Original Research Article

A Cross-sectional study on the development of Diabetic Cardiovascular Complications in Type 2 Diabetes Mellitus in a South Indian Tertiary Care Hospital

Abstract

Background: Diabetic cardiovascular complication is a familiar macrovascular complication of Type 2 Diabetes mellitus (T2DM). Cardiovascular disease (CVD) is the major cause of morbidity and mortality for people with diabetes. **Objective:** The aim of this study was to evaluate the parameters related to diabetic cardiovascular complication in patients with T2DM. **Methodology:** This study was conducted on 530 subjects (171 with or 359 without diabetic cardiovascular complication). Prevalence of diabetic cardiovascular complication was measured, risk factors for diabetic cardiovascular complications, and drug utilization pattern was assessed. **Results:** Cardiovascular complication was significantly higher in the subjects who are poorly educated, nature of work (house wives) and risk factors were pre-existing conditions (Hypertension, Cardiac, endocrine and other diseases), habit of smoking (past smoker), tea/coffee (twice without sugar), poor glycemic control, elevated triglyceride levels, elevated creatinine levels, duration of diabetes (5-10 years; >10 years). **Conclusion:** Combination of Glimepiride and Metformin (35.10%), Metformin (34.04%), combination of insulin isophane and insulin regular (23.40%), Insulin Regular (11.70%) were the anti-diabetic drugs widely prescribed to the T2DM patients with cardiovascular complications. Significant risk factors for development of diabetic cardiovascular complication were multiple.

Key-words: Type 2 diabetes, prevalence, Risk factors, duration of diabetes, diabetic cardiovascular complication, Metformin, insulin.

Introduction

The incidence of diabetes mellitus (DM) is rapidly rising worldwide. The overall burden of DM has increased from 30 million in 1985 to 382 million in 2014[1]. The latest estimates by the international diabetes federation project suggests that 592 million (1 in 10 persons) will have DM by 2035 worldwide [2]. Patients with type 2 diabetes are at increased risk of cardiovascular diseases and associated clinical complications [3]. Cardiovascular disease (CVD) is the major cause of morbidity and mortality for people with diabetes. In a nationwide database survey in primary care, the prevalence of CVD in patients with type 2 diabetes was high (21.4%) [4]. The common conditions coexisting with type 2 diabetes (e.g., hypertension and dyslipidemia) are evident risk factors for CVD. Numerous benefits are seen when multiple risk factors are addressed globally [5, 6].

The World Health Organization (WHO) defines "drug utilization" as the marketing, distribution, prescription and use of the drugs in a society considering its medical, social, and economic consequences [7]**.** Drug utilization studies aid to evaluate the rationality of the drug therapy and to determine the rational use of drug especially in poor and rural populations [8]. This study was conducted with an objective to screen the type 2 diabetes patients in order to determine the prevalence of diabetic cardiovascular complication and to determine the risk factors that are responsible for the development of diabetic cardiovascular complication and to evaluate the pattern of utilization of drug.

Materials and Methods

A cross-sectional observational study was carried out at outpatients department of Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation, Gannavaram, Andhra Pradesh, South India [9, 10]. KVSRSCOPS/IEC/PG/231/2017 was the protocol approval number.

Selection of participants

A total of 530 people (359 with T2DM and 171 with diabetic cardiovascular complications) and willing to participate were included in the study.

Inclusion criteria

Individuals of either sex who were diagnosed with type 2 diabetes mellitus of any duration, established as per American Diabetes Association (ADA) guidelines.

Exclusion criteria

Patients with type 1 diabetes mellitus, gestational diabetes and maturity onset diabetes of the young were excluded from the study.

Data collection

Patient demographics, socioeconomic status, biochemical parameters were collected from the laboratory reports. The diagnosis of cardiovascular complications was confirmed from the clinical records (if already documented) and Echocardiography and blood tests related to DM. Data was collected from a total of 530 individuals (359 with T2DM and 171 with diabetic cardiovascular complications).

Statistical Analysis

Graph pad prism software was used for analysis, Chi- Square test and Odds ratios were calculated. P value less than 0.05 was regarded as statistically significant.

