

# Cardiac Risk Factors In Type 2 Diabetes Mellitus Patients Presenting in a Tertiary Care Center of Kumaon Region of Uttarakhand

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## ABSTRACT

**Background:** Compared with individuals without diabetes, patients with Type 2 Diabetes Mellitus have a considerably higher risk of cardiovascular morbidity and mortality. Most of the risk is associated with an augmented prevalence of risk factors such as hypertension, dyslipidemia, decreased physical activity, obesity, smoking and alcohol. Aim and Objective: To study cardiac risk factors in type 2 diabetes mellitus and to assess the socio-demographic profile of type 2 Diabetes Mellitus. **Methods:** A 2-Year hospital-based cross sectional observational study was conducted in Department of Medicine in a Tertiary center of Kumaon region in Uttarakhand. Risk factors assessed were Dyslipidemia, Hypertension, Obesity, Hyperglycemia, Smoking, Alcohol, Sedentary lifestyle, Uric acid levels. **Results:** Total 120 eligible patients were included in study, 64 male and 56 females with mean age (53±14 years) and mean duration of disease (86±4.56 months). 73.33% were either obese or overweight, 57.50% had raised blood pressure, 62.5% had elevated total cholesterol, 70% had low HDL levels, 54.16% had raised Triglyceride levels. 65% patients either had lower than required or no physical activity. 73% of the patients had one or the other risk factor present. **Conclusion:** Early detection of risk factors and proper treatment play a vital role for the prevention of coronary artery disease.

**Keywords:** T2DM, CAD, Risk factors, Hypertension, Obesity, Dyslipidemia, Sedentary lifestyle.

## INTRODUCTION

Diabetes Mellitus is a chronic condition that occurs when the body cannot produce enough insulin or effectively utilize it. Cardiovascular disease is increased in Type 2 Diabetes Mellitus subjects due to a complex combination of various traditional and non-traditional risk factors that have an important role to play in the beginning and the evolution of atherosclerosis to clinical events. Diabetes and cardiovascular diseases are rapidly gaining pandemic proportions and India is leading the race of numbers worldwide. Compared with individuals without diabetes, patients with Type 2 Diabetes Mellitus have a considerably higher risk of cardiovascular morbidity and mortality which is augmented with associated risk factors such as hypertension, dyslipidemia, decreased physical activity, obesity, smoking and alcohol consumption in these patients.<sup>[1,2]</sup>

There are approximately 33 million diabetics in India presently and this number is expected to reach 79.4 million in 2030. The International Diabetes Federation has reported that the prevalence of diabetes in adults in India is 7.1%. The prevalence in urban areas is 9%.<sup>[3]</sup> Rapid urbanization has caused decreased physical activity and consumption of fast food causing amplification of this risk and increasing the incidence of this disease. Poor glycemic control and duration of diabetes seem to be the strongest risk factors for the development of vascular complications while other factors such as hypertension, dyslipidemia, obesity, smoking, age and genetic factors all contribute for the same. It is also notable that the incidence of Coronary artery disease among South Asians is higher when compared to that among Europeans.<sup>[4]</sup> Several studies have demonstrated that South Asians with diabetes have a higher mortality rate due to Coronary artery disease when compared to other ethnic groups.<sup>[5,6]</sup>

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## MATERIALS AND METHODS

This cross sectional, observational study was carried out in the Department of Medicine, Government Medical College and Dr. Susheela Tiwari

Government Hospital, Haldwani from January 2018-October 2019 on 120 eligible patients with Type 2 diabetes over a period of 2 years. The research procedure followed was in accordance with the approved ethical standards of Hospital, Ethics Committee (Human).

Inclusion criteria: Patients diagnosed with Type 2 Diabetes Mellitus as per WHO criteria: Fasting Plasma Glucose level of 126 mg/dl or higher and a 2 hour plasma glucose level of 200 mg/dl or higher)

Exclusion criteria: All Type 1 diabetes mellitus, patients with proven CAD and patients not willing to participate.

