

## Original Research Article

# Clinical profile of diabetes in young adults aged 15 to 30 years

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### ABSTRACT

**Background:** There is a shift in age of onset of diabetes to a younger age in the recent years. There are very few data available on diabetes in the youth. Hence the study has been undertaken. Objective of the study is to describe the clinical profile of young diabetics and to estimate burden of selected end organ complications at the time of study.

**Methods:** A hospital based Cross sectional study was conducted at a tertiary care centre among 75 young diabetic patients (aged 15-30 years). After taking informed consent, detailed history clinical examination, biochemical investigations like FBS and 2 hours PPBS, HbA1c, lipid profile, screening for neuropathy, retinopathy and nephropathy were done.

**Results:** The mean age of the study population was  $26.35 \pm 3.8$  years, majority were males (62.7 %), 77.3% have positive family history. Mean BMI was  $24.8 \pm 4.6$  kg/m<sup>2</sup>, 45.3% were overweight, 20 % were obese. The mean FBS levels was  $216.63 \pm 73.46$  mg/dl, 2 hr PPBS  $261.51 \pm 80.0$  mg/dl and mean HbA1c  $8.66 \pm 1.34$  %. The total cholesterol level was higher in 46.7%, with mean of  $198.4 \pm 21.0$ . Mean triglyceride level was  $136.99 \pm 38.9$ . Nephropathy was present in 25.3%, retinopathy in 13.3% and neuropathy in 9.3 % of the patients. 30.6% had at least one of the three complications. SBP was associated with neuropathy ( $p=0.030$ ), DBP with retinopathy ( $p=0.029$ ) and neuropathy ( $p=0.007$ ) and high FBS levels with retinopathy ( $p<0.001$ ) and neuropathy ( $p<0.001$ ).

**Conclusion:** Microvascular complications in young diabetes is alarmingly high. Regular screening, early detection, adequate control of FBS and BP may improve quality of life.

**Keywords:** Neuropathy, Retinopathy, Young diabetes

## INTRODUCTION

Diabetes is a serious, chronic disease that occurs either when the pancreas does not produce enough insulin,<sup>1</sup> or when the body cannot effectively use the insulin it produces.<sup>2</sup> There are 3 key types of diabetes mellitus (DM): Type 1 DM occurs from the failure of pancreas to yield sufficient insulin. This form was previously denoted as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes", its exact cause is not known. Type 2 Diabetes Mellitus (T2DM) begins with insulin resistance, a condition in which cells fail to respond to insulin

properly.<sup>1</sup> As the disease progresses a lack of insulin may also develop.<sup>2</sup> This form was previously referred to as "non-insulin-dependent diabetes mellitus" (NIDDM) or "adult-onset diabetes". Gestational diabetes is the third main form and occurs when pregnant women without a previous history of diabetes develop high blood sugar levels.

The largest numbers of people with diabetes were residing in South-East Asia and Western Pacific Regions, accounting for approximately half the diabetes burden in the world. Worldwide, the number of people with diabetes has increased significantly between 1980 and

2014, from 108 million to a current figure 2 times higher. Forty per cent of this increase is estimated to result from population growth and ageing, 28% from a rise in age-specific prevalence, and 32% from the interaction between the two. The global prevalence of diabetes has grown from 4.7% in 1980 to 8.5% in 2014, during which time prevalence has increased or at best remained unchanged in every country.<sup>3</sup>

India is poised to be among the world's top economies by 2020 and is undergoing a rapid epidemiological transition: the burden of chronic diseases is overtaking the burden of infectious diseases. India already has the highest number of adult diabetes cases (20 million) worldwide and this number is expected to rise to 57 million by 2020. While there is little data on T2DD in children and adolescents in India, there are five reasons to believe that this type of diabetes is a phenomenon that is waiting to be declared to a large extent. First, rapid urbanization and economic growth create a social dynamic that promotes risk factors for diabetes. These include being overweight, decreasing physical activity, increasing sedentary activities such as television and diets rich in fat and energy in adults and children. Other factors include prenatal factors (e.g., low birth weight, maternal under-nutrition), biological propensity to central obesity and insulin resistance, low lean mass, diabetes during pregnancy, impaired glucose tolerance, and urban stress.<sup>4,5</sup>

All forms of diabetes increase the risk of long-term complications. These usually develop after many years but may be the first symptom in people who would not otherwise have been diagnosed before that date. The main long-term complications are damage to the blood vessels. Diabetes doubles the risk of cardiovascular disease and about 75% of deaths in diabetics are due to coronary artery disease.<sup>6,7</sup> Other "macrovascular" diseases are stroke, and peripheral artery disease. The main complications of diabetes due to the involvement of small blood vessels include damage to the eyes, kidneys and nerves. Ocular lesions, known as diabetic retinopathy, are caused by damage to the blood vessels in the retina of the eye and can lead to progressive loss of vision and blindness. Kidney damage, called diabetic nephropathy, can lead to tissue scarring, loss of protein in the urine, and possibly chronic kidney disease, sometimes requiring dialysis or kidney transplantation. Nerve damage, called diabetic neuropathy, is the most common complication of diabetes. Symptoms may include numbness, tingling, pain, and altered pain that can cause skin damage.

