

Prevalence of Metabolic Syndrome in Newly Diagnosed Type 2 Diabetes Mellitus

S Nahar¹, MZ Rahman², M Ullah³, BC Debnath⁴, N Sultana⁵, CMRQ Farhad⁶

¹Department of Biochemistry, NICVD, ²The State of Medical Faculty of Bangladesh, Dhaka, ³Department of Cardiology, NICVD, ⁴Department of Biochemistry, Sylhet Women's Medical College, Sylhet, ⁵Department of Biochemistry, Jalalabad Ragib Rabeya medical College, Sylhet, ⁶Department of Biochemistry, Sylhet MAG Osmani Medical College, Sylhet.

Abstract:

Keywords:

Metabolic syndrome, Type II diabetes mellitus.

Background- People with metabolic syndrome are twice as likely to die from, and three times as likely to have a heart attack or stroke compared with people without the syndrome. People with metabolic syndrome have a five-fold greater risk of developing type 2 diabetes. We investigated the prevalence of metabolic syndrome in patients with newly diagnosed diabetes mellitus.

Methods- It was a cross sectional study. The study was conducted in Department of Biochemistry, Sylhet MAG Osmani Medical College, Sylhet & Diabetic Hospital, Sylhet. The study was conducted From July 2008 to June 2009 among 200 patients with newly diagnosed type 2 diabetic patients with age >20 years. Along with blood glucose, different components of metabolic syndrome was assessed, i.e. serum triglyceride level, serum HDL level, blood pressure and waist circumference.

Results- Prevalence of metabolic syndrome was 73.5% according to NCEP-ATP III criteria, 81.0% according to modified NCEP-ATP III criteria, 82.5% according to modified WHO criteria and 61.0% according to IDF criteria. All variables other than waist hip ratio and fasting blood sugar had statistically significant higher mean values among patients with metabolic syndrome than patients without metabolic syndrome.

Conclusion- It may be concluded that prevalence of metabolic syndrome is considerable in newly diagnosed type 2 diabetic patients in our population. The considerable prevalence of metabolic syndrome in our population is implicative of an alarming risk of cardiovascular disease in future.

(Cardiovasc. j. 2011; 4(1): 17-25)

Introduction:

The metabolic syndrome is a cluster of the most dangerous heart attack risk factors: diabetes and prediabetes, abdominal obesity, high cholesterol and high blood pressure. A quarter of the world's adults have metabolic syndrome. People with metabolic syndrome are twice as likely to die from, and three times as likely to have a heart attack or stroke compared with people without the syndrome. People with metabolic syndrome have a five-fold greater risk of developing type 2 diabetes. Up to 80% of the 200 million people with diabetes globally will die of cardiovascular disease. This puts metabolic syndrome and diabetes way ahead of HIV/AIDS in morbidity and mortality terms yet the problem is not as well recognized. Metabolic syndrome is characterized by hyperinsulinaemia, low glucose tolerance, dyslipidaemia, hypertension and obesity.¹ There are different diagnostic criteria for metabolic syndrome. According to modified WHO criteria metabolic syndrome is defined as a presence of diabetes and e"2 of the following: 1)

BMI >30 kg/m² or Waist hip ratio>0.9 for men, >0.85 for women. 2) TG e"150 mg/dl or HDL <35 mg/dl (male), <39 mg/dl (female). 3). BP e"140/90 mm Hg or on medication.

Fifty million Americans now carry the diagnosis of metabolic syndrome a cluster of life shortening morbidities that include type 2 diabetes.² Prevalence of metabolic syndrome is extremely high among young adults in urban areas and the most prevalent components of the metabolic syndrome are found to be high triglycerides, low HDL cholesterol, high blood pressure, abdominal obesity and high fasting glucose respectively.³ The prevalence of metabolic syndrome in developed countries is 22-39%.¹ The prevalence of type 2 diabetes was found to be 3.8% in rural Bangladesh among subjects in the age category 30-64 years (Hussain et al. 2006). The prevalence of metabolic syndrome in rural Bangladesh is <3%.⁴