#### Methodology

A written consent was taken from all eligible subjects. A structured questionnaire prepared in English and Hindi, was used to collect information from each patient. The information obtained included Patient's personal history, physical examination findings like name, age, sex, demographic profile, smoking habits, alcohol use, hypertension, duration of diabetes, medication of diabetes and hypertension, compliance, physical exercise. Height and weight was measured using an analogue scale. Body-mass index (BMI) was calculated from weight in kilograms divided by the square of the height in meters. Blood pressure was measured using a digital machine (Microlife watch BP Home) in a sitting position after 5 minutes of

rest. All plasma samples were analysed at Department of Biochemistry and Department of Pathology, Dr. Susheela Tiwari hospital, according to standardized protocol. Risk factors assessed in study were Dyslipidemia (ATP-III), Hypertension (as per JNC7), Obesity (as per WHO-2004), Alcohol intake (as per NIAAA), Physical inactivity (as per WHO). Microvascular complications of diabetes were also assessed by appropriate investigations.

#### Statistical analysis

All the background clinical data were recorded in proforma. Record files were constructed in the Microsoft Excel software. The detailed analysis included the profiling of patients on different demographic and clinical parameters. Descriptive analysis of quantitative data was expressed as means and standard deviation.

## RESULTS

The mean  $\pm$  SD of age of the patients in this study was  $53 \pm 14.3$  years, 39(32.5%) patients belonged to group 52-61 years, followed by 34 (28.3%) in 42-51 years. Study had 64(53.3%) male and 56(46.7%) female patients. 46(38.3%) patients had studied till high school, followed by 34(28.33%) graduates. 74(61.7%) patients belonged from plain areas while 46(38.3%) from hilly regions [Table 1].

**Table 1: Distribution of demographic profile of patients**

Variable		No. of patients (n=120) (%)	Males	Females
Age groups (years)	16-31	0	0	0
	32-41	5(4.17%)	3(4.6%)	2(3.5%)
	42-51	34(28.33%)	19(29.7%)	15(26.8%)
	52-61	39(32.5%)	20(31.3%)	19(33.9%)
	62-71	29(24.2%)	13(20.3%)	16(28.6%)
	72-81	11(9.2%)	8(12.5%)	3(5.3%)
	82-91	2(1.7%)	1(1.5%)	1(1.8%)
Gender		120 (100%)	64(53.3%)	56(46.7%)
Literacy	Illiterate	21(17.5%)	9(14.1%)	12(21.4%)
	High School	46(38.3%)	20(31.3%)	26(46.4%)
	Intermediate	19(15.8%)	12(18.8%)	7(12.5%)
	Graduation	34(28.3%)	23(35.9%)	11(19.6%)
Region	Hilly	46(38.3%)	25(39.1%)	21(37.5%)
	Plain	74(61.7%)	39(60.9%)	35(62.5%)

**Table 2: Distribution of various lipid levels, hypertension and BMI of patients**

Variable		Patients (n=120)(%)	Males	Females
LDL(mg/dl)	Optimal(<100)	58(48.3%)	25(39.1%)	33(58.9%)
	Near Optimal(100-129)	23(19.2%)	12(18.8%)	11(19.6%)
	Borderline High(130-159)	18(15%)	11(17.2%)	7(12.5%)
	High(160-189)	12(10%)	9(14.1%)	3(5.5%)
	Very High( $\geq$ 190)	9(7.5%)	7(10.8%)	2(3.5%)
HDL(mg/dl)	Low(<40)	84(70%)	54(84.4%)	30(53.6%)
	High( $\geq$ 60)	36(30%)	10(15.6%)	26(46.4%)
Total Cholesterol (mg/dl)	Desirable(<200)	45(37.5%)	23(35.9%)	19(33.9%)
	Borderline high(200-239)	43(35.8%)	24(37.5%)	28(50%)
	High( $\geq$ 240)	32(26.7%)	17(26.6%)	9(16.1%)
Triglycerides(mg/dl)	Normal(<150)	55(45.8%)	27(42.2%)	28(50%)
	Borderline high(150-199)	41(34.2%)	21(32.8%)	20(35.7%)
	High( $\geq$ 200)	24(20%)	16(25%)	8(14.2%)
Systemic Hypertension(mmHg)	Optimal(<120/80)	51(42.5%)	27(42.2%)	24(42.9%)
	Pre htn (120-139/80-89)	21(17.5%)	10(15.6%)	11(19.6%)
	Stage1(140-159/90-99)	32(26.7%)	18(28.1%)	14(25%)
	Stage 2( $\geq$ 160/ $\geq$ 100)	16(13.3%)	9(14.1%)	7(12.5%)