Results

The clinical characteristics of the people enrolled in the study were presented in table 1.Table 2 and 3 depicts the socio-demographic and life style characteristics of subjects with and without diabetic cardiovascular complications respectively. The prevalence of diabetic cardiovascular complications was significantly higher in uneducated people (60.8%), nature of work (house wives) and risk factors were co-morbidities(Hypertension P<0.0001, cardiac diseases P<0.0001,other diseases P<0.0001,endocrine diseases P< 0.0001), habit of smoking(past smoker 11.2%, P=0.0061), tea/coffee(twice without sugar 44.4%, P=0.0181), HbA1c(7-9% P=0.0003, >9% P=0.0084), elevated triglyceride levels (35.8%, P=0.0265), elevated creatinine levels(19.9%, P<0.0001), duration of diabetes(>10, 5-10 years P<0.0001). Gender, age, marital status, BMI, body weight, locality, monthly income, blood glucose levels, HDL levels, food habits and habit of drinking alcohol are not significantly associated with the development of diabetic cardiovascular complications.

Univariate regression analysis was done to assess the odds ratios for the modifiable and nonmodifiable risk factors for T2DM (Table 4). The analysis showed that poorly educated (OR, 0.3702; 95% CI, 0.2544 to 0.5385, P<0.0001), nature of work (house wives OR, 0.2875; 95% CI, 0.1723 to 0.4797, P<0.0001) and risk factors were co-morbidities (Hypertension OR, 16.54; 95% CI, 7.444 to 36.77, P<0.0001, Cardiac diseases OR, 264.7; 95% CI, 89.89 to 779.3, P<0.0001, other diseases OR, 15.54; 95% CI, 6.922 to 34.89, P<0.0001, endocrine diseases OR, 9.199; 95%

CI, 3.812 to 22.20, P<0.0001), habit of smoking (past smoker OR, 2.537; 95% CI, 1.280 to 5.026, P=0.0061), tea/coffee(twice without sugar OR, 2.364; 95% CI, 1.143 to 4.889, P=0.0181), poor glycemic control (7-9% OR, 2.310; 95% CI, 1.468 to 3.634, P=0.0003; 9% OR, 1.995; 95% CI, 1.188 to 3.348, P=0.0084), elevated triglyceride levels (OR, 0.5656; 95% CI, 0.3412 to 0.9375, P=0.0265), elevated creatinine levels (OR, 36.43; 95% CI, 9.688 to 137.0, P<0.0001), duration of diabetes (5-10 years OR, 3.349; 95% CI, 2.055 to 5.457, P<0.0001; >10 years OR, 5.329; 95% CI, 3.234 to 8.783, P<0.0001).

The pattern of Drug utilization was evaluated and results were presented in Table 5. Combination of Glimepiride and Metformin (35.10%), Metformin (34.04%), combination of insulin isophane and insulin regular (23.40%), Insulin Regular (11.70%) were the anti-diabetic drugs mostly given to the T2DM patients with cardiovascular complications.

Discussion

The results suggested that subjects who have poor educational qualification, nature of work (house wives) and with co-morbidities (Hypertension, Cardiac, endocrine and other diseases), habit of smoking (past smoker), tea/coffee (twice without sugar), poor glycemic control, elevated triglyceride levels, elevated creatinine levels, duration of diabetes are the major risk factors for the development of cardiovascular complication.

Education

The results suggest that education (60.8%, p<0.0001) is one of the risk factors for the development of diabetic cardiovascular complication (OR, 0.3702; 95% CI, 0.2544 to 0.5385).

Nature of work

The results revealed that house wives (32.2%, P <0.0001) were significantly associated with diabetic cardiovascular complications (OR, 0.2875; 95% CI, 0.1723 to 0.4797). However, further studies are needed to evaluate the exact impact of nature of work on risk of developing diabetic cardiovascular complications.

Co morbidities

Hypertension (P < 0.0001) was positively associated with diabetic cardiovascular complications. Mattos et al., concluded that the presence of hypertension was risk factor for the development of CVD [11]. Another study by Iciar et al.,concluded that there are consistent evidences that along with control of hypertension, dyslipidaemia are necessary for reducing cardiovascular risk in T2DM patients [12]. Studies by Al-Khawlani et al., Per et al., Umamahesh

et al., also concluded that hypertension was a risk factor for diabetic cardiovascular complications [13-15]. The present study's results also support that hypertension (34.8%, P < 0.0001) was a risk factor for development of diabetic cardiovascular complications (OR, 16.54; 95% CI, 7.444 to 36.77).