Diabetes mellitus is the commonest metabolic abnormality in the world. Type 2 diabetes is the

commonest form of diabetes, constituting nearly 90% of diabetic population in any country. Prevalence of type 2 diabetes is increasing in most of the countries especially in developing countries.⁵

The metabolic syndrome has been shown to be predictive of cardiovascular diseases (CVD) and diabetes. Diabetic patients are at an excessive risk of CVD mortality. In addition to increasing the risk of CVD, the metabolic syndrome may hasten the development of stroke and complication of diabetes mellitus like diabetic nephropathy, retinopathy and neuropathy.⁶

The metabolic syndrome prevalence is even higher in diabetes mellitus patients and insulin resistance is believed to be the underlying cause for both type 2 diabetes mellitus and the metabolic syndrome.

Patients with type-2 diabetes mellitus (DM) already fulfill one of the NCEP-ATP III or IDF diagnostic criteria, and two more are required for metabolic syndrome diagnosis. From an epidemiological point of view, the syndrome is highly prevalent in patients with type-2 DM, and it often precedes the onset of hyperglycemia. The prevalence of the metabolic syndrome is 46.9% for males and 65.1% for females in Korea with type 2 diabetes mellitus.⁷

However, much controversy surrounds the importance of Metabolic Syndrome in diabetics as a separate biological entity over each of its components as a cardiovascular risk factor. On the other hand, many studies have shown that Metabolic Syndrome, irrespective of its definition, is an independent clinical indicator of macrovascular and microvascular complications in diabetics.⁸

We studied the prevalence of metabolic syndrome in our newly diagnosed type 2 diabetes mellitus patients. So that we can aware the diabetic patients as well as concerned physicians about the prevalence of metabolic syndrome so that adequate measures may be taken to reduce the risk of cardiovascular disease.

Materials and Methods:

It was a cross sectional study. The study was conducted in Department of Biochemistry, Sylhet MAG Osmani Medical College, Sylhet & Diabetic Hospital, Sylhet. The study was conducted From July 2008 to June 2009 among 200 patients with

newly diagnosed type 2 diabetic patients with age >20 years. Patients with type I DM and gestational DM were excluded from the study The sampling technique was purposive and convenient.

Anthropometric Measurements

Body weight (in kg) was measured in light clothing and without shoes. The weight was recorded to the nearest kg. Height was measured without shoes with the subjects standing fully erect on a flat surface and taken to the nearest centimeter. Body mass index was calculated by the formula - $BMI = \text{Weight in kg} / (\text{Height in meter})^2$

Waist circumference (in centimeter) was measured at midway between the costal margin & iliac crest. Waist circumference was measured at the end of normal expiration.

Hip circumference (in centimeter) was taken as the largest circumference at the posterior extension of the buttocks (Transtrochantaric). Waist hip ratio is the waist circumference divided by the hip circumference.

Blood pressure was measured on the right arm in the sitting position using a sphygmomanometer by the auscultatory method.

Diagnosis of Type 2 Diabetes Mellitus

Type 2 diabetes mellitus was diagnosed by history and performing blood glucose level. Fasting e" 126 mg/dl or 2 hours after oral glucose load is e" 200 mg/dl was considered diagnostic of diabetes mellitus.⁹

Laboratory Analysis

From each subject 5ml fasting venous blood sample was drawn by a disposable plastic syringe with all aseptic precautions in sitting posture and was collected into a properly cleaned and dry test tube without any anticoagulant.

Serum glucose was measured by Glucose Oxidase Method (GOD-PAP) (Sacks 2001) method. Serum Triglyceride was measured by GPO – PAP (Gowland 1988) method. Serum Total Cholesterol, HDL Cholesterol and LDL Cholesterol was measured by Precipitation & CHOD-PAP method (Gowland 1988).

Statistical Analysis

Results were expressed as mean \pm SD. The data were analyzed with the help of SPSS software program

(14.0) using the relevant tests of significance such as Unpaired 't' test & Chi-square test. A level of $P < 0.05$ was accepted as statistically significant.