The complications are time dependent mostly, if not well controlled, may cause blindness, kidney failure, lower limb amputation and several other long-term consequences that impact significantly on quality of life. There are no global estimates of diabetes-related end-stage renal disease, cardiovascular events, lower-extremity amputations or pregnancy complications, though these conditions are prevalent among many

people with diabetes. There are very few data available on diabetes in the youth, because the disease is still relatively rare compared to older onset diabetes.<sup>8</sup> Population based data on young diabetics is difficult to obtain because the disease is relatively rare compared to older onset diabetes.<sup>9</sup> Hence this study has been undertaken to find out clinical profile and to estimate burden of selected end organ complications among young diabetes patients.

## METHODS

A cross sectional hospital-based study was conducted in MES Medical College, Department of General Medicine on clinical profile and microvascular complication of young diabetic patients of age group 15-30 years of one-year duration from 1<sup>st</sup> January 2017 to 31<sup>st</sup> December 2017. Convenient sampling procedure was utilized. Diabetic patients of age group 15-30 years attending general medicine inpatient and outpatient in MES medical college were identified and enrolled in the study. A total of 75 patients were included in the study. All diagnosed cases of diabetes mellitus between ages 15-30 according to WHO criteria were included. Critically ill patients, non-cooperative patients, gestational diabetes were excluded.

### Working definition

- Diabetes mellitus: WHO Diagnostic criteria.<sup>10</sup>
- Hypertension: systolic blood pressure  $\geq 140$  mmHg / diastolic blood pressure  $\geq 90$  mmHg.<sup>11</sup>
- Hypercholesterolemia: according to ATP III guidelines.<sup>12</sup>
- Nephropathy: if urine albumin excretion  $>300$  mg/g of creatinine.<sup>13</sup>
- Retinopathy: retinal (fundus) examination by both direct and indirect ophthalmoscope under supervision of a trained ophthalmologist.
- Neuropathy was assessed by Biothesiometer (Mean VPT, Vibratory perception threshold of the great toes  $\geq 20$  V).

### Data collection

After taking informed consent, detailed history and clinical examination of patients, biochemical investigations like fasting and 2 hours post prandial plasma glucose, glycated haemoglobin, lipid profile, and screening for neuropathy, retinopathy and nephropathy were done for all the patients.

### Statistical analysis

Data was coded and entered in MS excel and analysis was done using Epi-Info (version 7). Descriptive analysis was done. Proportions were expressed in percentage. Mean and standard deviation calculated for continuous

variables. Chi-square / Fischer exact test was done to look for associations between categorical variables.

**RESULTS**

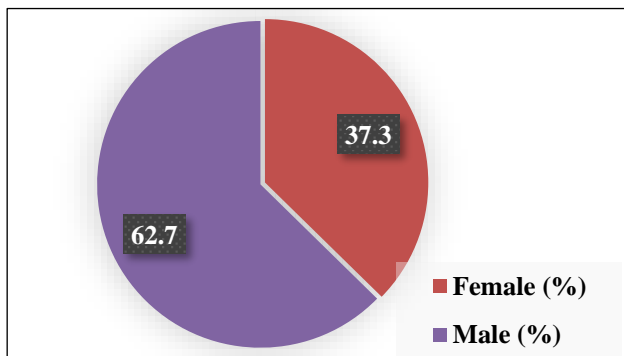
A hospital-based study was done on patients presenting to the General medicine department in MES Medical college, Kerala, India. Subjects who have diabetes between the age 15 to 30 were included in the study. 75 patients were included in the study.

**Baseline characteristics**

The distribution of gender showed that males were the majority 62.7% (47 nos.) and females were just more than a quarter of the total population 37.3% (28 nos.) (Figure 1).

The mean age of the study population is 26.35±3.8 years, in that males were having higher mean age of 26.6±3.75 years when compared to 25.93±3.9 years for females. Majority of the patients were in age group 25-30 (69.3%) with 70.2% males and 67.9% females (Table 1).

The socioeconomic status of the group showed majority are in poor class of BG Socioeconomic scale with 58.7% in Class IV. The education of patients showed that majority were having high school education. large majority were students (66.7%). 80% were married (Table 2).



**Figure 1: Gender distribution.**

The distribution of gender showed that males were the majority 62.7 % (47 nos.) and females were just more than a quarter of the total population 37.3% (28 nos.)