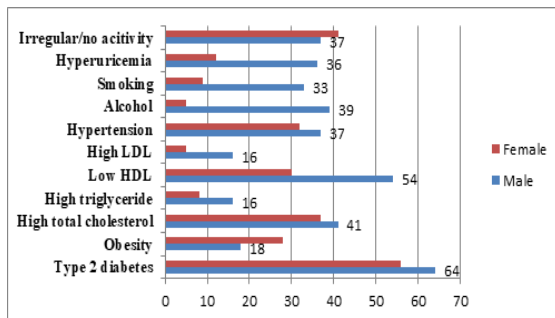
B.M.I(kg/m <sup>2</sup> )	Normal(18.5-24.9)	32(26.7%)	19(29.7%)	13(23.2%)
	Overweight(25-29.9)	42(35%)	27(42.2%)	15(26.8%)
	Obese(≥30)	46(38.3%)	18(28.1%)	28(50%)

**Table 3: Distribution of patients basis of habits, physical activity and complications**

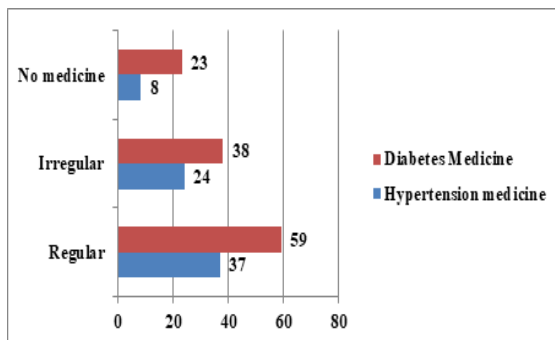
Variable	No. of patients (n=120) (%)	Males	Females	
Smoking habits	Current smoker	42(35%)	28(43.8%)	14(25%)
	Non smoker	78(65%)	36(56.2%)	42(75%)
Alcohol consumption	Heavy (≥14 std drinks)	16(13.3%)	15(23.4%)	1(1.8%)
	Moderate(<14 std drinks)	28(23.3%)	24(37.5%)	4(7.1%)
	Non alcoholics	76(63.3%)	25(39.1%)	51(91.1%)
Physical activity	Regular (≥30 min daily)	42(35%)	27(42.2%)	15(26.8%)
	Sometimes	40(33.3%)	22(34.4%)	18(32.1%)
	Not at all	38(31.7%)	15(23.4%)	23(41.1%)
Complications	Nephropathy	8(6.7%)	5(7.9%)	3(5.4%)
	Neuropathy	14(11.7%)	5(7.9%)	9(16.1%)
	Retinopathy	10(8.3%)	6(9.4%)	4(7.1%)
	Diabetic foot	5(4.2%)	2(3.1%)	3(5.4%)

**Table 4: Distribution of patients according to duration of diabetes, mean HbA1C and mean uric acid levels**

Duration of diabetes(years)	No. of patients	Mean HbA1C	Mean Uric acid levels
<2	16	5.76±1.83	4.58±0.94
2-5	34	5.23±1.14	4.30±0.95
6-9	41	6.61±2.60	4.92±1.01
≥10	29	6.91±2.83	5.81±1.07



**Figure 1: Gender wise distribution of different risk factors**



**Figure 2: Distribution of patients on basis of drug treatment**

Mean LDL Cholesterol was 94.61±15.60. Total 39(32.5%) patients had raised LDL levels, Mean Total Cholesterol was 187.37 ± 37.46, 75(62.5%) had high Total cholesterol levels, Mean Triglyceride was 183.29 ±60.33, 65(54.2%) had high triglyceride levels, 84(70%) had low HDL levels. Only 45(37.5%) patients had their cholesterol levels within normal range. Mean Systolic blood pressure was 114.5±13.69mmhg, Mean Diastolic blood

pressure 72.89±9.25mmhg, 69(57.5%) patients did not have optimal control on their blood pressure. Mean BMI of the study group was 27.1±4.3 kg/m<sup>2</sup>, 88(73.3%) patients were either overweight or obese. [Table 2].

Majority 78(65%) patients were non-smokers and 76(63.3%) non alcoholics, 78(65%) of the patients had less or no physical activity than recommended, 37(30.8%) patients had microvascular complications. [Table 3].

Mean±SD level of HbA1c in study group was 6.63±2.69%. Mean±SD duration of Diabetes 86±4.56 months, Mean±SD HbA1c was 6.63±2.69%. Mean±SD uric acid level was 5.32±0.93. With increasing duration of diabetes patients had poor glycemic control and raised uric acid levels. [Table 4].

Out of 69 hypertensives, 37(53.6%) were on regular medication while 32(46.4%) patients were on irregular/no medicines. 61(50.8%) diabetics in the study were on irregular/no medicines.

