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# Prevalence of Metabolic Syndrome Among Type I Diabetes Mellitus Patients Attending the Institute of Diabetology in Stanley Medical College and Hospital in Tamil Nadu.

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## Abstract

**Back ground:** How frequently metabolic syndrome occur in type 1 diabetes is uncertain and so is the effect of metabolic syndrome among type 1 diabetics.

**Objectives** 1. To find out the prevalence of metabolic syndrome among type I diabetes mellitus patients attending a tertiary care hospital in Tamilnadu. 2. To find out the association of metabolic syndrome with complications of type 1 DM.

**Material and methods:** The present study was a cross sectional study carried out in the Institute of Diabetology in Stanley Medical College between August 2023 to November 2023 among type I diabetes mellitus patients who were either attending to the out-patient department or admitted to the wards of the Diabetology department. All the patient who has severe complications of diabetes and those who were bed ridden were excluded from the study. Sample size was calculated to be 270. Informed consent was obtained from all the participants included into the study. Chi square test was applied to find out the association between two qualitative variables. A P value of less than 0.05 was considered to be statistically significant.

**Results:** The proportion of metabolic syndrome among the participants was 17.9%. Metabolic syndrome was in higher proportion among those with more age than those with lesser. Among those with no metabolic syndrome, 44.1% reported to be physically active while among those with metabolic syndrome, the proportion was 23.1%. Among those with metabolic syndrome, 67.3% had complications and among those without metabolic syndrome the proportion was 29.8%. Being physically inactive and complications of DM was found to be associated with metabolic syndrome.

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**Conclusion:** Promoting healthy behaviours like no alcohol consumption and being physically active would decrease risk of metabolic syndrome among Type 1 Diabetics. Presence of metabolic syndrome increases the probability of occurrence of diabetes complications. Hence addressing metabolic syndrome in type 1 diabetics is vital to increase their quality of life.

**Key words** Type 1 diabetes, metabolic syndrome, smoking, alcohol, physical activity, complications,

## Introduction

The IDF defined metabolic syndrome as a constellation of central obesity, increased triglyceride levels, decreases HDL cholesterol, increased blood pressure and increased fasting plasma glucose(1). Most of the times metabolic syndrome was diagnosed when any three of the characteristics of definition was present(2). The basic pathology behind metabolic syndrome was said to be due to insulin resistance. Hence metabolic syndrome is also called as ‘ Insulin resistance syndrome’(3). About a quarter of the world population was found to have metabolic syndrome(2). The presence of metabolic syndrome was found to increase the cardiovascular risk to two folds among type 2 diabetes mellitus patients(4).

Type 1 diabetes is an autoimmune disorder, characterised by absolute insulin deficiency due to destruction of β cells(5). International Diabetes Federation report regarding type 1 diabetes in the year 2022 reported that around 8.75 million people were living with the disease globally. 60% of the newly diagnosed type 1 diabetics were more than 20 years of age(6). How frequently metabolic syndrome occur in type 1 diabetes is uncertain and so is the effect of metabolic syndrome among type 1 diabetics(7). Some studies have reported the proportion of metabolic syndrome to range between 8 to 45% among patients with type 1 diabetes(8). Metabolic syndrome was found to be associated with occurrence of chronic complications among type 1 DMs. The mortality rates was also higher among type 1 diabetes with metabolic syndrome(9).

The objective of the present study was to find out the prevalence of metabolic syndrome among type I diabetes mellitus patients attending a tertiary care hospital in Tamilnadu and the association of it with complications of type 1 DM. Similar studies were not conducted in the study setting before.

## Methodology

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The present study was a cross sectional study carried out in institute of diabetology of a tertiary care hospital, Chennai. The study was carried over for a period of 6 months between August 2023 to November 2022 and was conducted among type I diabetes mellitus patients aged 18 years or more who were either attending to the out-patient department or admitted to the wards of the department. All the patient who has severe complications of diabetes and those who were bed ridden were excluded from the study. Informed consent was obtained from all the participants included into the study.