**Table 1: Age and gender distribution.**

Age groups (years)	Male n (%)	Female n (%)	Total n (%)
15 to 20	05 (10.6)	02 (7.1)	07 (9.3)
21 to 25	09 (19.1)	07 (25.0)	16 (21.3)
25 to 30	33 (70.2)	19 (67.9)	52 (69.3)
Total	47 (100)	28 (100)	75 (100)

Majority of the patients were in age group 25-30 (69.3%) with 70.2% males and 67.9% females.

The socioeconomic status of the group showed majority are in poor class of BG Socioeconomic scale with 58.7% in Class IV. The education of patients showed that majority were having high school education. large majority were students (66.7%). 80% were married.

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**Table 2: Sociodemographic characteristic.**

Socioeconomic status B.G Prasad's classification (N=75)	n (%)
Class II	01 (1.3)
Class III	19 (25.3)
Class IV	44 (58.7)
Class V	11 (14.7)
Education levels (N=75)	n (%)
Upper primary	22 (29.3)
High School	34 (45.3)
Degree	19 (25.3)
Occupation levels (N=75)	n (%)
Semi-skilled	07 (9.3)
Skilled	16 (21.3)
Students	50 (66.7)
Professional	02 (2.7)
Marital Status (N=75)	n (%)
Unmarried	15 (20.0)
Married	60 (80.0)

**Clinical profile**

Polyuria was seen among 54.7% of the patients, polydipsia was observed in 53.3 % and weight loss was present in 46.7% of the study population (table 3). The comorbidities present in the patients showed 10.7% having hypertension, 6.6% had recurrent skin infection, 1.3% had Pulmonary TB, 1.3% had Osteomyelitis, 1.3% had Bipolar affective disorder, 1.3% had Infertility and 1.3% had Chronic inflammatory demyelinating polyneuropathy (table 4). The age of onset of diabetes showed majority (44%) had the onset between 21 to 25 years age, followed by more than 26 years in 33.3% and less than 20 years in 22.7% (Table 5).

The disease duration was mostly between 1 to 5 years in 56% of the participants, followed by less than one year in 22.7% (Figure 2). Patients having family history of Diabetes were higher, with 77.3% (58 nos.) having a positive family history (Figure 3).

Addiction of smoking was seen in 12% of the patients and no alcoholics (figure 4). The physical activity among the study population showed 58% having moderate levels of physical activity and 36 % had poor physical activity.

Only 6 % among the study population had good physical activity (table 6). The diet control among the study population showed 61.3 % having poor diet control and 28 % having moderate levels of diet control. Only 10.7 % had good physical activity (Table 7).

Majority of the patients (52 %) were taking OHA only. Insulin alone was used by 14.6% of the study population and both OHA and insulin were used by 33.4% of the patients (Table 8).

**Table 3: Symptoms.**

Symptoms (N=75)	n (%)
Polyuria	41 (54.7)
Polydipsia	40 (53.3)
Weight loss	35 (46.7)

Polyuria was seen among 54.7% of the patients, polydipsia was observed in 53.3 % and weight loss was present in 46.7% of the study population

Polyuria was seen among 54.7% of the patients, polydipsia was observed in 53.3% and weight loss was present in 46.7% of the study population.

**Table 4: Comorbidities.**

Comorbidities (N=75)	n (%)
Hypertension	08 (10.7)
Pulmonary TB	01 (1.3)
Osteomyelitis	01 (1.3)
Bipolar affective disorder	01 (1.3)
Infertility	01 (1.3)
Chronic Inflammatory demyelinating polyneuropathy	01 (1.3)
Recurrent skin infections	05 (6.6)

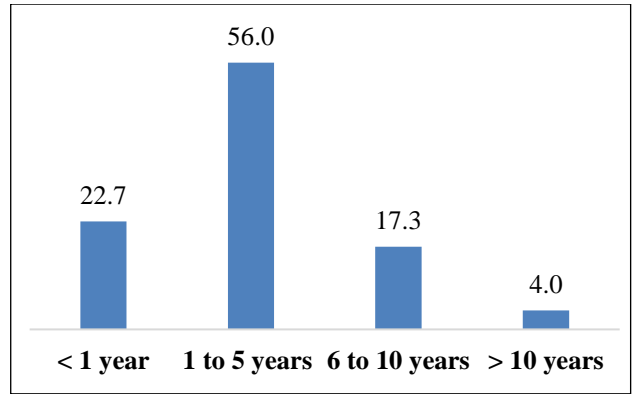
The comorbidities present in the patients showed 10.7% having hypertension, 6.6% had recurrent skin infection, 1.3% had Pulmonary TB, 1.3% had Osteomyelitis, 1.3% had Bipolar affective disorder, 1.3% had Infertility and 1.3% had Chronic inflammatory demyelinating polyneuropathy.