Results and Observations:

A total of two hundred newly diagnosed type 2 diabetes mellitus patients were included in this study. . Out of all patients maximum 35.0% were within 41 to 50 years age group followed by 24.0% within 31 to 40 years, 25.0% within 51 to 60 years, 9.5% within 20 to 30 years and 6.5% more than 60 years age group (Figure-1). Among study subjects 117 (58.5%) were male and 83 (41.5%) % were female. Male and female ratio was 1.43: 1.

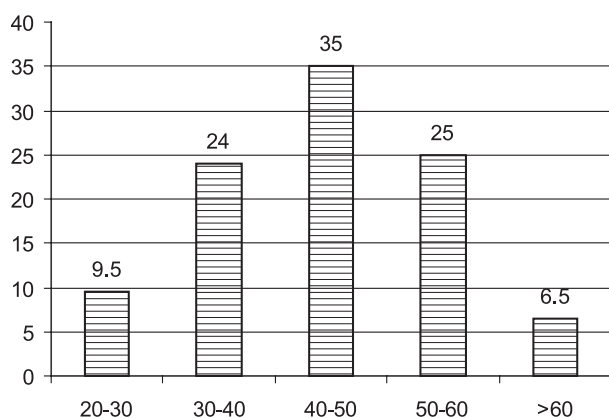


Fig 1: Age distribution of the patients

Table- I shows the distribution of patients by different categories of BMI. Among male patients maximum 56.4% were normal weight, 36.8% over weight, 3.4% obese and 3.4% under weight. Among female patients maximum 49.4% were over weight 38.6% normal weight, 12% obese and 0.0% under weight Out of all patients maximum 49.0% were normal weight, 42.0% over weight, 7.0% obese and 2.0% under weight. There were 51(61.4 %) female patients with BMI>25 in contrast with 47(40.2%) male patients with BMI>25.

Different components of metabolic syndrome were shown in Table-II. According to NCEP-ATP III criteria waist circumference of 27.5% patients were above the cut-off point, 53.0% had hypertension, 81.0% had raised TG, 77.5% had low HDL and 69.0% had raised FBS. In Modified NCEP-ATP III criteria waist circumference of 63.0% patients were above the cut-off point, 53.0% had hypertension, 81.0% had raised TG, 77.5% had low HDL and 69.0% had raised FBS. In Modified WHO criteria 27.5% patients had hypertension, 95.0% patient's BMI or WHR were above the cut-off point and 83.0% had raised TG or low HDL. As per IDF criteria waist circumference of 65.0% patients were above the cut-off point, 53.0% had hypertension, 81.0% had raised TG, 77.5% had low HDL and 80.0% had raised blood sugar.

Table-I

Distribution of the patients by different categories of BMI

Weight (based on BMI) kg/m ²	Male (n= 117)	Female (n= 83)	Total subjects (n= 200)
Under weight (≤ 18.5)	4 (3.4) [#]	0 (.0)	4 (2)
Normal (18.51-24.99)	66 (56.4)	32 (38.6)	98 (49)
Over weight (25.00-29.99)	43 (36.8)	41 (49.4)	84 (42)
Obese (>30)	4 (3.4)	10 (12.0)	14 (7)

[#]Figure within parenthesis indicated corresponding column percentage.

Table-II

Distribution of components of metabolic syndrome among study subjects

Components	NCEP-ATP III	ModifiedNCEP-ATP III	Modified WHO	IDF
Waist Circumference	55 (27.5) [#]	126 (63.0)	-	130 (65.0)
Blood pressure	106 (53.0)	106 (53.0)	55 (27.5)	106 (53.0)
TG	162 (81.0)	162 (81.0)	-	162 (81.0)
HDL	155 (77.5)	155 (77.5)	-	155 (77.5)
FBS	138 (69.0)	138 (69.0)	-	160 (80.0)
BMI or WHR	-	-	190 (95.0)	-
TG or HDL	-	-	166 (83.0)	-

[#]Figure within parenthesis indicated corresponding column percentage.