Smoking

The study's results revealed that habit of smoking (11.2%, P=0.0061) was significantly associated risk factor for development diabetic cardiovascular complications. Umamahesh et al., conducted a 11-year follow up study and concluded that smoking habit and alcohol consumption were significantly associated with CVD events in Indian population with type 2 diabetes [15]. Study by Al-Khawlani et al., concluded that CHD was the most frequent macrovascular complication in the group of type 2 DM patients [13].Studies by Iciar Martín-Timón et al., also concluded that habit of smoking was a risk factor for diabetic cardiovascular complications [12]. The present study's results also determine that habit of smoking (11.2%, P = 0.0061) was a risk factor for diabetic cardiovascular complications (OR, 2.537; 95% CI, 1.280 – 5.026).

Habit of tea/ coffee

The results revealed that habit of taking tea/ coffee twice without sugar (44.4%, P=0.0181) was significantly and majorly associated risk factor for diabetic cardiovascular complications (OR, 2.364; 95% CI, 1.143 – 4.889).Therefore, further research was needed to assess the exact impact of habit of taking tea/ coffee on risk for diabetic cardiovascular complications.

HbA1c

Poor glycemic control was remarkably associated with the development of diabetic cardiovascular complications. Mattos et al., concluded that poor glycemic control in diabetic patients was the classical risk factor for development of CVD [11]. In the present study, poor glycemic control (7-9% 47.5%, P=0.0003; 9% 26%, p=0.0084) was a significant risk factor for diabetic cardiovascular complications (7-9% OR, 2.310; 95% CI, 1.468 – 3.634, 9% OR, 1.995; 95% CI, 1.188 – 3.348). Another study by Iciar et al., concluded that there are consistent evidences that optimal glycemic control [12]. Studies by Al-Khawlani et al., concluded that poor glycemic control was remarkably associated with the development of diabetic cardiovascular complications [13].

Triglycerides

The results of this study revealed that elevated triglyceride levels (35.8%, P =0.0265) were significantly and majorly associated risk factor for diabetic cardiovascular complications (OR, 0.5656; 95% CI, 0.3412 - 0.9375). Mattos et al., concluded that dyslipidemia was major risk factors for the development of CVD in individuals with diabetes [11]. Another study conducted by Iciar et al., concluded that dyslipidemia was a significant risk factor [12]. Studies by Umamahesh et al., concluded that triglycerides was majorly associated with the development of diabetic cardiovascular complications [15].

Serum creatinine

The results of this study revealed that elevated Serum creatinine levels (19.9%, P <0.0001) was major associated risk factor for diabetic cardiovascular complications (OR, 36.42; 95% CI, 9.688 – 137.0). Further studies are required to assess the exact impact of creatinine levels for developing diabetic cardiovascular complications.

Duration of T2DM

The results of this study revealed that duration of T2DM (5-10 years 39.2%, P <0.0001; >10 years 42.7%, p<0.0001) were significantly associated risk factor for diabetic cardiovascular complications (5-10 years OR, 3.349; 95% CI, 2.055 – 5.457, >10 years OR, 5.329; 95% CI 3.234 – 8.783). Study conducted by Al-Khawlani et al., concluded that CHD was the most frequent macrovascular complication in type 2 DM patients [13]. Per et al., concluded that Hypertension is more important among men and the duration of diabetes among women as risk factor for macrovascular complications in type 2 diabetes [14].

Drug utilization pattern

The results of our study are similar to the study conducted by Sekhar et al., in which metformin was the most commonest drug used; glimepiride and metformin combination was the commonest combination therapy [8].

Conclusion

Subjects with poor educational status, nature of work (house wives) and risk factors were co-morbidities (Hypertension, Cardiac, endocrine and other diseases), habit of smoking (past smoker), tea/coffee (twice without sugar), poor glycemic control, elevated triglyceride levels, elevated creatinine levels, duration of diabetes are the major risk factors for the development of cardiovascular complication. Combination of Glimepiride and Metformin, Metformin,

combination of insulin isophane and insulin regular, Insulin Regular were the anti-diabetic drugs mostly given to the T2DM patients with cardiovascular complications.

Key findings

- The prevalence of cardiovascular complication was found to be 13.85%.
- The prevalence of cardiovascular complication was higher in males compared to females (P=0.1240).
- The major co morbidities for the development of cardiovascular complication include hypertension (P<0.0001), cardiac diseases (P<0.0001), endocrine diseases (P<0.0001) and other diseases (P<0.0001).
- Habit of smoking, habit of taking tea/coffee is significantly associated with the development of cardiovascular complication.
- Poor glycemic controls, serum creatinine levels, triglyceride levels, are significantly associated with the development of cardiovascular complication.
- Duration of diabetes (>10years, 42.7% P<0.0001, 5-10 years 39.2% P<0.0001) cardiovascular complication.