**Table 5: Age of onset.**

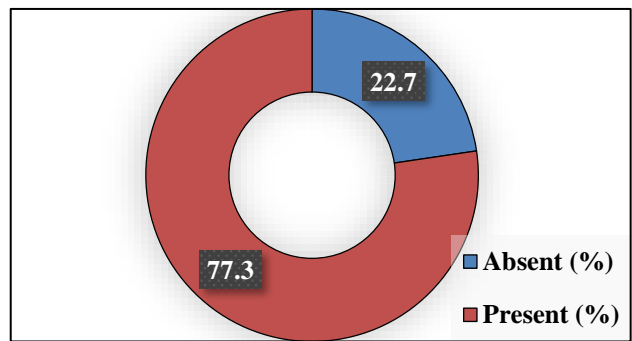
Age of onset (N=75)	n (%)
Less than 20 years	17 (22.7)
21 to 25 years	33 (44.0)
More than 26 years	25 (33.3)

The age of onset of diabetes showed majority (44%) had the onset between 21 to 25 years age, followed by more than 26 years in 33.3% and less than 20 years in 22.7%.

The disease duration was mostly between 1 to 5 years in 56% of the participants, followed by less than one year in 22.7%.

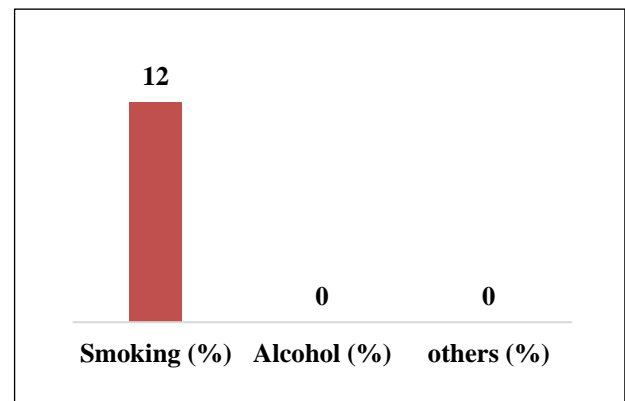


**Figure 2: Disease duration.**



**Figure 3: Family history.**

Patients having family history of Diabetes were higher, with 77.3% (58 nos.) having a positive family history.



**Figure 4: Addictions.**

Addiction of smoking was seen in 12% of the patients.

**Table 6: Physical activity.**

Physical activity (N=75)	n (%)
Good	05 (6.0)
Moderate	43 (58.0)
Poor	27 (36.0)

The physical activity among the study population showed 58% having moderate levels of physical activity and 36

% had poor physical activity. Only 6% among the study population had good physical activity.

**Table 7: Diet.**

Diet control (N=75)	n (%)
Good	08 (10.7)
Moderate	21 (28.0)
Poor	46 (61.3)

The diet control among the study population showed 61.3% having poor diet control and 28% having moderate levels of diet control. Only 10.7% had good physical activity.

**Table 8: Treatment.**

Diabetes treatment (N=75)	n (%)
Oral Hypoglycaemic Agents (OHA) only	39 (52.0)
Insulin only	11 (14.6)
Both OHA and Insulin	25 (33.4)

Majority of the patients (52 %) were taking OHA only. Insulin alone was used by 14.6% of the study population and both OHA and insulin were used by 33.4% of the patients.

**Clinical examination**

After general examination, pallor was present in 5 patients, oedema was seen in 7 patients and only one patient had clubbing. The mean height of the patients was 163.12±9.09 cm, the mean weight was 66.12±13.8 kg and the BMI of the population was measured to be 24.8±4.6 kg/m<sup>2</sup>. 45.3% of the patients were overweight and 20% were obese. There were 10.7% undernourished patients and 24 % were normal (table 9). The blood pressure was recorded, the mean SBP was 127.23±9.15 mm of Hg and the mean DBP was 75.7±9.5 mm of Hg. The SBP was higher in 9.3% and DBP was higher in 5.3% of the patient (Table 10). The fundus examination showed retinopathy in 16 patients (13.3%), Mild Non-Proliferative Diabetic Retinopathy (NPDR) in 14 patients and moderate NPDR in 2 patients (Table 11).

**Table 9: Built and nourishment.**

Built (N=75)	n (%)
Undernourished	08 (10.7)
Normal	18 (24.0)
Overweight	34 (45.3)
Obese	15 (20.0)
Mean Height: 163.12±9.09 cm	
Mean Weight: 66.12±13.8 kg	
Mean BMI: 24.8 ± 4.6 kg/m <sup>2</sup>	

The mean height of the patients was 163.12±9.09 cm, the mean weight was 66.12±13.8 kg and the BMI of the population was measured to be 24.8±4.6 kg/m<sup>2</sup>. 45.3% of

the patients were overweight and 20% were obese. There were 10.7% undernourished patients and 24% were normal.

