Publisher
MEDRESEARCH
www.medresearch.in

International Journal of Medical Research and Review

2023 Volume 11 Number 5 September-October

E-ISSN:2320-8686
P-ISSN:2321-127X

Research Article

Diabetes Mellitus

A Cross-Sectional Study of Socio-Demographic and Clinical Features of Indian Subjects with Type 2 Diabetes Mellitus in a Tertiary Diabetes Hospital

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DOI: https://doi.org/10.17511/ijmrr.2023.i05.02

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Introduction: Diabetes mellitus is a group of heterogeneous diseases with varied clinical presentation and disease progression. Understanding the sociodemographic factors in subjects with diabetes is an important step for planning diabetes care. **Objectives:** The objective of the study was to assess the socio-demographic and clinical features of subjects with diabetes and the impact of these factors on their glycemic control. **Materials and Methods:** A cross-sectional observational study was conducted in the outpatient department of Karnataka Institute of Endocrinology and Research, Bangalore. 200 subjects with diabetes were recruited for the study, between January to August 2019. **Results:** In the study, the mean age at diagnosis was 43.73 ± 8.705 years. The majority of subjects were in the age group >56 years (53%). 59.5% of the subjects were males and 83.5% of the subjects were from urban areas. The majority of them were diagnosed during routine check-ups (52.5%). The most common symptom was polyuria (21%). 12.5% of the subjects were incidentally detected during hospital admission. 46.5% had a family history of Diabetes. 77.5% of the subjects were overweight and obese. Only 18.5% of the subjects had HbA1c <7. 39% of the subjects had dyslipidemia, 54.5% had hypertension and 19% had hypothyroidism. 29% of the subjects had retinopathy, 20% had neuropathy, 7% had nephropathy and 3.5% had PAD. 79% of the subjects were on OHA, 6% were on insulin and 12.5% were on both OHA and insulin. Amongst the subjects on oral drugs, only 6.3% were on monotherapy and the rest were on multiple drugs. Amongst subjects on insulin, 96.5% were on premixed insulin. Age, gender, education, OHA and a combination of insulin and OHA for treatment were the factors associated significantly with glycemic control. Good control was highest in the young age group (66.7%) and lowest in the old age group (16%). Females had the highest level of poor control compared to males. Graduates had a higher percentage of good control compared to lower educational status. Subjects on OHA had a higher percentage of good control. **Conclusions:** The study revealed that poor glycemic control, comorbidities like HTN, obesity, dyslipidemia and chronic complications were commonly prevalent in subjects with T2DM. Emphasis should be given to periodic evaluation of glycemic status, comorbidities, and diabetes complications.

Keywords: Socio-demographic features, Clinical Features. Diabetes Mellitus

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How to Cite this Article

Shetty S, Vasava N, R A, A Cross-Sectional Study of Socio-Demographic and Clinical Features of Indian Subjects with Type 2 Diabetes Mellitus in a Tertiary Diabetes Hospital. Int J Med Res Rev. 2023;11(5):109-115.
Available From
https://ijmrr.medresearch.in/index.php/ijmrr/article/view/1446

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Manuscript Received	Review Round 1	Review Round 2	Review Round 3	Accepted
2023-10-07	2023-10-10	2023-10-17	2023-10-24	2023-10-31

Conflict of Interest	Funding	Ethical Approval	Plagiarism X-checker	Note
Nil	Nil	Yes	19%	

Introduction

Diabetes mellitus refers to a group of common metabolic disorders that share the phenotype of chronic hyperglycemia, resulting from progressive loss of β-cell mass and/or function [1]. It is one of the most common chronic diseases worldwide. According to the statistics, an estimated 537 (10.5%) million adults worldwide are currently living with diabetes. Of these, 74.2 million people with diabetes are from India. More than one in 10 adults are living with diabetes worldwide. Diabetes is associated with significant mortality and morbidity, poor quality of life and a huge economic burden. Globally, diabetes has been listed among the top 10 causes of mortality [2]

Diabetes is a group of heterogeneous disorders with variable clinical presentation and disease progression. It can affect both genders and all age groups. It can be type 1 diabetes (T1DM), type 2 diabetes (T2DM), gestational diabetes (GDM) or other specific type of diabetes. Ethnicity, family history of diabetes, obesity, hypertension (HTN), and dyslipidemia are the common risk factors for type 2 diabetes. Subjects with T2DM may have at least one diabetes-related comorbid condition like hypertension (HTN), dyslipidemia or thyroid dysfunction. Despite the advances in pharmacotherapy, many subjects with diabetes are unable to achieve good glycemic control. They are also predisposed to complications including cardiovascular disease, neuropathy, nephropathy, retinopathy and foot ulcers [3]. To summarise, type 2 diabetes is a multi-system disease with multiple risk factors, diverse clinical manifestations and various complications.