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Table 1. Clinical characteristics of patients with type 2 diabetes mellitus (N=359)

Characteristic	Number (%)
Gender	
Male	155 (43.2)
Female	204 (56.8)
Age (Years)	
0-20	1 (0.3)
21-40	83 (23.2)
41-60	217 (60.6)
Above 60	57 (15.9)
Marital status	
Unmarried	16 (4.5)
Married	343 (95.5)
Education	
Uneducated	131 (36.5)
Educated	228 (63.5)
BMI(Kg/m^2)	
< 25 Kg/m^2	114 (31.8)
> /=25 Kg/m^2	245 (68.2)
Weight	
< 50 kg	5 (1.3)
50-70 kg	161 (45)
> 70 kg	192 (53.6)
Nature of work	
Unemployed	41 (11.4)
Private employee	93 (25.9)
Govt. employee	39 (10.8)
Daily labor	38 (10.6)
House wife	148 (41.3)
Locality	
Rural	105 (29.2)
Urban	254 (70.7)
Income per month in INR	
No	170 (47.5)
< 25000	115 (32.1)
> 25000	73 (20.4)
Pre-existing conditions	
No	131 (29.4)
Hypertension	138 (30.8)
Cardiovascular diseases	7 (1.56)
Endocrine diseases	59 (13.2)
Other diseases	112 (25.1)
Systolic BP (mmHg)	

<140	259 (72.1)
>/=140	100 (27.9)
Diastolic BP (mmHg)	
<90	281 (78.3)
>/=90	78 (21.7)
HbA1C	
<7	141 (44.2)
7-9	109 (34.2)
>9	69 (21.6)
Fasting Sugar Level in Blood	
70-80 mg/dL	10 (3)
80-120 mg/dL	92 (27.6)
121-160 mg/dL	107 (32)
161-200 mg/dL	71 (21.3)
>200 mg/dL	54 (16.2)
Post prandial blood Sugar levels	
90-110 mg/dL	3 (1)
111-130 mg/dL	9 (3)
131-150 mg/dL	33 (10.9)
151-200 mg/dL	165 (54.6)
>200 mg/dL	92 (30.5)
Random Sugar levels in blood	
80-100 mg/dL	0
101-120 mg/dL	0
121-140 mg/dL	0
141-160 mg/dL	2 (13.3)
161-200 mg/dL	1 (6.7)
>200 mg/dL	12 (80)
HDL	
Not known	54 (20.1)
Normal	130 (48.3)
Low	55 (20.4)
High	30 (11.2)
Triglycerides	
Not known	54 (20.5)
Normal	109 (41.5)
Low	8 (3)
High	92 (35)
Total Cholesterol	
Not known	54 (19.6)
Normal	151 (54.7)
Low	6 (2.2)
High	65 (23.6)
LDL	
Not known	57 (20.8)
Normal	163 (59.4)

Low	9 (3.3)
High	45 (16.5)
Urea	
Not known	72 (36.4)
Normal	78 (39.4)
Low	0
High	48 (24.2)
Serum creatinine	
Not known	45 (12.6)
Normal	305 (85.2)
Low	5 (1.4)
High	3 (0.8)
Duration of T2DM	
<5 Years	172 (47.9)
5-10 Years	111 (30.9)
>10 Years	76 (21.2)
Following T2DM education	
Yes	282 (79.2)
No	74 (20.8)

T2DM, Type 2 Diabetes Mellitus; BMI, Body Mass Index; HTN, Hypertension; CVDs, Cardiovascular Diseases; HbA1C, Glycated haemoglobin; HDL, High Density Lipoproteins; LDL, Low Density Lipoproteins

Table 2. Socio-demographic characteristics of diabetic patients with (N=171) or without cardiovascular complications (N=359).

