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# FREQUENCY OF METABOLIC SYNDROME AMONG PATIENTSWITH NEWLY DIAGNOSED TYPE II DIABETES MELLITUS

**Dr. Sajjad[1], Dr. Abdul Ahad[2], Dr Sobia Habib[3]**

[1]TMO, Saidu Teaching Hospital Swat, Email: sajjadasharay@gmail.com

[2]Prof of Medicine, Saidu Teaching Hospital Swat

[3]Women Medical Officer, Catagory D Hospital South Waziristan

**Corresponding Author: Dr Sajjad**, TMO, Saidu Teaching Hospital Swat,
Email: sajjadasharay@gmail.com

## ABSTRACT

**BACKGROUND:** Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and hyperglycemia, and its prevalence has risen globally due to increasing urbanization, sedentary lifestyles, and poor dietary habits. One of the major complications associated with T2DM is metabolic syndrome, a cluster of conditions that increase the risk of cardiovascular disease, stroke, and type 2 diabetes itself. Metabolic syndrome includes abdominal obesity, hypertension, hyperglycemia, high triglycerides, and low high-density lipoprotein (HDL) cholesterol. The aim of this study was determine the frequency of metabolic syndrome among patients presenting with Type 2 Diabetes Mellitus (T2DM) and to explore its association with various demographic and biochemical factors**.**

**METHODS:** A cross-sectional study was conducted on 257 patients newly diagnosed with T2DM. Demographic data (age, gender, BMI, education status, residence) and biochemical markers (fasting plasma glucose, triglycerides, and HDL cholesterol) were collected. The presence of metabolic syndrome was defined according to the National Cholesterol Education Program Adult Treatment Panel III criteria. Statistical analysis was performed to determine the association between demographic factors, biochemical markers, and metabolic syndrome.

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**RESULTS:** The mean age of the study population was 49.2 years (SD = 10.3), with 135 males (52.5%) and 122 females (47.5%). The prevalence of metabolic syndrome was 69.6%. Significant associations were found between metabolic syndrome and older age (p = 0.01), higher BMI (p = 0.003), lower education levels (p = 0.02), and elevated triglycerides (p = 0.02) and low HDL cholesterol (p = 0.03). Gender (p = 0.24) and residence (p = 0.33) did not show significant differences. Fasting plasma glucose levels (p = 0.11) were not significantly associated with metabolic syndrome in this population.

**CONCLUSION:** Metabolic syndrome is highly prevalent among newly diagnosed T2DM patients, with age, BMI, education level, and biochemical markers such as triglycerides and HDL being significant contributing factors. Targeted interventions addressing weight management, lipid control, and educational disparities may help reduce the burden of metabolic syndrome and associated cardiovascular risks in this population.

**KEYWORDS:** Type 2 Diabetes Mellitus, Metabolic Syndrome, Prevalence, BMI, Triglycerides, HDL Cholesterol.

## INTRODUCTION

Type 2 diabetes (T2D), previously known as adult-onset diabetes, is characterized by high blood sugar, insulin resistance, and a relative deficiency in insulin production. Many individuals with T2D remain undiagnosed or unaware of their condition, posing challenges for initiating appropriate treatment, especially since patients often go through a denial phase. Common symptoms include increased thirst, frequent urination, and unexplained weight loss. Other symptoms may include increased hunger, fatigue, and non-healing sores.[1] These symptoms typically develop gradually. Long-term complications from poorly managed blood sugar include cardiovascular diseases, strokes, diabetic retinopathy (which can lead to blindness), kidney failure, and poor circulation in the limbs, potentially leading to amputations. Hyperosmolar hyperglycemic state may arise suddenly, though diabetic ketoacidosis is less common. Additionally, the rising prevalence of metabolic syndrome (MetS) among newly diagnosed T2D patients presents a significant challenge.[2] Metabolic syndrome is characterized by a cluster of at least three of the following conditions: abdominal obesity, hypertension, high blood sugar, high triglycerides, and

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low HDL cholesterol.[3] Studies indicate that 61% of newly diagnosed T2D patients meet the criteria for MetS and face a significantly higher risk of stroke or myocardial infarction in the next decade. MetS also increases the risk of developing T2D by five to sevenfold. T2D is primarily caused by obesity and physical inactivity, though genetic factors also contribute.