## DISCUSSION

The International Diabetes Federation has reported that the prevalence of diabetes in adults in India is 7.1%. The prevalence in urban areas is 9%.<sup>[3]</sup> Recent studies had reported urban diabetes prevalence rates of 8–20% and rural diabetes prevalence rates of 5–15%.<sup>[7]</sup> This study shows that diabetes was associated with multiple cardiovascular risk factors. We have used the cross-sectional design which was a type of observational study, because it suited the most of a time-limited study. Studies like Hazarika et al.(2004),<sup>[8]</sup> Prabhakaran et al.(2005),<sup>[9]</sup> Mehan et al.(2006),<sup>[10]</sup> Kaur et al.(2007),<sup>[11]</sup> Kar et al(2010),<sup>[12]</sup> were conducted in other parts of india. Our main motivation for this analysis was to obtain the risk profile so that we can prevent or decrease the burden of coronary artery disease in diabetics in Kumaon region of uttarakhand, North India. Our study population had a negligible proportion of illiterate T2DM subjects. This finding was expected given

that our sample was drawn from a tertiary care hospital located in an urban area.

#### **Age, sex and regional distribution**

Mean age of patients was  $53 \pm 14.3$  years. Majority of patients 39(32.5%) belonged to age group 52-61 years which was similar as found by King H et al (1998),<sup>[13]</sup> Jaya Prasad Tripathy et al(2017),<sup>[15]</sup> Wild S et al (2004),<sup>[16]</sup> and majority of type 2 diabetics were in 5th and 6th decade of their life. 64(53.3%) male and 56 (46.7%) females were included in the study. 74 (61.7%) patients were from non-hilly/plains region and 46 (38.3%) patients were from hilly region. The prevalence of diabetes was more in non-hilly/urban areas.

#### **Body mass index**

Obesity is a growing health problem in both developed and developing countries. Prospective epidemiological studies have shown a relationship between overweight or obesity and cardiovascular morbidity, CVD mortality and total mortality. Obesity is strongly related to major cardiovascular risk factors such as raised blood pressure, glucose intolerance, type-2 diabetes and dyslipidaemia.<sup>14</sup> Mean BMI of the study group was  $27.1 \pm 4.3$  Kg/m<sup>2</sup>. 88 (73.33%) patients were either overweight/obese. More females were obese, while males were overweight. Similar findings were found by Kar et al(2010),<sup>[12]</sup> Izharul Hasan and Shabnum Khatoun et al (2012),<sup>[17]</sup> Lahham et al(2009),<sup>[18]</sup> R. Umadevi et al(2018).<sup>[19]</sup>

#### **Dyslipidemia**

Excess calories in the body are converted into triglycerides and stored in fat cells throughout the body. Low-density lipoprotein (LDL) cholesterol is deposited in the walls of arteries and causes atherosclerosis. HDL cholesterol protects against vascular disease. Mean Total Cholesterol was  $187.37 \pm 37.46$ , 75(62.5%) patients had hypercholesterolemia. Mean LDL Cholesterol was  $94.61 \pm 15.60$ , 21(17.5%) patients had high LDL levels. Similar results were observed by Prabhakaran et al.(2005).<sup>[9]</sup> Mean HDL Cholesterol was  $54.5 \pm 26.19$ . 84(70%) patients had low HDL levels. Mean triglyceride was  $183.29 \pm 60.33$ . 65(54.17%) patients had high triglyceride levels. Cyril James et al (2012) in their study stated dyslipidemia as the major risk factor for Coronary artery disease.<sup>[20]</sup> The Framingham Heart study established a strong,<sup>[21]</sup> positive association of LDL-cholesterol with cardiovascular disease as well as a powerful inverse and protective effect of HDL-cholesterol levels. Turner RC et al (1998) reported that Coronary artery disease was significantly associated with increased concentrations of low density lipoprotein cholesterol,<sup>[22]</sup> decreased concentrations of high density lipoprotein cholesterol, and increased triglyceride concentration.