Comprehensive management of subjects with diabetes requires an evidence-based and patient-centric approach to achieve good glycemic control, delay/prevent complications, improve quality of life, and reduce disability and mortality [4]. It is essential to identify vulnerable populations and work out appropriate measures to reduce the economic, physical, and emotional burden of diabetes mellitus. Unfortunately, response to therapy is variable amongst subjects with diabetes. One of the factors responsible for differences in diabetes outcomes is differences in socio-demographic and clinical features. Understanding these factors in people with diabetes is an important Step for diabetes care planning, diabetes education, and research. It will also help define healthcare delivery following individual healthcare needs [5].

Several epidemiological studies across the world have assessed the sociodemographic and clinical features of subjects with diabetes. However, there is limited information on these factors in our population, to be able to develop specific strategies for the management of diabetes and its complications. The present study was conducted to explore the sociodemographic and clinical profile of subjects with diabetes attending our tertiary care hospital in Bangalore. The purpose of the study was to recognize the study population’s diabetes status and its determinants. This study intended to provide feedback to improve the quality of care of subjects with diabetes at our institutional level.

Objectives

1. To assess the socio-demographic and clinical features of subjects with type 2 diabetes

2. To assess the impact of socio-demographic factors on their glycemic control

Material and Methods

Study Design: A cross-sectional observational study was conducted in the outpatient department of Karnataka Institute of Endocrinology and Research, Bangalore. 200 subjects with type 2 diabetes were recruited for the study, between January to August 2019.

Inclusion Criteria

1. Subjects with type 2 diabetes of any duration

2. Age between 18 to 80 years

Exclusion Criteria

1. Subjects with type 1 diabetes

2. Women with gestational diabetes

3. People with secondary diabetes due to specific causes like pancreatic diseases, endocrine diseases etc.

Ethical Approval: The study was approved by the ethical committee of the hospital. The subject's consent for the collection of data was taken after the objectives of the study were explained to them.

Data Collection: A total of 200 subjects with type 2 diabetes were included in the study. Subjects were evaluated with detailed history, physical examination and laboratory investigations. The questionnaire included family history, marital status, education, income, age at onset of diabetes, mode of diagnosis, comorbidities, complications, glycated hemoglobin (HbA1c), body mass index (BMI), low-density lipoprotein (LDL) cholesterol, medications being taken.

Age was classified as young age: 18-35 years, middle age: 36-55 years, and old age: ≥ 56 years [6]. Comorbidities associated with diabetes included HTN, dyslipidemia and thyroid dysfunction. Diabetes-related complications include eye-related (retinopathy), cardiovascular (ischemic heart disease {IHD} and acute myocardial infarction), cerebrovascular (cerebrovascular accidents and transient ischemic attacks), renal (nephropathy - microalbuminuria, overt proteinuria, chronic renal failure and end-stage renal failure) and limb related (peripheral arterial disease {PAD} and neuropathy). Subjects were categorised based on the medications being used as oral hypoglycemic agents (OHA) only, insulin only, and a combination of OHA and insulin.

BMI was calculated by dividing weight (kg) by height (m2). Based on BMI (kg/m2), obesity was classified as underweight: < 18.5, normal: 18.5–22.9, overweight: 23.0–24.9, grade 1 obesity: 25.0–29.9 and grade 2 obesity: >30 [7]. Blood pressure (BP) was recorded after the subjects had rested for at least 5 min. Two readings were taken 5 min apart and the mean of the two was considered as the BP. HbA1C was done by the ion-exchange resin method. HbA1C levels of <7% were considered as good control. Glycemic control was classified as HbA1C category 1: <7%, category 2: 7 -7.9%, category 3: 8 -8.9%, category 4: >9%.