Type 2 diabetes accounts for about 90% of all diabetes cases, with the remaining 10% attributed to type 1 diabetes and gestational diabetes.[4] In type 1 diabetes, there is an autoimmune destruction of insulin-producing beta cells, leading to insufficient insulin production. Diagnosis of diabetes is typically through blood tests, such as fasting plasma glucose, oral glucose tolerance test, or glycated hemoglobin (A1C). Type 2 diabetes is largely preventable by maintaining a healthy weight, regular exercise, and a balanced diet rich in fruits, vegetables, and low in sugar and saturated fats.[5]

While type 1 diabetes patients generally do not experience hyperlipidemia with proper glycemic control, those with type 2 diabetes often exhibit dyslipidemia, even with relatively good blood sugar control. Common lipid abnormalities in T2D include elevated plasma triglycerides, elevated low-density lipoprotein cholesterol (LDL-C), and decreased high-density lipoprotein cholesterol (HDL-C). Metabolic syndrome is associated with increased cardiovascular morbidity and mortality, type 2 diabetes, and overall mortality.[6] The primary clinical goal in addressing metabolic syndrome is to improve public health and mitigate negative outcomes through comprehensive management. Although cardiovascular disease (CVD) is widely recognized as a major outcome of MetS, there is ongoing debate about whether T2D is a significant outcome or merely a component of metabolic syndrome. Strong evidence links MetS with an increased risk of developing diabetes. Studies show varying prevalence rates of MetS among individuals with T2D. For example, the prevalence of MetS among women with T2D has been reported as high as 96.1%. In other studies, the frequency of MetS among diabetic patients ranged from 60% to 83%, with differences in gender distribution. These variations highlight the need for more local data on the frequency of MetS in T2D populations. The current study aims to determine the prevalence of MetS among T2D patients in our population. By examining this, we seek to provide valuable local data and offer directions for future research to better understand and address the challenges of MetS in T2D management.

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**Methodology:**

The study was a cross-sectional design conducted on 257 patients who were newly diagnosed with Type 2 Diabetes Mellitus (T2DM). Participants were recruited from a healthcare facility where they were evaluated for the presence of metabolic syndrome. The inclusion criteria required that participants be adults aged 18 and above, with a confirmed diagnosis of T2DM. Data collection involved obtaining demographic information such as age, gender, education status, and residential area. Anthropometric measurements, including height, weight, and body mass index (BMI), were recorded for each participant. Biochemical investigations were conducted, which included fasting plasma glucose (FPG), fasting serum triglycerides, and fasting high-density lipoprotein (HDL) cholesterol levels.

Metabolic syndrome was diagnosed based on the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria, which defined it as the presence of at least three of the following conditions: abdominal obesity, elevated blood pressure, high fasting blood glucose, high triglycerides, and low HDL cholesterol levels. Descriptive statistics were used to analyze the demographic characteristics of the sample. The associations between demographic and biochemical factors with metabolic syndrome were assessed using chi-square tests, and p-values less than 0.05 were considered statistically significant.

Ethical approval was obtained from the institutional review board, and informed consent was acquired from all participants before their inclusion in the study. The results were analyzed using statistical software, and the findings were compared with those of previous studies to provide a deeper understanding of the prevalence and risk factors for metabolic syndrome in newly diagnosed T2DM patients.

**RESULTS:**

The mean age of the patients in this study is 49.2 years, with a standard deviation of 10.3 years.

The prevalence of metabolic syndrome appears to increase with age, particularly in the 46-60 years group, where the p-value of 0.01 indicates statistical significance. This suggests that older patients are more likely to develop metabolic syndrome when diagnosed with Type 2 diabetes.

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However, for other age groups (18-30 years and 31-45 years), the p-values are greater than 0.05, indicating no statistically significant difference between those with and without metabolic syndrome.

Of the total 257 patients, 135 are male and 122 are female. While males have a slightly higher prevalence of metabolic syndrome (70.4%) compared to females (65.6%), the p-value of 0.24 indicates that this difference is not statistically significant. This suggests that gender does not have a strong influence on the likelihood of metabolic syndrome in this sample.

The mean BMI of the patients is 28.7 kg/m², which falls into the overweight category. The results show a clear association between higher BMI and metabolic syndrome.

Obese patients (BMI ≥ 30) have the highest prevalence of metabolic syndrome (81.4%), and this difference is highly statistically significant ($p = 0.003$). Overweight patients (BMI 25-29.9) also have a significantly higher rate of metabolic syndrome (75.6%) with a p-value of 0.01.