#### **Systemic Hypertension**

Uncontrolled diabetes and hypertension has been reported in a study in India.<sup>[23]</sup> In our study Mean systolic blood pressure was  $114.5 \pm 13.69$  and Mean diastolic blood pressure was  $72.89 \pm 9.25$ . 69(57.5%) patients were pre-hypertensive and hypertensives and 51(42.5%) were non hypertensives. Among hypertensives 37(53.6%) were on regular medication and 32(46.4%) on irregular medication. Majority of hypertensive patients in our study were from non-hilly /urban areas. Hazarika NC (2004),<sup>[8]</sup> Mehan et al.(2006),<sup>[10]</sup> Jaya Prasad Tripathy et al(2017),<sup>[15]</sup> Bowden et al. (2006)[24], Sowers JR et al (2001) stated that hypertension constitute the major risk factors for coronary heart disease.<sup>[25]</sup>

#### **Hyperglycemia**

Mean duration of Diabetes was  $86 \pm 4.56$  months, Mean HbA1c was  $6.63 \pm 2.69\%$ , fasting  $112 \pm 18.6$ mg/dl (70-220), PP  $216 \pm 41.36$ mg/dl(92-618). In our study 59(49.2%) were on regular treatment and 61(50.8%) on irregular medication, on herbal medication or were not taking any medicine. In the present study the fasting and 2 hour post prandial blood glucose levels were of poor control in majority of patients constituting a risk factor for CAD. With increased duration of Diabetes there was poor glycemic control among patients. Turner RC et al (1998),<sup>[22]</sup> Maulee Hiromi Arambewela et al (2018) reported that Coronary artery disease was significantly associated with increased hemoglobin A1c levels.<sup>[26]</sup>

#### **Smoking/Alcohol**

The strong association of smoking and alcohol intake with coronary artery disease is well established. In our study 42(35%) were smokers but majority of patients 78(65%) were nonsmokers. Hazarika et al,<sup>[8]</sup> Prabhakaran et al,<sup>[9]</sup> Mehan et al,<sup>[10]</sup> Kaur et al,<sup>[11]</sup> Kar et al,<sup>[12]</sup> Bowden et al. (2006),<sup>[24]</sup> in their study stated that smoking constitute the major risk factors for coronary heart disease and cardiovascular disease. 44(36.7%) patients were alcoholics, 76(63.3%) patients were nonalcoholic. J.I Blomster et al(2014),<sup>[27]</sup> in their study concluded that in patients with type 2 diabetes, moderate alcohol use, particularly wine consumption, was associated with reduced risks of cardiovascular events and all-cause mortality.

#### **Physical activity**

According to non-communicable country profile of India estimated physical inactivity prevalence in males was 10.8% and in females was 17.3%.<sup>[14]</sup> 78(65%) patients had irregular or no physical activity. Majority of patients were from non-hilly/urban areas. Mehan et al.(2006),<sup>[10]</sup> Børge Moe et al(2014),<sup>[28]</sup> Sluik D et al(2012),<sup>[29]</sup> investigated the association between physical activity and mortality in individuals with diabetes and reported that higher levels of physical activity was associated with lower mortality risk in individuals with diabetes.

**Hyperuricemia**

Mean uric acid level was  $5.32 \pm 0.93$ , mean serum uric acid in male was  $5.89 \pm 1.36$  and in females was  $4.30 \pm 0.77$ . Serum uric acid level was raised in 48(40%) patients. Uric acid levels were significantly raised in male patients. In this study 16(13.3%) patients with duration of diabetes <2 yrs had mean Uric acid  $4.58 \pm 0.94$ , while 29(24.2) patients with diabetes duration  $\geq 10$  yrs had mean uric acid  $5.81 \pm 1.07$ . Mean uric acid levels increased with increased duration of diabetes. T. Murali Venkateswara Rao et al (2016),<sup>[30]</sup> in their study found significant association between duration of diabetes and serum uric acid. Uric acid was associated with carotid intima-media thickness resulting in atherosclerosis.

**Microvascular Complications**

Microvascular complication was present in 31(25.9%) patients. Diabetic nephropathy in 8(6.6%), Diabetic neuropathy in 14(11.67%) patients, Diabetic foot in 5(4.16%) patients and Diabetic retinopathy in 10(8.3%) patients.

**CONCLUSION**

To reduce the high morbidity and mortality due to cardiovascular disease, regular disease screening and intervention should be started in early adulthood. Governmental intervention is needed to increase access to care, support health promotion information, and provide resources to residents of Kumaon region who may lack awareness of the importance of cardiovascular disease risk prevention and management.

**Limitations**

The study was limited by a cross sectional design hence temporarily (cause and effect relationships) could not be established. The number of included participants was limited. Only cigarettes/bidi was included and no other form of tobacco use was ascertained. Other forms of tobacco use, such as chewing tobacco was widely used, but were not included in this study and neither was passive smoking induced.

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