Statistical analysis: Data was entered into a Microsoft Excel data sheet and analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Continuous data was represented as mean and standard deviation. [8, 9, 10]

Graphical representation of data: MS Excel and MS Word were used to obtain various types of graphs such as bar diagrams, and pie diagrams.

P-value (Probability that the result is true) of <0.05 was considered statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze the data.

Results

In the study, the mean age at diagnosis was 43.73 ± 8.705 years. The majority of subjects were in the age group >56 years (53%) followed by the age group 36 to 55 years (45.5%). 59.5% of the subjects were males. 83.5% of the studied subjects were from urban areas. 61% of subjects were from the nuclear family while the remaining 39% were from the joint family. 94% of subjects were married, 2.5% were single, 3% were widowed, and 0.5% were divorced. 11% were illiterates, 57% had secondary education and only 31.5 % were graduates (**Table1**).

Table 1: General Profile of Subjects with Diabetes

		Count	%
Age	18 to 35 years (Young)	3	1.5%
	36 to 55 years (Middle)	91	45.5%
	>56 years (Old)	106	53.0%
Sex	Female	81	40.5%
	Male	119	59.5%
Residence	Rural	33	16.5%
	Urban	167	83.5%
Family	Joint	78	39.0%
	Nuclear	122	61.0%
Marital Status	Divorced	1	0.5%
	Married	188	94.0%
	Single	5	2.5%
	Widowed	6	3.0%
Education	Graduation	63	31.5%
	Illiterate	22	11.0%
	Middle	1	0.5%
	Secondary	114	57.0%

In the study, the majority of them were diagnosed during routine check-ups (52.5%). The most common symptom was polyuria (21%) followed by tiredness (13%), polydipsia (11.5%) and weight loss (10%). 12.5 % of subjects were incidentally detected during admission (**Table 2**). 46.5% had a family history of Diabetes (**Table 3**).

Table 2: Mode of Diagnosis

	Number	%
Polyuria	42	21.0%
Polydipsia	23	11.5%
Polyphagia	5	2.5%
Tiredness	26	13.0%
Weight loss	20	10.0%
Burn feet	4	2.0%
Routine Check-up	105	52.5%
Incidentally detected with Admission	25	12.5%

Table 3: Family History of DM

		Count	%
FamilyH/O DM	Nil	107	53.5%
	Yes	93	46.5%

In the study, 1% of the studied subjects were underweight, 21.5% had normal BMI, 13.0% were overweight, 37.5% had grade I obesity and 27% had grade II obesity (**Table 4**). In the study, only 18.5% of the studied subjects had HbA1c <7. 34% of the subjects had HbA1c of 7 to 8, while 16.5% had HbA1c of 8 to 9, 14.5% had HbA1c of 9 to 10 and 16.5% had HbA1c of > 10 (**Table 5**).

Table 4: BMI Classification

		Count	Column N %
BMI	<18.5 (Underweight)	2	1.0%
	18.5 to 22.9 (Normal)	43	21.5%
	23 to 24.9 (Overweight)	26	13.0%
	25 to 29.9 (Obese I)	75	37.5%
	>30 (Obese II)	54	27.0%

Table 5: Level of Glycemic Control

		Count	%
HbA1C	<7	37	18.5%
	7 to 8	68	34.0%
	8 to 9	33	16.5%
	9 to 10	29	14.5%
	>10	33	16.5%

Amongst the subjects studied, 7.5% had IHD, 39% had dyslipidemia, 54.5% had HTN and 19% had hypothyroidism. 29% of the subjects had retinopathy, 20% had neuropathy, 7% had nephropathy and 3.5% had PAD (**Table 6**).

Table 6: Comorbidities and Complications

Co morbidities	Present		Complications	Present	
	Count	%		Count	%
IHD	15	7.5%	Retinopathy	58	29.0%
Dyslipidemia	78	39.0%	Neuropathy	40	20.0%
HTN	109	54.5%	Nephropathy	14	7.0%
Hypothyroid	38	19.0%	PAD	7	3.5%

In the study, 79% of the subjects were on OHA, 6% were on insulin and 12.5% were on both OHA and insulin (**Table 7**). Amongst the subjects on oral drugs, 6.3% were on monotherapy, 22.8% were on dual therapy, 33.5% were on triple therapy, 27.8% were on 4 drug therapy and 9.5% of the subjects were on 5 drugs. Amongst subjects on insulin, 96.5% were on premixed insulin. 80% of the subjects were on other medications for their comorbidities (**Table 8**).