**Table 10: Blood pressure.**

Blood pressure (N=75)	n (%)
Systolic Blood Pressure (SBP)	
High SBP	7 (9.3)
Mean SBP: 127.23±9.15 mm of Hg	
Diastolic Blood Pressure (DBP)	
High DBP	4 (5.3)
Mean DBP: 75.7±9.5 mm of Hg	

The blood pressure was recorded, the mean SBP was 127.23±9.15 mm of Hg and the mean DBP was 75.7±9.5 mm of Hg. The SBP was higher in 9.3% and DBP was higher in 5.3% of the patient.

**Table 11: Fundus changes.**

Fundus changes (N=16)	n (%)
Microaneurysms	16 (100)
Dot haemorrhages	02 (12.5)
Mild NPDR	14 (87.5)
Moderate NPDR	02 (12.5)
Severe NPDR	00 (0.0)
Proliferative diabetic retinopathy	00 (0.0)

The fundus examination showed retinopathy in 16 patients (13.3%), Mild Non-Proliferative Diabetic Retinopathy (NPDR) in 14 patients and moderate NPDR in 2 patients.

**Table 12: Blood glucose levels.**

Blood glucose levels (N=75)	n (%)
FBS: <126 mg/dl	03 (04)
FBS: >126 mg/dl	72 (96.0)
2hr PPBS: <200 mg/dl	19 (25.3)
2hr PPBS: >200 mg/dl	56 (74.6)
HbA1c: 7 to 9.9%	66 (88.0)
HbA1c: >10%	09 (12.0)
Mean FBS: 216.63±73.46 mg/dl	
Mean PPBS: 261.51±80.0 mg/dl	
Mean HbA1c: 8.66±1.34 %	

**Investigations**

The mean FBS levels was 216.63±73.46 mg/dl, 96% of the patients had FBS more than 126 mg/dl. The 2 hr PPBS levels showed 74.6% having more than 200 mg/dl with a mean value of 261.51±80.0 mg/dl. The HbA1c levels were more than 6.5 % in all the patients and 12% had more than 9.9 %, with mean HbA1c of 8.66±1.34% (Table 12). The cholesterol levels were higher in 46.7% of the patients, with mean total cholesterol of 198.4±21.0. The Triglyceride levels was normal in 72% and

high in 8%, with mean triglyceride level of 136.99±38.9. The LDL levels showed nearly half of them (42.7%) with normal values and HDL levels also normal in majority of the patients (70.7%) (Table 13).

The mean FBS levels was 216.63±73.46 mg/dl, 96% of the patients had FBS more than 126 mg/dl. The 2 hr PPBS levels showed 74.6% having more than 200 mg/dl with a mean value of 261.51±80.0 mg/dl. The HbA1c levels were more than 6.5 % in all the patients and 12% had more than 9.9 %, with mean HbA1c of 8.66±1.34 %.

**Table 13: Cholesterol Levels.**

Cholesterol levels (N=75)	n (%)
Total Cholesterol: <200 mg/dl	40 (53.3)
Total Cholesterol: 200 to 239mg/dl	35 (46.7)
Total Cholesterol: ≥240 mg/dl	00 (0.0)
Mean Total Cholesterol: 198.4±21.0	
Triglycerides: <150 mg/dl (normal)	54 (72.0)
Triglycerides: 150 to 199 mg/dl (Borderline)	15 (20.0)
Triglycerides: >200 mg/dl (High)	06 (8.0)
Mean Triglycerides level: 136.99±38.9	
LDL: <100	32 (42.7)
LDL: 100 to 129	28 (37.3)
LDL: 130 to 159	11 (14.7)
LDL: 160 to 189	04 (5.3)
Mean LDL Level: 111.07 ± 23.7	
HDL: <40	18 (24.0)
HDL: 41 to 59	53 (70.7)
HDL: >60	04 (5.3)
Mean HDL Level: 45.76±10.16	

The cholesterol levels were higher in 46.7% of the patients, with mean total cholesterol of 198.4±21.0. The Triglyceride levels was normal in 72% and high in 8%, with mean triglyceride level of 136.99±38.9. The LDL levels showed nearly half of them (42.7%) with normal values and HDL levels also normal in majority of the patients (70.7%)