Characteristic	People with T2DM N (%)	People with T2DM and CVDs N (%)	P-Value
Gender			
Male	155 (43.2)	86 (50.3)	Ref
Female	204 (56.8)	85 (49.7)	0.1240
Age			
0-20 years	1 (0.3)	0	Ref
21-40 years	83 (23.2)	3 (1.8)	0.8492
41-60 years	217 (60.6)	94 (55)	0.5107
Above 60 years	57 (15.9)	74 (43.3)	0.2569
Marital status			
Unmarried	16 (4.5)	2 (1.2)	Ref
Married	343 (95.5)	169 (98.8)	0.0508
Education			
Uneducated	131 (36.5)	104 (60.8)	Ref
Educated	228 (63.5)	67 (39.2)	<0.0001***
BMI(Kg/m^2)			
<25 Kg/m^2	114 (31.8)	58 (33.9)	Ref
>/=25 Kg/m^2	245 (68.2)	113 (66.1)	0.6190
Body weight (Kg)			
<50	5 (1.3)	1 (0.6)	Ref
50-70	161 (45)	92 (53.8)	0.3202
>70	192 (53.7)	78 (45.6)	0.5124
Nature of work			
Unemployed	41 (11.4)	53 (31)	Ref
Private employee	93 (25.9)	35 (20.5)	<0.0001***
Govt. employee	39 (10.8)	15 (8.8)	0.0008***
Daily labor	38 (10.6)	13 (7.6)	0.0004***
House wife	148 (41.2)	55 (32.2)	<0.0001***
Locality			
Rural	105 (29.2)	68 (39.7)	Ref
Urban	254 (70.8)	103 (60.2)	0.0158
Monthly income			
No income	170 (47.5)	98 (57.3)	Ref
Below 25000	115 (32.1)	52 (30.4)	0.2466
Above 25000	73 (20.4)	21 (12.3)	0.0115*
Co-morbidities			
No	131 (29.4)	7 (2)	Ref
HTN	138 (30.8)	122 (34.8)	<0.0001***
History of CVDs	7 (1.56)	99 (28.3)	<0.0001***
Endocrine diseases	59 (13.2)	29 (8.3)	<0.0001***

Other diseases	112 (25.1)	93 (26.6)	<0.0001***
Systolic BP			
<140 mmHg	259 (72.1)	98 (57.6)	Ref
>/=140 mmHg	100 (27.9)	72 (42.4)	0.0009***
Diastolic BP			
<90 mmHg	281 (78.3)	127 (74.3)	Ref
>/=90 mmHg	78 (21.7)	44 (25.7)	0.3060
HbA1C (%)			
<7	141 (44.2)	42 (26.6)	Ref
7-9	109 (34.2)	75 (47.5)	0.0003***
>9	69 (21.6)	41 (26)	0.0084**
Fasting Sugar Levels in Blood			
70-80 mg/dL	10 (3)	5 (3.2)	Ref
80-120 mg/dL	92 (27.6)	43 (27.4)	0.9071
121-160 mg/dL	107 (32)	49 (31.2)	0.8784
161-200 mg/dL	71 (21.3)	27 (17.2)	0.6434
>200 mg/dL	54 (16.2)	33 (21)	0.7337
Post prandial blood sugar (mg/dl)			
90-110	3 (1)	3 (2.1)	Ref
111-130	9 (3)	5 (3.5)	0.5501
131-150	33 (10.9)	19 (13.5)	0.5199
151-200	165 (54.6)	55 (39)	0.1666
>200	92 (30.5)	59 (41.8)	0.5913
Random Sugar Levels in blood			
80-100 mg/dL	0	2 (3.9)	0.3509
101-120 mg/dL	0	2 (3.9)	0.3509
121-140 mg/dL	0	3 (5.9)	0.2556
141-160 mg/dL	2 (13.3)	5 (9.8)	0.9074
161-200 mg/dL	1 (6.7)	12 (23.5)	0.0961
>200 mg/dL	12 (80)	27 (52.9)	Ref
HDL (mg/dl)			
Not known	54 (20.1)	57 (38)	Ref
Normal	130 (48.3)	44 (29.4)	<0.0001***
Low	55 (20.4)	37 (24.7)	0.1133
High	30 (11.2)	12 (8)	0.0115*
Triglycerides (mg/dl)			
Not known	54 (20.5)	55 (37.2)	Ref
Normal	109 (41.5)	38 (25.7)	<0.0001***
Low	8 (3)	2 (1.4)	0.0650
High	92 (35)	53 (35.8)	0.0265*
Total Cholesterol			
Not known	54 (19.6)	55 (35.9)	Ref
Normal	151 (54.7)	59 (38.6)	<0.0001***
Low	6 (2.2)	-----	0.0160*
High	65 (23.6)	39 (25.5)	0.0569
LDL (mg/dl)			