Table-III shows the baseline characteristics in newly diagnosed type 2 diabetes mellitus patients with and without metabolic syndrome (According to NCEP-ATP III criteria). Mean age in patients with metabolic syndrome & without metabolic syndrome were (44.84 ± 10.33) & (48.89 ± 10.18) respectively. BMI in patients with metabolic syndrome & without metabolic syndrome were (25.48 ± 3.39) & (23.47 ± 3.52) respectively. Waist circumference in patients with metabolic syndrome & without metabolic syndrome were (90.46 ± 7.72) & (84.45 ± 8.81) respectively. Waist hip ratio in patients with metabolic syndrome & without metabolic syndrome were (0.95 ± 0.02) & (0.94 ± 0.02) respectively. Systolic & diastolic blood pressure in patients with metabolic syndrome & without metabolic syndrome were (129.46 ± 11.76, 80.03 ± 8.96) & (119.81 ± 9.75, 71.89 ± 7.61) respectively.

Fasting blood sugar, Total cholesterol, HDL, LDL, TG in patients with metabolic syndrome & without metabolic syndrome were (175.78 ± 77.66, 184.87 ± 38.83, 36.80 ± 5.19, 105.03 ± 27.82, 224.96 ± 81.02) & (150.81 ± 106.90, 159.40 ± 32.80, 41.43 ± 4.26, 89.49 ± 29.05, 155.30 ± 37.65) respectively.

All variables other than waist hip ratio and fasting blood sugar had statistically significant higher mean values among patients with metabolic syndrome than patients without metabolic syndrome. No significant difference was observed in waist hip ratio & fasting blood sugar between patients with and without metabolic syndrome.

Table-IV shows the baseline characteristics in newly diagnosed type 2 diabetes mellitus patients with and without metabolic syndrome (According to Modified NCEP-ATP III criteria). Mean age in patients with metabolic syndrome & without metabolic syndrome were (45.12 ± 10.25) & (49.29 ± 10.54) respectively. BMI in patients with metabolic syndrome & without metabolic syndrome were (25.50 ± 3.34) & (22.58 ± 3.37) respectively. Waist circumference in patients with metabolic syndrome & without metabolic syndrome were (90.48 ± 7.60) & (82.00 ± 8.41) respectively. Waist hip ratio in patients with metabolic syndrome & without metabolic syndrome were (0.95 ± 0.02) & (0.94 ± 0.02) respectively. Systolic & diastolic blood pressure in patients with metabolic syndrome & without metabolic syndrome were (128.83 ± 11.74, 79.63 ± 8.91) & (118.68 ± 9.63, 70.39 ± 7.20) respectively.

Fasting blood sugar, Total cholesterol, HDL, LDL, TG in patients with metabolic syndrome & without metabolic syndrome were (172.19 ± 78.14, 183.96 ± 37.95, 37.15 ± 5.29, 104.72 ± 27.78, 219.11 ± 79.97) & (156.26 ± 117.17, 153.21 ± 33.03, 41.79 ± 3.82, 84.71 ± 28.36, 152.74 ± 38.83) respectively.

All variables other than fasting blood sugar had statistically significant higher mean values among patients with metabolic syndrome than patients without metabolic syndrome. No significant difference was observed in fasting blood sugar between patients with and without metabolic syndrome.