**Complications**

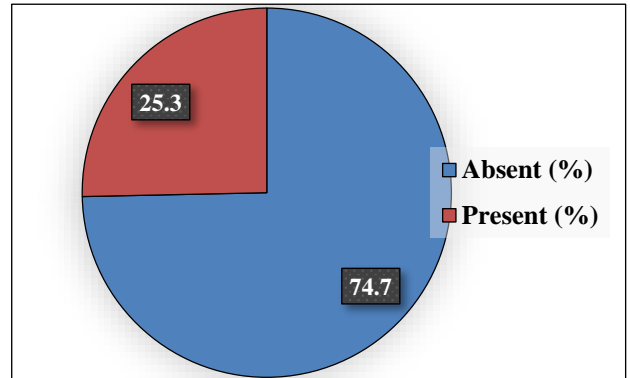
One third of patients (30.6%) had at least one of the three complications. Nephropathy was present in nearly a quarter of the patients 25.3% (figure 5). Retinopathy was present in less than a quarter of the patients 13.3% (figure 6). Neuropathy was present in a small portion of the patients 9.3 % (Figure 7).

Nephropathy was present in nearly a quarter of the patients 25.3%. Retinopathy was present in less than a quarter of the patients 13.3%. Neuropathy was present in a small portion of the patients 9.3 %.

Nephropathy was present in nearly a quarter of the patients 25.3%.

**Table 14: Complications.**

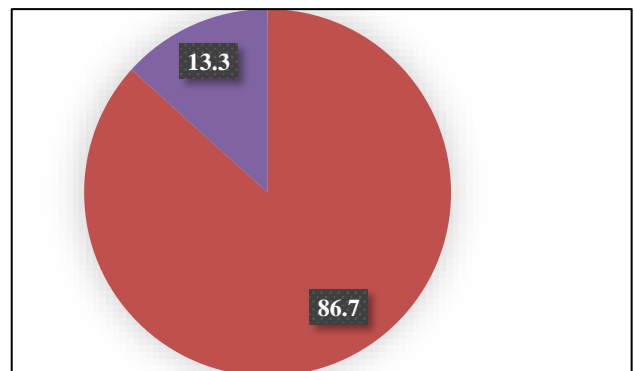
Complications (N=75)	n (%)
Nephropathy	19 (25.3)
Retinopathy	10 (13.3)
Neuropathy	07 (9.3)



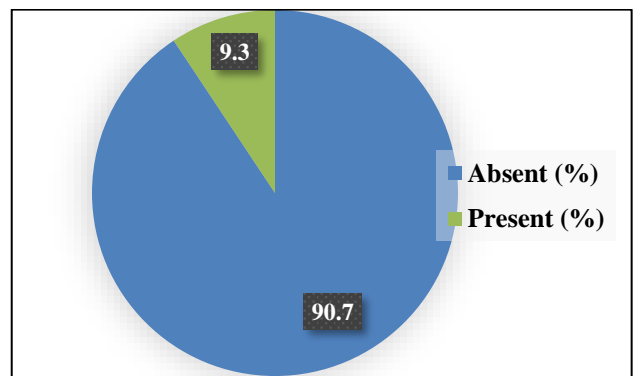
**Figure 5: Nephropathy.**

Association of complication and other variables

Male gender showed statistically significant association with neuropathy(p=0.032).



**Figure 6: Retinopathy.**



**Figure 7: Neuropathy.**

Retinopathy was present in less than a quarter of the patients 13.3%.

Neuropathy was present in a small portion of the patients 9.3%.

**Table 15: Association of complication and other variables.**

Parameters	Nephropathy P value	Retinopathy P value	Neuropathy P value
Age	0.121	0.641	0.181
Gender	0.251	0.055	0.032
Diet control	0.138	0.341	0.088
Physical activity	0.702	0.074	0.051
Smoking	0.575	0.063	<0.001
Duration	0.003	<0.001	<0.001
Treatment	0.260	0.586	0.775
Family history	0.283	0.066	0.133
BMI	0.316	0.341	0.268
Total cholesterol	0.095	0.364	0.560
FBS	0.104	<0.001	<0.001
PPBS	0.231	0.420	0.510
HbA1c	0.556	0.403	0.156
Systolic BP	0.943	0.364	0.030
Diastolic BP	0.850	0.029	0.007

The association of smoking and complications revealed a positive association of acquiring neuropathy in patients who is a smoker ( $p < 0.001$ ).

An increase in disease duration is associated with the presence of neuropathy ( $p < 0.001$ ), nephropathy ( $p = 0.003$ ) and retinopathy ( $p < 0.001$ ). As the FBS levels increase there was significant chance of retinopathy ( $p < 0.001$ ) and neuropathy ( $p < 0.001$ ). The Blood pressure of the patients, systolic and diastolic blood pressure was assessed.

There was statistically significant association seen between SBP and the presence of neuropathy ( $p = 0.030$ ). Diastolic pressure also showed statistically significant association between retinopathy ( $p = 0.029$ ) and neuropathy ( $p = 0.007$ ). Other parameters like age, diet, physical activity, type of treatment, family history, BMI, total cholesterol levels, HbA1c were not found have any significant association with nephropathy, retinopathy or neuropathy (Table 15).