Not known	57 (20.8)	56 (37.3)	Ref
Normal	163 (59.4)	59 (39.4)	<0.0001***
Low	9 (3.3)	2 (1.3)	0.0465*
High	45 (16.5)	33 (22)	0.3235
Urea (mg/dl)			
Not known	72(36.4)	48(40.7)	Ref
Normal	78(39.4)	21(17.8)	0.0029**
Low	0	-----	
High	48(24.2)	49(41.5)	0.1214
Serum creatinine			
Not known	45 (12.6)	14 (8.2)	Ref
Normal	305 (85.2)	123 (71.9)	0.4224
Low	5 (1.4)	-----	0.2178
High	3 (0.8)	34 (19.9)	<0.0001***
Duration of T2DM			
<5 Years	172 (47.9)	31 (18.1)	Ref
5-10 Years	111 (30.9)	67 (39.2)	<0.0001***
>10 Years	76 (21.2)	73 (42.7)	<0.0001***
Following T2DM education			
Yes	282(79.2)	121(71.2)	Ref
No	74(20.8)	49(28.8)	0.0417*

T2DM, Type 2 Diabetes Mellitus; BMI, Body Mass Index; HTN, Hypertension; CVDs, Cardiovascular Diseases; HbA1C, Glycated hemoglobin; HDL, High Density Lipoproteins.

Table 3. Food and life style characteristics of diabetic patients with (N=171) or without cardiovascular complications(N=359).

Characteristic	Patients with T2DM N (%)	Patients with T2DM and CVDs N (%)	P-value
Food habits			
Vegetarian	60 (16.7)	27 (15.7)	Ref
Mixed	299 (83.3)	144 (84.2)	0.7884
Physical activity			
No physical activity	176 (49)	95 (55.5)	Ref
Regular exercise	183 (50.9)	76 (44.5)	0.1597
Habit of smoking			
Never	320 (89.1)	141 (83)	Ref
Yes	22 (6.1)	10 (5.9)	0.9372
Past smoker	17 (4.7)	19 (11.2)	0.0061**
Habit of drinking alcohol			
Never	304 (85.1)	146 (85.4)	Ref
Yes	44 (12.3)	18 (10.6)	0.5893
Past alcoholic	9 (2.5)	7 (4.1)	0.3440
Habit of having junk foods			
Never	180 (50.3)	87 (50.9)	Ref
Once a week	31 (8.7)	16 (9.4)	0.8443
Twice a week	23 (6.4)	14 (8.2)	0.5249
Thrice a week and more	28 (7.8)	13 (7.6)	0.9111
Occasionally	96 (26.8)	41 (24)	0.5868
Habit of taking fruits /fruit juices			
Never	66 (18.5)	40 (23.4)	Ref
Once a week	27 (7.5)	14 (8.2)	0.6856
Twice a week	35 (9.8)	12 (7)	0.1415
Thrice a week and more	125 (34.9)	41 (24)	0.0218*
Occasionally	105 (29.3)	64 (37.4)	0.9822
Habit of taking soft drinks			
Never	272 (76.2)	132 (77.2)	Ref
Once a week	6 (1.7)	2 (1.2)	0.6464
Twice a week	5 (1.4)	3 (1.8)	0.7733
Thrice a week and more	14 (4)	1 (0.6)	0.0336*
Occasionally	60 (16.8)	33 (19.3)	0.6038

Habit of taking tea/coffee			
Never	55 (15.3)	11 (9.4)	Ref
Once daily without sugar	54 (15)	21 (17.9)	0.1089
Twice daily without sugar	110 (30.6)	52 (44.4)	0.0181*
Thrice daily without sugar	58 (16.2)	14 (12)	0.6721
Once daily with sugar	25 (6.9)	9 (7.7)	0.2456
Twice daily with sugar	37 (10.3)	5 (4.3)	0.4971
Thrice daily with sugar	20 (5.6)	5 (4.3)	0.7092
Situations at working places			
No stress	181 (50.4)	94 (55)	Ref
Stress	178 (49.6)	77 (45)	0.3267

Table 4. Univariate regression analysis for the development of cardiovascular complications in patients with T2DM.