Table-III

Baseline characteristics in newly diagnosed type 2 diabetes mellitus with and without metabolic syndrome (According to NCEP-ATP III Criteria¹⁰)

Variables	Type 2 Diabetes Mellitus		p value*
	With MS	Without MS	
Age (years)	44.84 ± 10.33	48.89 ± 10.18	0.015
BMI (kg/ m ²)	25.48 ± 3.39	23.47 ± 3.52	0.001
Waist circumference (cm)	90.46 ± 7.72	84.45 ± 8.81	0.001
Waist hip ratio	0.95 ± 0.02	0.94 ± 0.02	0.066 (NS)
Systolic BP (mm Hg)	129.46 ± 11.76	119.81 ± 9.75	0.001
Diastolic BP (mm Hg)	80.03 ± 8.96	71.89 ± 7.61	0.001
Fasting blood sugar (mg/dl)	175.78 ± 77.66	150.81 ± 106.90	0.073 (NS)
Total cholesterol (mg/dl)	184.87 ± 38.83	159.40 ± 32.80	0.001
HDL (mg/dl)	36.80 ± 5.19	41.43 ± 4.26	0.001
LDL (mg/dl)	105.03 ± 27.82	89.49 ± 29.05	0.001
TG (mg/dl)	224.96 ± 81.02	155.30 ± 37.65	0.001

* Unpaired t test was done and p<0.05 taken as level of significance.

Table-IV

Baseline characteristics in newly diagnosed type 2 diabetes mellitus with and without metabolic syndrome (According to Modified NCEP-ATP III Criteria¹⁰)

Variables	Type 2 Diabetes Mellitus		p value*
	With MS	Without MS	
Age (years)	45.12 ± 10.25	49.29 ± 10.54	0.026
BMI (kg/ m ²)	25.50 ± 3.34	22.58 ± 3.37	0.001
Waist Circumference (cm)	90.48 ± 7.60	82.00 ± 8.41	0.001
Waist hip ratio	0.95 ± 0.02	0.94 ± 0.02	0.028
Systolic BP (mm Hg)	128.83 ± 11.74	118.68 ± 9.63	0.001
Diastolic BP (mm Hg)	79.63 ± 8.91	70.39 ± 7.20	0.001
Fasting Blood sugar(mg/dl)	172.19 ± 78.14	156.26 ± 117.17	0.310 (NS)
Total cholesterol (mg/dl)	183.96 ± 37.95	153.21 ± 33.03	0.001
HDL (mg/dl)	37.15 ± 5.29	41.79 ± 3.82	0.001
LDL (mg/dl)	104.72 ± 27.78	84.71 ± 28.36	0.001
TG (mg/dl)	219.11 ± 79.97	152.74 ± 38.83	0.001

* Unpaired t test was done and p<0.05 taken as level of significance.

Table-V shows the baseline characteristics in newly diagnosed type 2 diabetes mellitus patients with & without metabolic syndrome (According to Modified WHO criteria). Mean age in patients with metabolic syndrome & without metabolic syndrome were (46.06 ± 10.31) & (45.20 ± 11.03) respectively. BMI in patients with metabolic syndrome & without metabolic syndrome were (25.15 ± 3.31) & (23.97 ± 4.35) respectively. Waist circumference in patients with metabolic syndrome & without metabolic syndrome were (89.57 ± 8.03) & (85.54 ± 9.54) respectively. Waist hip ratio in patients with metabolic syndrome & without metabolic syndrome were (0.95 ± 0.02) & (0.93 ± 0.03) respectively. Systolic & diastolic blood pressure in patients with metabolic syndrome & without metabolic syndrome

were (128.70 ± 12.07, 79.09 ± 9.31) & (118.43 ± 7.35, 72.14 ± 7.10) respectively.

Fasting blood sugar, Total cholesterol, HDL, LDL, TG in patients with metabolic syndrome & without metabolic syndrome were (172.63 ± 89.03, 182.59 ± 34.10, 37.43 ± 5.48, 104.85 ± 28.70, 220.19 ± 76.65) & (152.80 ± 74.28, 157.03 ± 51.95, 40.86 ± 3.62, 82.34 ± 22.10, 141.94 ± 48.69) respectively.

All variables other than age, BMI & fasting blood sugar had statistically significant higher mean values among patients with metabolic syndrome than patients without metabolic syndrome. No significant difference was observed in age, BMI & fasting blood sugar between patients with and without metabolic syndrome.