Gender showed statistically significant association with neuropathy ( $p = 0.032$ ). The association of smoking and complications revealed a positive association of acquiring neuropathy in patients who is a smoker ( $p < 0.001$ ). An increase in disease duration is associated with the presence of neuropathy ( $p < 0.001$ ), nephropathy ( $p = 0.003$ ) and retinopathy ( $p < 0.001$ ). As the FBS levels increase there was significant chance of retinopathy ( $p < 0.001$ ) and neuropathy ( $p < 0.001$ ). The Blood pressure of the

patients, systolic and diastolic blood pressure was assessed. There was statistically significant association seen between SBP and the presence of neuropathy ( $p = 0.030$ ). Diastolic pressure also showed statistically significant association between retinopathy ( $p = 0.029$ ) and neuropathy ( $p = 0.007$ ). Other parameters like age, diet, physical activity, type of treatment, family history, BMI, total cholesterol levels, HbA1c were not found have any significant association with nephropathy, retinopathy or neuropathy.

## DISCUSSION

A total of 75 patients who have diabetes between the age 15 to 30 who satisfied out inclusion and exclusion criteria were included in the study.

### Age and gender wise distribution

In our study males were the majority 62.7% (47 nos.) and females were 37.3% (28 nos.). The mean age of the study population is  $26.35 \pm 3.8$  years. Other reviewed studies showed similar levels of mean age and gender.<sup>14</sup>

### Comorbidities

In our study 10.7% have hypertension, 6.6% had recurrent skin infection, 1.3% had Pulmonary tuberculosis. Diabetes mellitus is a metabolic disorder that weakens the immune system and also a known risk factor for tuberculosis. The prevalence of tuberculosis is higher in patients with diabetes mellitus in comparison with non-diabetes mellitus and impaired glucose tolerance. Naing NN et al. found 14.7% of diabetes mellitus patients with tuberculosis.<sup>15</sup>

### Height, weight and BMI

In our study the mean height of the patients was  $163.12 \pm 9.09$  cm, the mean weight was  $66.12 \pm 13.8$  kg and the BMI of the population was measured to be  $24.8 \pm 4.6$  kg/m<sup>2</sup>. 45.3% of the patients were overweight and 20 % were obese. There were 10.7% undernourished patients. The reviewed studies showed obesity had an impact on insulin resistance.<sup>14</sup> Bays et al, reported that an increased BMI was associated with an increased prevalence of diabetes mellitus, hypertension and dyslipidaemia. Cockram et al, reported that all studies consistently showed a strong relationship between obesity and type 2 diabetes.<sup>16,17</sup>

### Blood pressure

In our study the mean SBP was  $127.23 \pm 9.15$  mm of Hg and the mean DBP was  $75.7 \pm 9.5$  mm of Hg. The SBP was higher in 9.3% and DBP was higher in 5.3% of the patients. There was a relationship between hyperglycaemia and hypertension. Some studies reported hypertension with hyperglycemia.<sup>18</sup> The prevalence of hypertension was high in the diagnosed diabetes mellitus.

Ferrannin et al, reported that high blood pressure was present in over two-thirds of patients with type 2 diabetes, and the increase coincides with the development of hyperglycemia.<sup>19</sup>

### **Fundus changes**

In our study fundal changes was present in 13.3% patients (microaneurysms in 16 patients, and dot haemorrhages in 2). Mild Non-Proliferative Diabetic Retinopathy (NPDR) was seen in 14 patients and moderate NPDR in 2. According to Mohan et al, patients suffering from NIDDM of 25 years duration, DR was detected in 52% of patients.<sup>20</sup> Non-proliferative diabetic retinopathy was seen 41.7% and PDR in 10.3% of patients. Diabetic retinopathy (DR) has been shown to be the cause of visual impairment in 86 percent of type 1 diabetic patients and in 33 per cent of type 2 diabetics In India. However, this morbidity is largely preventable and treatable. If managed with timely intervention, the quality of life can be preserved.

### **Cholesterol levels**

The total cholesterol levels were higher in 46.7% of the patients, with mean total cholesterol of  $198.4 \pm 21.0$ . The Triglyceride levels was normal in 72% and high in 8%, with mean triglyceride level of  $136.99 \pm 38.9$ . The LDL levels showed nearly half of them (42.7%) with normal values and HDL levels also normal in majority of the patients (70.7%). Similarly, reviewed studies by Harris reported that high or borderline high total cholesterol was common in diabetes and is present in 70% of adults with diagnosed diabetes and 77% with undiagnosed diabetes in the USA population. Of these individuals, 95% showed evidence of coronary heart disease or two or more risk factors for heart disease.<sup>21</sup> The prevalence of low HDL and high VLDL was higher in diabetes mellitus group in comparison with impaired glucose tolerance and non-diabetes mellitus groups. A review from Mooradian<sup>22</sup> showed that the characteristic features of diabetic dyslipidaemia are a high plasma triglyceride concentration, low HDL cholesterol concentration and high VLDL cholesterol particles.