Characteristic	OR (95% CI)	P-Value
Gender		
Male	1	Ref
Female	0.7510 (0.5211 to 1.082)	0.1240
Age (Years)		
0-20	1	Ref
21-40	0.1257 (0.004301 to 3.676)	0.8492
41-60	1.303 (0.05258 to 32.31)	0.5107
Above 60	3.887 (0.1553 to 97.27)	0.2569
Marital status		
Unmarried	1	Ref
Married	3.942 (0.8956 to 17.35)	0.0508
Education		
Uneducated	1	Ref
Educated	0.3702 (0.2544 to 0.5385)	<0.0001***
BMI(Kg/m^2)		
<25 Kg/m^2	1	Ref
>/=25 Kg/m^2	0.9065 (0.6157 to 1.335)	0.6190
Body weight (Kg)		
<50	1	Ref
50-70	2.857 (0.3286 to 24.84)	0.3202
>70	2.031 (0.2334 to 17.68)	0.5124
Nature of work		
Unemployed	1	Ref
Private employee	0.2911 (0.1657 to 0.5114)	<0.0001***
Govt. employee	0.2975 (0.1446 to 0.6124)	0.0008***
Daily labour	0.2646 (0.1250 to 0.5605)	0.0004***
House wife	0.2875 (0.1723 to 0.4797)	<0.0001***
Locality		
Rural	1	Ref
Urban	0.6262 (0.4275 to 0.9170)	0.0158
Monthly income		
No income	1	Ref
Below 25000	0.7844 (0.5199 to 1.183)	0.2466
Above 25000	0.4990 (0.2892 to 0.8610)	0.0115*
Pre-existing conditions		
No	1	Ref
Hypertension	16.54 (7.444 to 36.77)	<0.0001***
Cardiovascular diseases	264.7 (89.89 to 779.3)	<0.0001***
Endocrine diseases	9.199 (3.812 to 22.20)	<0.0001***

Other diseases	15.54 (6.922 to 34.89)	<0.0001***
Systolic BP (mmHg)		
<140	1	Ref
>/=140	1.903 (1.299 to 2.788)	0.0009***
Diastolic BP (mmHg)		
<90	1	Ref
>/=90	1.248 (0.8161 to 1.909)	0.3060
HbA1C (%)		
<7	1	Ref
7-9	2.310 (1.468 to 3.634)	0.0003***
>9	1.995 (1.188 to 3.348)	0.0084**
Fasting Sugar Levels in blood		
70-80 mg/dL	1	Ref
80-120 mg/dL	0.9348 (0.3010 to 2.903)	0.9071
121-160 mg/dL	0.9159 (0.2971 to 2.823)	0.8784
161-200 mg/dL	0.7606 (0.2380 to 2.430)	0.6434
>200 mg/dL	1.222 (0.3840 to 3.890)	0.7337
Post prandial blood sugar (mg/dl)		
90-110	1	Ref
111-130	0.5556 (0.07995 to 3.860)	0.5501
131-150	0.5758 (0.1055 to 3.143)	0.5199
151-200	0.3333 (0.06534 to 1.701)	0.1666
> 200	0.6413 (0.1252 to 3.285)	0.5913
Random Sugar Levels in blood		
80-100 mg/dL	2.273 (0.1014 to 50.95)	0.3509
101-120 mg/dL	2.273 (0.1014 to 50.95)	0.3509
121-140 mg/dL	3.182 (0.1524 to 66.41)	0.2556
141-160 mg/dL	1.111 (0.1882 to 6.560)	0.9074
161-200 mg/dL	5.333 (0.6207 to 45.83)	0.0961
>200 mg/dL	1	Ref
HDL (mg/dl)		
Not known	1	Ref
Normal	0.3206 (0.1934 to 0.5316)	<0.0001***
Low	0.6373 (0.3644 to 1.114)	0.1133
High	0.3789 (0.1761 to 0.8153)	0.0115*
Triglycerides (mg/dl)		
Not known	1	Ref
Normal	0.3423 (0.2021 to 0.5796)	<0.0001***
Low	0.2455 (0.04982 to 1.209)	0.0650
High	0.5656 (0.3412 to 0.9375)	0.0265*
Total Cholesterol		
Not known	1	Ref
Normal	0.3836 (0.2371 to 0.6208)	<0.0001***
Low	0.07554 (0.004151 to 1.375)	0.0160*
High	0.5891 (0.3410 to 1.018)	0.0569
LDL		