Table-V

Baseline characteristics in newly diagnosed type 2 diabetes mellitus with and without metabolic syndrome (According to Modified WHO Criteria¹¹)

Variables	Type 2 Diabetes Mellitus		p value*
	With MS	Without MS	
Age (years)	46.06 ± 10.31	45.20 ± 11.03	0.658 (NS)
BMI	25.15 ± 3.31	23.97 ± 4.35	0.071 (NS)
Waist Circumference (cm)	89.57 ± 8.03	85.54 ± 9.54	0.010
Waist hip ratio	0.95 ± 0.02	0.93 ± 0.03	0.003
Systolic BP (mm Hg)	128.70 ± 12.07	118.43 ± 7.35	0.001
Diastolic BP (mm Hg)	79.09 ± 9.31	72.14 ± 7.10	0.001
Fasting Blood sugar(mg/dl)	172.63 ± 89.03	152.80 ± 74.28	0.220 (NS)
Total cholesterol (mg/dl)	182.59 ± 34.10	157.03 ± 51.95	0.001
HDL (mg/dl)	37.43 ± 5.48	40.86 ± 3.62	0.001
LDL (mg/dl)	104.85 ± 28.70	82.34 ± 22.10	0.001
TG (mg/dl)	220.19 ± 76.65	141.94 ± 48.69	0.001

* Unpaired t test was done and p<0.05 taken as level of significance.

Table-VI
Baseline characteristics in newly diagnosed type 2 diabetes mellitus with and without metabolic syndrome (According to IDF Criteria¹²)

Variables	Type 2 Diabetes Mellitus		p value*
	With MS	Without MS	
Age (years)	44.63 ± 9.94	47.91 ± 10.89	0.030
BMI	26.63 ± 2.86	22.32 ± 2.79	0.001
Waist Circumference (cm)	93.44 ± 5.62	81.71 ± 6.98	0.001
Waist hip ratio	0.95 ± 0.01	0.94 ± 0.02	0.001
Systolic BP (mm Hg)	128.89 ± 11.62	123.78 ± 12.07	0.003
Diastolic BP (mm Hg)	80.25 ± 9.33	74.17 ± 8.08	0.001
Fasting Blood sugar(mg/dl)	163.66 ± 76.66	177.76 ± 100.54	0.292(NS)
Total cholesterol (mg/dl)	181.09 ± 33.38	173.47 ± 46.12	0.178(NS)
HDL (mg/dl)	37.39 ± 5.43	39.04 ± 5.12	0.033
LDL (mg/dl)	102.34 ± 28.65	98.68 ± 29.36	0.383(NS)
TG (mg/dl)	217.46 ± 83.68	189.36 ± 66.07	0.009

*Unpaired t test was done and $p < 0.05$ taken as level of significance.

Table-VI shows the baseline characteristics in newly diagnosed type 2 diabetes mellitus patients with & without metabolic syndrome (According to IDF criteria). Mean age in patients with metabolic syndrome & without metabolic syndrome were (44.63 ± 9.94) & (47.91 ± 10.89) respectively. BMI in patients with metabolic syndrome & without metabolic syndrome were (26.63 ± 2.86) & (22.32 ± 2.79) respectively. Waist circumference in patients with metabolic syndrome & without metabolic syndrome were (93.44 ± 5.62) & (81.71 ± 6.98) respectively. Waist hip ratio in patients with metabolic syndrome & without metabolic syndrome were (0.95 ± 0.01) & (0.94 ± 0.02) respectively. Systolic & diastolic blood pressure in patients with metabolic syndrome & without metabolic syndrome were (128.89 ± 11.62, 80.25 ± 9.33) & (123.78 ± 12.07, 74.17 ± 8.08) respectively.

Fasting blood sugar, Total cholesterol, HDL, LDL, TG in patients with metabolic syndrome & without metabolic syndrome were (163.66 ± 76.66, 181.09 ± 33.38, 37.39 ± 5.43, 102.34 ± 28.65, 217.46 ± 83.68) & (177.76 ± 100.54, 173.47 ± 46.12, 39.04 ± 5.12, 98.68 ± 29.36, 189.36 ± 66.07) respectively.