### **Blood glucose levels**

In our study the mean FBS levels was  $216.63 \pm 73.46$  mg/dl, 96% of the patients had FBS more than 126 mg/dl. The 2 hr PPBS levels showed 74.6% having more than 200 mg/dl with a mean value of  $261.51 \pm 80.0$  mg/dl. The HbA1c levels were more than 6.5 % in all the patients and 12% had more than 9.9 %, with mean HbA1c of  $8.66 \pm 1.34$  %. As the FBS levels increase there was significant chance of retinopathy and neuropathy. 2hr PPBS and HbA1c levels did not show significant association with any of the complications. This general presentation and association with the complication was similar to the reviewed studies by Mooradian and Abdel A, et al.<sup>22,23</sup>

## **Complications**

### **Nephropathy**

In our present study nephropathy was present in nearly a quarter of the patients 25.3%. The occurrence of Nephropathy among T1DM in our study is low but corresponds to the cumulative incidences found in other recent studies in European patients with T1DM diagnosed in adolescence.<sup>24</sup> In T2DM, the occurrence was lower than previously reported in original Maori, Australian and Canadian populations with early onset T2DM.<sup>25,26</sup> It can be of course argued that those reports come from selected populations with differences in both environmental factors and genetic background compared with our population.

### **Retinopathy**

In our present study retinopathy was present in less than a quarter of the patients 13.3%. Studies of large series of insulin-dependent diabetic (IDDM) patients examined by direct ophthalmoscopy have found retinopathy in 5 to 30% after 5 years, in 10 to 50% after 10 years, and in 80% after 20 years.<sup>27</sup> Frank et al, found retinopathy in 20% of the diabetic patients, but no retinopathy in 65 demographically similar nondiabetic control subjects.<sup>28</sup> The prevalence of retinopathy in Frank's study was found to increase with duration of diabetes, no retinopathy was found in 60 children who had diabetes for less than four years; retinopathy was found in 27% of those who had IDDM for five to nine years, and in 71% of those with IDDM for more than ten years. These authors observed that retinopathy prevalence in diabetic children increased with age, with a sharp rise after age 15 years, indicating that duration and age act independently. Lestradet et al, reported a rapid rise in the prevalence of retinopathy ten years after onset of diabetes in a group of 372 insulin-dependent juvenile diabetics who had received conventional treatment.<sup>29</sup> These investigators found the prevalence of retinopathy detected by clinical examination and retinal photography was 27% at 16 years, 53% at 20 years, and 85% at 26 years after onset of diabetes.

### **Neuropathy**

In our present study neuropathy was present in a small portion of the patients 9.3%. The estimates of neuropathy prevalence vary widely from 9.6 to 78% in different populations.<sup>13,30,31</sup> This could be attributed to different types of diabetes (e.g. type 1 and type 2 diabetes), genetic predisposition, age of onset of diabetes, existing healthcare facilities, sample selection, different diagnostic criteria used (pin-prick perception, clinical signs and symptoms, and quantitative sensory tests or electrodiagnostic tests).<sup>32,33</sup> This is much lower than reports from other studies in Indian patients by Pradeepa et al. (19.5%) and Rani et al. (14.4%), respectively.<sup>13,30</sup> The lower prevalence in the present



study could possibly be because of a different study set-up (tertiary care vs community based), increased knowledge and awareness of diabetes and its complications in recent times leading to earlier type 2 diabetes mellitus diagnosis and control of its complications. The present study was in line with that of Raman et al, which was carried out in a similar clinical set-up including 248 NDDM patients reporting neuropathy prevalence to be 10.5%.<sup>31</sup>

## CONCLUSION

To conclude microvascular complications are very common in young diabetic patients too. One third of patients (30.6%) had at least one of the three complications. Nephropathy was present in 25.3%, Retinopathy in 13.3% and Neuropathy in 9.3 %. So, these complications should not be ignored in the young patients and it needs an early intervention and treatment. Awareness about early detection, early referral and evaluation is important as early initiation of therapy can improve quality of life of patients.

Nephropathy was associated with duration of disease. Retinopathy was associated with duration of disease, FBS and DBP. Neuropathy was associated with male gender, smoking, duration of disease, FBS, SBP and DBP. Every effort should be made to spread awareness about avoidable risk factors especially smoking in the young. Strict control of blood pressure should also be considered along with glycaemic control to prevent microvascular complications.

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