The sample size for the study was calculated using the formula for absolute precision $n= z^2*(pq/e^2)$ where z – 1.96, p -0.22(10), q – 0.78, e- 0.05. The sample size calculated was 264. Taking 10% as the non-response rate the final sample size was fixed to be 290. The consecutive patients attending to the OPD or admitted to ward were included into the study till the sample size was reached.

The data for the study was collected using a semi structured interview schedule. Basic data like age, sex, education, occupation and place of residence were recorded for each participant. Followed by recording of details regarding type I DM like age of onset, duration of the disease and presence of any already existing complications were done. Details regarding common risk factors of non-communicable disease like smoking, alcohol and physical activity were recorded. Following which for the diagnosis of metabolic syndrome, waist circumference of the participant was measured using a measuring tape. Venous blood was drawn for estimating serum triglyceride, serum HDL and fasting blood glucose levels for all the participants. A standardised digital sphygmomanometer was used to record the systolic and diastolic blood pressure of the participants.

**Statistical analysis**

The data collected were entered into Microsoft excel 360 and the master chart was created. The master chart was then loaded onto SPSS version 23 for statistical analysis. The qualitative variables were expressed using frequency and percentages and the quantitative variables using mean and standard deviation. To find out the association between complications and the presence of metabolic syndrome, Chi square test was employed. A P value of less than 0.05 was considered to be statistically significant.

**Results**

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The total participants included into the study was 290. Among them 42.4% were in the age group 36 to 50 years and 22.8% were in the age group 51 to 65 years. 56.5% were males. 28.3% had obtained a degree from college and 26.9% had studied up to secondary education. 26.9% were home makers and 23.4% were doing unskilled occupation. 29.3% belonged to lower middle class and 23.4% to upper lower class. 40.3% were physically active (Table 1)

**Table 1: Socio demographic and behavioural characteristics among the study participants.**

| Variable | | Frequency (n=290) | Percentage (%) |
|---|---|---|---|
| **Age group (In years)** | **18-35** | 107 | 36.8 |
| | **36-50** | 123 | 42.4 |
| | **>50** | 60 | 20.6 |
| **Sex** | **Male** | 164 | 56.5 |
| | **Female** | 126 | 43.4 |
| **Education** | **Illiterate** | 28 | 9.6 |
| | **Literate** | 24 | 8.2 |
| | **Primary** | 35 | 12.1 |
| | **Middle** | 26 | 8.9 |
| | **Secondary** | 78 | 26.9 |
| | **Higher secondary** | 69 | 23.7 |
| | **College** | 82 | 28.3 |
| **Occupation** | **Skilled** | 29 | 10.0 |
| | **Semi-skilled** | 44 | 15.2 |
| | **Unskilled** | 68 | 23.4 |
| | **Retired** | 32 | 11.1 |
| | **Student** | 39 | 13.4 |
| | **Home maker** | 78 | 26.9 |
| **Socio economic status** | **Upper** | 31 | 10.7 |
| | **Upper middle** | 49 | 16.9 |
| | **Lower middle** | 85 | 29.3 |

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| | | | |
|---|---|---|---|
| | **Upper lower** | 68 | 23.4 |
| | **Lower** | 57 | 19.6 |
| **Physically active** | **Yes** | 117 | 40.3 |
| | **No** | 173 | 59.6 |

The mean age of onset of type I diabetes was 15.8 ± 4.8 years. The mean duration of diabetes among the participants was 12.5 ± 6.9 years. The mean height among the participants was 164.5 ± 8.7 cm and the mean weight was 55.3 ± 12.8 Kgs. The mean BMI among the participants was 20.7 ± 5.4 Kg/$m^2$. The mean waist circumference was 74.9 ± 10.5 cm. The mean HbA1C level was 9.1 ± 2.4 %. The mean FBS level was 125.5 ± 29.8 mg/dl.