All variables other than fasting blood sugar, total cholesterol & LDL level had statistically significant higher mean values among patients with metabolic

syndrome than patients without metabolic syndrome. No significant difference was observed in, fasting blood sugar, total cholesterol & LDL between patients with and without metabolic syndrome.

Prevalence of metabolic syndrome was shown by different criteria in Table-VII. According to NCEP-ATP III prevalence rate of metabolic syndrome was 73.5%, by modified NCEP-ATP III criteria 81.0%, by Modified WHO criteria 82.5% and by IDF criteria only 61.0%.

Table-VII

Distribution of prevalence of metabolic syndrome according to different diagnostic criteria

Diagnostic criteria	Prevalence	95% CI
NCEP-ATP III	73.5%	67.3-79.6
Modified NCEP-ATP III	81.0%	75.6-86.4
Modified WHO	82.5%	77.2-87.8
IDF	61.0%	54.2-67.8

Prevalence of metabolic syndrome among study subjects by sex was shown in Table-VIII shows After stratification by gender, 64.1% male and 86.7% female, 69.2% male and 97.6% female, 81.2% male and 84.3% female, and 38.5% male and 92.8%

female patients had metabolic syndrome according to NCEP-ATP III, Modified NCEP-ATP III, Modified WHO, and IDF criteria respectively. Prevalence of metabolic syndrome among female was significantly higher than male by all diagnostic criteria other than by modified WHO criteria.

Table-VIII

Distribution of prevalence of metabolic syndrome in different diagnostic criteria by sex

Diagnostic criteria	Sex		p value*
	Male	Female	
NCEP-ATP III	64.1% (75) #	86.7% (72)	0.001
Modified NCEP-ATP III	69.2% (81)	97.6 % (81)	0.001
Modified WHO	81.2% (95)	84.3% (70)	0.565
IDF	38.5% (45)	92.8% (77)	0.001

*Chi-square test was done and $p < 0.05$ taken as level of significance

#Figure within parenthesis indicated corresponding column number.

Discussion:

Metabolic syndrome is a cluster of cardiovascular risk factors. The components of metabolic syndrome are obesity, hypertension, low glucose tolerance and dyslipidemia. Association of other components of metabolic syndrome with diabetes mellitus increases the risk of cardiovascular complications significantly.

The incidence and prevalence of Diabetes Mellitus have been increasing steadily in Bangladesh. Diabetes is the most feared disease because it leads to a variety of complications including end-stage vascular disease, cardiovascular damage and retinal abnormalities. As a consequence, a large burden is put on the National Health System of all countries around the world.

Insulin resistance & consequent diabetes mellitus are major components of metabolic syndrome and may be one of the main causes of complication of metabolic syndrome. The metabolic syndrome accelerates both macro vascular and micro vascular complications frequently observed in diabetes mellitus. The prevalence of metabolic syndrome in newly diagnosed type 2 diabetes mellitus patients was evaluated by a cross sectional

study in Department of Biochemistry, Sylhet MAG Osmani Medical College & Diabetic Hospital, Sylhet. The study was done from July 2008 to June 2009.

Out of 200 patients, 117 were males and 83 were females. Of all patients, only 7.0% were obese, 49.0% normal weight, 42.0% over weight and 2.0% under weight. Mean BMI was 25.48 kg/m² for patients with metabolic syndrome and 23.47 kg/m² for patients without metabolic syndrome. Of all patients, 49% subjects with BMI > 25 kg/m². There were overall female predominance with BMI > 25 (61.4% females, 40.2 % males). In the study of Alshkri and Elmehdawi,⁸ out of 99 patients, 61 were females and 38 were males. Of all patients, 74.4% were obese and obesity was significantly more frequent among females ($p < 0.001$). Mean BMI was 33.6 kg/m². Our results are partially comparable with this study.

