male (n=37)		Female (n=40)	
	No.	%	No.	%	No.	%
Type 2 diabetes	77	100	37	48.05	40	51.95
Waist circumference	37	48.05	7	18.91	30	81.09
Hypertension	63	81.81	31	49.20	32	50.79
Raised triglycerides	41	53.24	21	51.21	20	48.79
Low HDL	64	83.11	32	50	32	50

As all of them were diabetics, comparison was made for the presence of abdominal obesity, hypertension, low HDL and high triglycerides levels. The total number was 77 (77%). Out of 77 participants having the syndrome males were 37 (48.05%) and females were 40 (51.95%). All the patients were known diabetics. Increased waist circumference was found in 37 (48.05%), 7 (18.91%) were males and 30 (81.09%) were females. Hypertension was seen in 63 (81.81%) participants. Among these 31 (49.20%) were males and 32 (50.80%) were females. Triglycerides were increased in 41 (53.24%) participants with 21 (51.21%) males and 20 (48.79%) females having raised TGs. Decreased HDL Cholesterol levels were found in 64 (83.11%) patients of metabolic syndrome and it was equally 32 (50%) distributed in males and females (Table 2).

**Table 3: Comparison of participants having metabolic syndrome (n=77) with those without the syndrome (n=23).**

	Metabolic syndrome	Mean±SD	P-value
Waist circumference	Yes	89.87±8.65	0.003*
	No	82.65±5.49	
Systolic blood pressure	Yes	132.59±9.88	0.001*
	No	123.04±5.45	
Diastolic blood pressure	Yes	84.62±4.88	0.001*
	No	79.04±3.40	
Triglycerides	Yes	153.67±31.09	0.001*
	No	120.01±29.34	
HDL	Yes	41.39±7.50	0.001*
	No	49.23±9.91	

All the parameters were on higher side in participants having metabolic syndrome than those without syndrome and this was Statistically significant (Table 3).

Prevalence of fatty liver in total 100 patients of type 2 diabetes was forty-nine (49%) and out of 77 metabolic syndrome participants the prevalence was forty-five (58.44%). And this was more prevalent in female 30 (75%) participants out of total 40, than male out of 37 participants only 15 (40.54%) had fatty liver. Analysis of fatty liver in participants revealed that risk of fatty liver in metabolic syndrome was 10 times than that those with fatty liver in diabetes without metabolic syndrome (odds ratio -10.65 with  $p < 0.005$ ).

**Table 4: Severity of fatty liver in participants.**

Metabolic syndrome	Fatty liver				
	Normal	Mild	Moderate	Severe	Total
Yes	32	25	18	2	77
%	62.75	89.29	94.74	100	
No	19	3	1	0	23
%	37.25	10.71	5.26	0	
Fatty liver	Odds ratio	95% confidence limit		Chi²	
Normal	1.00	-		-	
Mild	4.94	1.23-19.87		6.26	
Moderate	10.68	1.16-98.42		6.84	
Severe	-	-		1.14	

## DISCUSSION

The prevalence rate of Mets was 77%. The prevalence rates of the Mets in both male and female as noted in this report are comparable to that of a previous report on the Mets. The frequency of metabolic syndrome was 77% which is in accordance with other studies, i.e., prevalence of 70-80% among Caucasian type 2 diabetics.<sup>4,5</sup> A study conducted in Indian urban population gives a prevalence of 76.3% among type-2 diabetics.<sup>6</sup>

In present study metabolic syndrome was found to be more common in females with type 2 diabetes mellitus as compared to their male counterparts. Various studies showed different effects of gender on the metabolic syndrome in different populations. In USA, metabolic syndrome is more prevalent in white males 62%. Mohsin A et al showed a very high prevalence (female 63% and male 56%) of the metabolic syndrome (85.8%) in type 2 diabetic population.<sup>7,8</sup> In a study at KJ Somayya Medical College, Mumbai, Maharashtra, India. The prevalence of Mets among urban Indian diabetic patients was 77.2% and was significantly higher in women (87.71%) when compared to men (69.33%) with ( $p < 0.0001$ ).<sup>9</sup>

The role of age as a risk factor of Mets cannot be overemphasized as age dependency of the syndrome's prevalence is seen in most populations around the world. The mean age of men with Mets was significantly higher than that of women, the age specific prevalence of Mets however was similar in both genders. These findings are similar to those documented in Seychelles population where the greatest prevalence of Mets using the ATP definition was highest at age 45-54 for men.<sup>10</sup> In a

Finnish study on Mets, the prevalence of the Mets was found to increase with increasing age in women 11% in age group 20-29 years increased up to 89% in age group >70 years.<sup>11</sup>

As all of them were diabetics, comparison was made for the presence of abdominal obesity, hypertension, low HDL and high triglycerides levels. In present study low HDL was most frequent while hypertriglyceridemia was least frequent. Low HDL was seen in 83.11% participants and was equally distributed in both sexes. Hypertension was the second most prevalent factor 81.81% and also equally distributed in both sexes. In Seychelles, South Africa region hypertension and adiposity was most frequent factor.<sup>10</sup> While in Mumbai, India it was hypertension followed by hypertriglyceridemia.<sup>9</sup> The combination of abdominal obesity and low HDL was also reported as the most common combination among Chinese type-2 diabetics with metabolic syndrome. In contrary to this we found hypertension and low HDL as prevalent components of metabolic syndrome. Some researchers have reported lower rates (25%) of occurrence of central obesity in the metabolic syndrome.<sup>12</sup> We report a prevalence rate of hypertension of 81%. This is similar to reports to reports from the Nigerian reports.<sup>13</sup> A small proportion- 11.68% of present subjects with type 2 DM have all the components of the Mets. This was similar to study in Abbottabad, 15.78% participants had all 5 components. This is in contradiction to the report by Fezeu et al who reported the absence of a combination of four components of the Mets in their study subjects but similar to Chinese type-2 diabetics with metabolic syndrome.<sup>12</sup> Marchesini et al showed that insulin resistance was the laboratory finding most closely associated with the presence of NAFLD in a large series of patients, irrespective of BMI, fat distribution or glucose tolerance.<sup>13</sup>

In present study the prevalence of fatty liver in metabolic syndrome found to be 58.44%, this was similar to Iran study by Merat S 55.8%, US study was 69.5%.<sup>14,15</sup> While the prevalence of fatty liver in type 2 diabetes found to be 49% and this was similar to NAFLD and NASH in present cohort of type 2 DM patients in Malaysia 49.6%, Korea 56%.<sup>16,17</sup>

The limitations of present study are in large part, related to the cross-sectional design of the study. The study is limited to reporting disease prevalence data and the incidence of disease occurrence in this population cannot be inferred from this study.

## CONCLUSION

In conclusion, the prevalence of the metabolic syndrome in type 2 DM is high in both genders and increases with age thus posing a potential high cardiovascular risk in this group of patients. The modifiable risk factors for the metabolic syndrome should be a focus point in the management of subjects with type 2 DM.

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