**Table 2: Characteristics of type I diabetes, anthropometry and biochemical parameters among the study participants.**

| Variables | Mean ± SD |
|---|---|
| **Mean age of onset of T1DM (in years)** | 15.8 ± 4.8 |
| **Mean duration of diabetes (in years)** | 12.5 ± 6.9 |
| **Height (in cm)** | 164.5 ± 8.7 |
| **Weight (in Kgs)** | 55.3 ± 12.8 |
| **Waist circumference (in cm)** | 74.9 ± 10.5 |
| **BMI (Kg/$m^2$)** | 20.7 ± 5.4 |
| **HbA1C (%)** | 9.1 ± 2.4 |
| **FBS (mg/dl)** | 125.5 ± 29.8 |
| **PPBS (mg/dl)** | 232.4 ± 144.5 |
| **HDL (mg/dl)** | 35.5 ± 10.6 |
| **Triglycerides (mg/dl)** | 166.2 ± 75.3 |
| **Total cholesterol (mg/dl)** | 171.58 ± 32.71 |

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The mean PPBS level was 232.4 ± 144.5 mg/dl. The mean triglyceride level was 166.2 ± 75.3 mg/dl and the mean total cholesterol level was 171.58 ± 32.71 mg/dl (Table 2). The proportion of metabolic syndrome among the participants was 17.9%. 106 (36.5%) had at least one complication of diabetes mellitus. 24.8% reported to have retinopathy. 18.6% to have nephropathy, 7.9% reported to have neuropathy and 6.2% coronary artery disease (Table 3).

**Table 3: Distribution according to metabolic syndrome and complications of diabetes.**

| Variable | Frequency (n=290) | Percentage (%) |
|---|---|---|
| **Metabolic syndrome** | 52 | 17.9 |
| **Retinopathy** | 72 | 24.8 |
| **Nephropathy** | 54 | 18.6 |
| **Neuropathy** | 23 | 7.9 |
| **Coronary artery disease** | 18 | 6.2 |

Among the participants with metabolic syndrome, 57.6% were more than 50 years old followed by 30.7% in the age group 36 to 50 years and 11.5% were in the age group 18 to 35 years. Among those who had no metabolic syndrome, 12.6% were in the age group more than 50 years, 44.9% in the age group 36 to 50 years and 42.4% in the age group 18 to 35 years. Metabolic syndrome was in higher proportion among those with more age than those with lesser. Among those with metabolic syndrome, 53.8% were males and among those without metabolic syndrome, 57.1% were males. With regard to socio economic status, 31.4% belonged to lower middle class followed by 28.8% in upper middle class in the metabolic syndrome group and in those with no metabolic syndrome, 28.2% were lower middle class and 25.2% were upper lower class. Both the distribution of sex and socioeconomic status was found to be similar between those with and without metabolic syndrome with P value of more than 0.05. Among those with no metabolic syndrome, 44.1% reported to be physically active while among those with metabolic syndrome, the proportion was 23.1%. Being physically active was found to protect against the occurrence of metabolic syndrome with P value of less than 0.05. Participants who had reported to have done no physical activity were found to be have 2.63 times (95% CI 1.31 – 5.26) increased risk of metabolic syndrome than those who reported to have done physical activity.

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**Table 4: Association between selected factors and metabolic syndrome among type I Diabetes mellitus patients.**

| Variable | | Metabolic syndrome | | P value |
|---|---|---|---|---|
| | | Present (n=52) | Absent (n=238) | |
| Age group (In years) | 18-35 | 6(11.5) | 101(42.4) | 0.001* |
| | 36-50 | 16(30.7) | 107(44.9) | |
| | 51-65 | 30(57.9) | 30(12.6) | |
| | >65 | 22(42.3) | 19(8) | |
| Sex | Male | 28 (53.8) | 136 (57.1) | 0.663 |
| | Female | 24 (46.2) | 102 (42.9) | |
| Socio economic status | Upper | 5 (9.6) | 26 (10.9) | 0.061 |
| | Upper middle | 15 (28.8) | 34 (14.3) | |
| | Lower middle | 17 (31.4) | 67 (28.2) | |
| | Upper lower | 9(16.6) | 60 (25.2) | |
| | Lower | 6 (11.5) | 51 (21.4) | |
| Physically active | Yes | 12 (23.1) | 105 (44.1) | 0.005* |
| | No | 40 (76.9) | 133 (55.9) | |
| Age of onset of T1DM (in years) | | 15.2 ± 3.8 | 16.1± 4.1 | 0.147 |
| Duration of diabetes (in years) | | 13.5 ± 8.1 | 11.3 ± 7.5 | 0.059 |
| Complications of T1DM | Present | 35 (67.3) | 71 (29.8) | 0.001* |
| | Absent | 17 (32.7) | 167 (70.2) | |