The p-value of 0.02 for the overall BMI analysis suggests that BMI is a significant factor in the occurrence of metabolic syndrome among patients with Type 2 diabetes.

The prevalence of metabolic syndrome is higher in patients with lower levels of education. For example, 77.8% of illiterate patients have metabolic syndrome, and the p-value of 0.02 indicates this difference is statistically significant.

Patients with up to middle school education also have a significantly higher prevalence of metabolic syndrome ($p = 0.05$), while those with higher education (graduate or above) show a slightly lower rate, though this difference is not statistically significant ($p = 0.10$).

The sample consists of 138 urban and 119 rural residents. The prevalence of metabolic syndrome is slightly higher in urban residents (69.6%) compared to rural residents (66.4%). However, the p-value of 0.33 indicates no statistically significant difference in metabolic syndrome rates between these two groups.

The biochemical markers measured (fasting plasma glucose, triglycerides, and HDL) also correlate with the presence of metabolic syndrome.

Fasting Serum Triglycerides: Higher triglyceride levels are significantly associated with metabolic syndrome ($p = 0.02$), with those with metabolic syndrome having higher triglyceride levels on average.

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Fasting HDL: Low HDL levels are also associated with metabolic syndrome (p = 0.03), suggesting that low HDL could be an important marker for identifying patients at risk.

Fasting Plasma Glucose: Although the average fasting plasma glucose was 158 mg/dL, the p-value of 0.11 indicates that there is no statistically significant difference in fasting plasma glucose levels between patients with and without metabolic syndrome in this sample. This might suggest that fasting glucose alone is not a strong predictor of metabolic syndrome in newly diagnosed Type 2 diabetes patients**.**

**Frequency of Metabolic Syndrome Among Patients with Newly Diagnosed Type 2 Diabetes Mellitus**

| Category | Subcategory | Total N = 257 | Metabolic Syndrome (Yes) | Metabolic Syndrome (No) | p-Value |
|---|---|---|---|---|---|
| **Age (Mean ± SD)** | | 49.2 ± 10.3 years | - | - | |
| **Age Range** | 18-30 Years | 47 | 30 (63.8%) | 17 (36.2%) | 0.32 |
| | 31-45 Years | 78 | 55 (70.5%) | 23 (29.5%) | 0.14 |
| | 46-60 Years | 132 | 90 (68.2%) | 42 (31.8%) | 0.01 |
| **Gender** | Male | 135 | 95 (70.4%) | 40 (29.6%) | 0.24 |
| | Female | 122 | 80 (65.6%) | 42 (34.4%) | |
| **Height (Mean ± SD)** | | 167.5 ± 9.6 cm | - | - | |
| **Weight (Mean ± SD)** | | 80.1 ± 15.4 kg | - | - | |
| **BMI (Mean ± SD)** | | 28.7 ± 4.2 kg/m² | - | - | |

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|---|---|---|---|---|---|
| **BMI Category** | Underweight (BMI < 18.5) | 14 | 2 (14.3%) | 12 (85.7%) | 0.68 |
| | Normal (18.5 - 24.9) | 67 | 35 (52.2%) | 32 (47.8%) | 0.04 |
| | Overweight (25 - 29.9) | 90 | 68 (75.6%) | 22 (24.4%) | 0.01 |
| | Obese (BMI ≥ 30) | 86 | 70 (81.4%) | 16 (18.6%) | 0.003 |
| **Education Status** | Illiterate | 45 | 35 (77.8%) | 10 (22.2%) | 0.02 |
| | Up to Middle School | 58 | 40 (69.0%) | 18 (31.0%) | 0.05 |
| | Up to HSSC | 74 | 48 (64.9%) | 26 (35.1%) | 0.12 |
| | Graduate or Above | 80 | 52 (65.0%) | 28 (35.0%) | 0.10 |
| **Residence** | Urban | 138 | 96 (69.6%) | 42 (30.4%) | 0.33 |
| | Rural | 119 | 79 (66.4%) | 40 (33.6%) | |
| **Duration of Type 2 DM (Mean ± SD)** | | 6.5 ± 3.2 months | - | - | 0.85 |
| **Investigations** | Fasting Plasma Glucose (Mean ± SD) | 158 ± 45 mg/dL | - | - | 0.11 |
| | Fasting Serum Triglyceride (Mean ± SD) | 205 ± 65 mg/dL | - | - | 0.02 |
| | Fasting HDL (Mean ± SD) | 45.2 ± 13.5 mg/dL | - | - | 0.03 |
| **Metabolic** | Yes | 175 | - | - | 0.000 |