In this study, according to the defined criterion of NCEP-ATP III prevalence rate of metabolic syndrome was 73.5%, by modified NCEP-ATP III¹⁰ criteria 81.0%, by Modified WHO criteria¹¹ 82.5% and by IDF criteria¹² only 61.0%. This prevalence is nearly similar with the findings of different studies in different countries. Alshkri and Elmehdawi found that prevalence of metabolic syndrome among type 2 diabetes mellitus patients in Libya was 92% according to NCEP-ATP III criteria and 80.8% according to IDF criteria.⁸ Lin et al. found that prevalence of metabolic syndrome among type 2 diabetes mellitus patients in USA was 70% according to NCEP-ATP III criteria.¹³ Monami et al. found that prevalence of metabolic syndrome among type 2 diabetes mellitus patients in Italy was 68.4% according to NCEP-ATP III criteria and 73.7% according to IDF criteria.¹⁴ Lu et al. found that prevalence of metabolic syndrome among type 2 diabetes mellitus patients in UK was 61.0% according to NCEP-ATP III criteria and 54.0% according to IDF criteria.¹⁵ On the other hand Cull et al found that prevalence of metabolic syndrome among type 2 diabetes mellitus patients in China was 55.7% according to NCEP-ATP III criteria, 50.8% according to IDF criteria.¹⁶

In present study, according to NCEP-ATP III criteria no significant difference was observed in waist hip ratio & fasting blood sugar between patients with and without metabolic syndrome. In

modified NCEP-ATP III criteria no significant difference was observed in fasting blood sugar between patients with and without metabolic syndrome. In modified WHO criteria no significant difference was observed in age, BMI & fasting blood sugar between patients with and without metabolic syndrome. As per IDF criteria no significant difference was observed in, fasting blood sugar, total cholesterol & LDL between patients with and without metabolic syndrome. There was no significant difference in fasting blood sugar in all criteria between patients with and without metabolic syndrome. Probably because of the study subjects were type 2 diabetic patients.

In this study, it was observed that prevalence of metabolic syndrome was higher in women than in men in all the four criteria (64.1% vs. 86.7%, 69.2% vs. 97.6%, 81.2% vs. 84.3%, and 38.5% vs. 92.8%) NCEP-ATP III, Modified NCEP-ATP III, Modified WHO and IDF respectively. Among metabolic syndrome prevalence in men the higher prevalence was observed in Modified WHO classification. However, in women higher prevalence was observed in modified NCEP-ATP III classification. Similar observation was also observed in study by Dhanaraj et al.¹⁷ In their study the subjects were newly detected type 2 diabetes with a BMI of <25 kg/m². The prevalence of metabolic syndrome was higher in women than in men in all the four criteria (25.75% vs. 48.19%, 37.12% vs. 59.03%, 49.2% vs. 51.80%, and 19.69% vs. 48.19%) NCEP-ATP III, Modified NCEP-ATP III, Modified WHO and IDF respectively. Females were significantly more affected by metabolic syndrome than males, probably because of the higher frequency of obesity among females in this study. In Alshkri and Elmehdawi study,⁸ metabolic syndrome in females was also found significantly more than in males. On the other hand Ford et al found that prevalence of metabolic syndrome were more common in male.¹⁸

Considerable prevalence of metabolic syndrome in type 2 diabetes mellitus patients is alarming in our population. Sedentary life style, altered food habits and obesity may be responsible for this.

Conclusion:

From this study it may be concluded that prevalence of metabolic syndrome is considerable in newly diagnosed type 2 diabetic patients in our

population. So both diabetic patients & physicians should be aware of the prevalence of metabolic syndrome. The considerable prevalence of metabolic syndrome in our population is implicative of an alarming risk of cardiovascular disease in future.

Recommendations:

1. Physicians treating type-2 diabetics should consider metabolic syndrome with greater emphasis and manage the patients accordingly.
2. Studies with larger samples may be conducted to define more precisely the frequency of metabolic syndrome and its different components among diabetics and non-diabetic subjects.
3. Prospective follow up studies are needed to identify the impact of metabolic syndrome on long-term complications of DM.

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