Not available	1	Ref
Normal	0.3684 (0.2293 to 0.5919)	<0.0001***
Low	0.2262 (0.04676 to 1.094)	0.0465*
High	0.7464 (0.4174 to 1.335)	0.3235
Urea		
Not known	1	Ref
Normal	0.4038 (0.2206 to 0.7394)	0.0029**
Low		
High	1.531 (0.8920 to 2.629)	0.1214
Serum creatinine		
Not known	1	Ref
Normal	1.296 (0.6866 to 2.447)	0.4224
Low	0.2853 (0.01485 to 5.480)	0.2178
High	36.43 (9.688 to 137.0)	<0.0001***
Duration of T2DM		
<5 Years	1	Ref
5-10 Years	3.349 (2.055 to 5.457)	<0.0001***
>10 Years	5.329 (3.234 to 8.783)	<0.0001***
Following T2DM education		
Yes	1	Ref
No	1.543 (1.015 to 2.347)	0.0417*
Food habits		
Vegetarian	1	Ref
Mixed	1.070 (0.6518 to 1.757)	0.7884
Physical activity		
No physical activity	1	Ref
Regular exercise	0.7694 (0.5336 to 1.109)	0.1597
Habit of smoking		
Never	1	Ref
Yes	1.032 (0.4760 to 2.236)	0.9372
Past smoker	2.537 (1.280 to 5.026)	0.0061**
Habit of drinking alcohol		
Never	1	Ref
Yes	0.8518 (0.4755 to 1.526)	0.5893
Past alcoholic	1.619 (0.5913 to 4.435)	0.3440
Habit of having junk foods		
Never	1	Ref
Once a week	1.068 (0.5544 to 2.057)	0.8443
Twice a week	1.259 (0.6178 to 2.567)	0.5249
Thrice a week and more	0.9606 (0.4742 to 1.946)	0.9111
Occasionally	0.8836 (0.5654 to 1.381)	0.5868
Habit of taking fruits /fruit juices		
Never	1	Ref
Once a week	0.8556 (0.4018 to 1.822)	0.6856
Twice a week	0.5657 (0.2634 to 1.215)	0.1415
Thrice a week and more	0.5412 (0.3192 to 0.9176)	0.0218*

Occasionally	1.006 (0.6094 to 1.660)	0.9822
Habit of taking soft drinks		
Never	1	Ref
Once a week	0.6869 (0.1367 to 3.451)	0.6464
Twice a week	1.236 (0.2910 to 5.254)	0.7733
Thrice a week and more	0.1472 (0.01914 to 1.132)	0.0336*
Occasionally	1.133 (0.7062 to 1.819)	0.6038
Habit of taking tea/coffee		
Never	1	Ref
Once daily without sugar	1.944 (0.8558 to 4.418)	0.1089
Twice daily without sugar	2.364 (1.143 to 4.889)	0.0181*
Thrice daily without sugar	1.207 (0.5047 to 2.886)	0.6721
Once daily with sugar	1.800 (0.6622 to 4.893)	0.2456
Twice daily with sugar	0.6757 (0.2168 to 2.105)	0.4971
Thrice daily with sugar	1.250 (0.3861 to 4.047)	0.7092
Situations at working places		
No stress	1	Ref
Stress	0.8330 (0.5779 to 1.201)	0.3267

Table 5. **Medication given for the patients with cardiovascular complications**

S. No	Generic Name Of Drugs	N (%)
1	Glimepiride + Metformin	33 (35.10)
2	Metformin	32 (34.04)
3	Insulin Isophane + Insulin Regular	22 (23.40)
4	Insulin Regular	11 (11.70)
5	Pioglitazone	9 (9.57)
6	Metformin + Teneligliptin	9 (9.57)
7	Insulin glargine	7 (7.44)
8	Glimepiride	6 (6.38)
9	Empagliflozin	5 (5.31)
10	Gliclazide + Metformin	5 (5.31)
11	Sitagliptin + Metformin	5 (5.31)
12	Teneligliptin	4 (4.25)
13	Gliclazide	4 (4.25)
14	Glipizide + Metformin	3 (3.19)
15	Voglibose	3 (3.19)
16	Acarbose	3 (3.19)
17	Metformin + Vildagliptin	3 (3.19)
18	Glimepiride + Metformin + Pioglitazone	2 (2.12)
19	Insulin Aspart + Insulin Protamine	1 (1.06)
20	Vildagliptin	1 (1.06)
21	Metformin + Voglibose	1 (1.06)
22	Sitagliptin	1 (1.06)
23	Canagliflozin	1 (1.06)
24	Linagliptin	1 (1.06)

25	Insulin Degludec + Insulin Aspart	1 (1.06)
26	Insulin Isophane	1 (1.06)
27	Lantus Insulin	1 (1.06)
28	Insulin Aspart	1 (1.06)
29	Insulin Lispro + Protamine Insulin	1 (1.06)
30	Glimepiride + Metformin + Voglibose	1 (1.06)