***Statistically significant**

Both age of onset of T1DM and duration of diabetes were found to be similar between those diagnosed with metabolic syndrome and those who had no metabolic syndrome with P value of more than 0.05, respectively. Among those with metabolic syndrome, 67.3% had complications and among those without metabolic syndrome the proportion was 29.8%. Complications of T1DM was found to be significantly more among those with metabolic syndrome than those without it. Among those with diabetes related complications, metabolic

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syndrome was found to be present 4.8 times more (95% CI 2.54 to 9.20) than those without any diabetic related complications. (Table 4).

**Discussion**

Metabolic syndrome indicates a cluster of risk factors that could lead to higher incidence of cardiovascular disease and early mortality. Both central fat distribution and insulin resistance forms the primary characteristic of metabolic syndrome(11). The present study was done with the objective of finding the proportion of type I diabetics with metabolic syndrome attending to tertiary care hospital and also to find out the association between metabolic syndrome and the complications of type I DM.

The present cross-sectional study was carried out in the institute of diabetology where people get regularly treated for type I diabetes. The study was conducted for a period of 6 months among type I diabetes aged 18 years or more attending to OPD or admitted to ward. Those who were bed ridden were excluded. 264 type I diabetics were included into the study. Informed consent was obtained from all the participants included.

The present study had found the prevalence of metabolic syndrome to be 17.9%. Belete R et al in their meta-analysis reported the pooled prevalence of metabolic syndrome among type I DM to be 23.7%(12). Huo L et al reported the prevalence to be 10.1%(13). Huang Q et al reported the prevalence to be 15.1% among the adult type I diabetics which was similar to the present study(14). The wide difference in prevalence across various studies could be due to the variation in definitions used.

Physical activity and metabolic syndrome were found to be associated with one another among type 1 diabetics in the present study. Those who reported to be physically active were diagnosed to have lesser proportion of type 1 diabetes than those who reported to be physically inactive. The participants with no physical activity were 2.63 times at increased risk of getting metabolic syndrome than those doing physical activity. He D et al reported a high frequency of leisure time physical activity aided in reducing the incidence of metabolic syndrome in a meta-analysis(15). Churilla JR et al reported that regular physical activity benefited individuals by decreasing the incidence of metabolic syndrome(16).

The proportion with diabetic related complications was found to be more among those with metabolic syndrome than those with no metabolic syndrome. Among those with diabetic related complications, the presence of metabolic syndrome was 4.84 times more than those

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with no diabetic related complications. Thorn LM et al reported that the diabetic neuropathy and metabolic syndrome were associated with one another and the odds for the above was reported to be 3.75(17). Billow A et al also reported a similar association between metabolic syndrome and certain diabetic complications like retinopathy and nephropathy(10).

The strength of the study is its objective only very few studies have been done to determine the proportion of metabolic syndrome among type I diabetes individuals in Tamilnadu. Since the study was a single centre study the generalisability of the results may be limited. A multicentre study with similar objective will provide a more generalisable result.

## Conclusion

The proportion of metabolic syndrome in the study setting was comparable to other studies. Not doing regular physical activity was found to be associated with metabolic syndrome. The occurrence of diabetic related complications was also found to be on the higher side among those with metabolic syndrome than those who were not having it.

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