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|---|---|---|---|---|---|
| **Syndrome** | | | | | |
| | No | 82 | - | - | |

**Discussion**

The present study aimed to explore the frequency of metabolic syndrome among patients newly diagnosed with Type 2 Diabetes Mellitus (T2DM) and its association with various demographic and biochemical factors. The results suggest that age, body mass index (BMI), education status, and specific biochemical markers, particularly triglycerides and HDL cholesterol, play significant roles in the development of metabolic syndrome in this population.Consistent with previous studies, our findings highlight the critical role of **age** in the prevalence of metabolic syndrome. Patients in the 46-60 years age group showed a significantly higher frequency of metabolic syndrome ($p = 0.01$), which is in line with previous research indicating that the risk of developing metabolic syndrome increases with age, particularly after 45 years (1). This could be due to the cumulative effect of aging on insulin resistance and the increasing prevalence of obesity in older adults (2).

**BMI** was also strongly associated with metabolic syndrome, particularly among those who were overweight or obese, supporting findings from a large body of literature. Our study found that **obese individuals** (BMI $\geq 30$) had the highest prevalence of metabolic syndrome (81.4%, $p = 0.003$). These results are consistent with a significant body of research that underscores the importance of obesity as a key risk factor for metabolic syndrome and T2DM (3, 4). The relationship between higher BMI and metabolic syndrome can be explained by the detrimental effects of excess fat tissue on insulin sensitivity and the metabolic processes, such as dyslipidemia and hypertension, which are characteristic of metabolic syndrome (5).

Education level emerged as another significant factor, with lower educational attainment being associated with a higher prevalence of metabolic syndrome ($p = 0.02$). Illiterate and low-education patients were more likely to have metabolic syndrome, which mirrors the findings of studies suggesting that socio-economic factors, including education, influence lifestyle choices and health

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outcomes (6). This finding suggests that public health interventions targeting education may help reduce the burden of metabolic syndrome in populations with lower socio-economic status.

Biochemical markers, such as **triglycerides** and **HDL cholesterol**, were found to be significantly associated with metabolic syndrome ($p = 0.02$ and $p = 0.03$, respectively). Elevated triglycerides and low HDL cholesterol are well-established components of metabolic syndrome, and their presence in newly diagnosed T2DM patients supports their utility in identifying those at high risk for cardiovascular events (7, 8). Elevated triglycerides reflect insulin resistance and poor metabolic control, while low HDL is a marker of impaired lipid metabolism, both of which exacerbate the risk of developing cardiovascular diseases (9, 10). Fasting plasma glucose did not show a significant association with metabolic syndrome in our study ($p = 0.11$), possibly due to the fact that the study population was newly diagnosed with T2DM, and their blood glucose levels might not have yet reached the thresholds required for a clear association.

Interestingly, **gender** and **residence** (urban vs. rural) did not show statistically significant differences in metabolic syndrome prevalence in our study. This contrasts with other studies that suggest that urbanization, associated with lifestyle changes like sedentary behavior and dietary shifts, may contribute to higher rates of metabolic syndrome (11). Similarly, gender differences in metabolic syndrome prevalence have been reported, with some studies finding higher prevalence among men, while others find a stronger association in women (12). Our findings indicate that these factors might not have as significant an impact in our sample, which could be due to the relatively homogenous nature of the study population or differences in cultural and lifestyle factors.

Overall, this study underscores the importance of early identification and management of metabolic syndrome, especially in newly diagnosed Type 2 diabetes patients. The findings suggest that targeted interventions focusing on weight management, improving lipid profiles, and addressing socio-economic disparities through education may be effective in preventing or delaying the onset of metabolic syndrome and its associated complications, including cardiovascular disease.

**CONCLUSION:** Metabolic syndrome is highly prevalent among newly diagnosed T2DM patients, with age, BMI, education level, and biochemical markers such as triglycerides and HDL

being significant contributing factors. Targeted interventions addressing weight management, lipid control, and educational disparities may help reduce the burden of metabolic syndrome and associated cardiovascular risks in this population.

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