Table 7: Therapy Distribution

	Yes	
	Count	%
On OHA Only	158	79.0%
On Insulin Only	12	6.0%
Combination	25	12.5%

Table 8: Therapy distribution No. of Drugs

		Count	%
No. of Drugs	1	10	6.3%
	2	36	22.8%
	3	53	33.5%
	4	44	27.8%
	5	15	9.5%
Type of insulin regimen	Bolus	3	25.0%
	Basal	3	25.0%
	Premix	9	75.0%
Other Drugs	Absent	40	20.0%
	Present	160	80.0%

Table 9: Association between glycemic control and parameters

		HbA1C %								P value
		<7		7.1 to 7.9		8 to 8.9		>9		
		Count	%	Count	%	Count	%	Count	%	
Age	18 to 35 years (Young)	2	66.7%	0	0.0%	0	0.0%	1	33.3%	0.031*
	36 to 55 years (Middle)	18	19.8%	19	20.9%	20	22.0%	34	37.4%	
	>56 years (Old)	17	16.0%	42	39.6%	20	18.9%	27	25.5%	
Sex	Female	18	22.2%	15	18.5%	16	19.8%	32	39.5%	0.014*
	Male	19	16.0%	46	38.7%	24	20.2%	30	25.2%	
Residence	Rural	5	15.2%	7	21.2%	5	15.2%	16	48.5%	0.126
	Urban	32	19.2%	54	32.3%	35	21.0%	46	27.5%	
Education	Graduate	21	33.3%	16	25.4%	16	25.4%	10	15.9%	0.002*
	Illiterate	3	13.6%	5	22.7%	2	9.1%	12	54.5%	
	Middle	0	0.0%	0	0.0%	0	0.0%	1	100.0%	
	Secondary	13	11.4%	40	35.1%	22	19.3%	39	34.2%	
BMI	Underweight	2	100.0%	0	0.0%	0	0.0%	0	0.0%	0.133
	Normal	5	11.6%	15	34.9%	6	14.0%	17	39.5%	
	Overweight	6	23.1%	7	26.9%	5	19.2%	8	30.8%	
	Obese I	18	24.0%	21	28.0%	14	18.7%	22	29.3%	
	Obese II	6	11.1%	18	33.3%	15	27.8%	15	27.8%	
IHD	Yes	1	6.7%	6	40.0%	1	6.7%	7	46.7%	0.218
	No	36	19.5%	55	29.7%	39	21.1%	55	29.7%	
Dyslipidemia	Yes	14	17.9%	22	28.2%	18	23.1%	24	30.8%	0.838
	No	23	18.9%	39	32.0%	22	18.0%	38	31.1%	
HTN	Yes	23	21.1%	34	31.2%	24	22.0%	28	25.7%	0.310
	No	14	15.4%	27	29.7%	16	17.6%	34	37.4%	
Hypothyroid	Yes	10	26.3%	8	21.1%	7	18.4%	13	34.2%	0.371
	No	27	16.7%	53	32.7%	33	20.4%	49	30.2%	
Retinopathy	Yes	6	10.3%	21	36.2%	12	20.7%	19	32.8%	0.271
	No	31	21.8%	40	28.2%	28	19.7%	43	30.3%	
Neuropathy	Yes	6	15.0%	13	32.5%	8	20.0%	13	32.5%	0.933
	No	31	19.4%	48	30.0%	32	20.0%	49	30.6%	
Nephropathy	Yes	1	7.1%	5	35.7%	3	21.4%	5	35.7%	0.727
	No	36	19.4%	56	30.1%	37	19.9%	57	30.6%	
PAD	Yes	0	0.0%	4	57.1%	0	0.0%	3	42.9%	0.186
	No	37	19.2%	57	29.5%	40	20.7%	59	30.6%	
On OHA Only	Yes	34	21.5%	51	32.3%	30	19.0%	43	27.2%	0.039*
	No	3	7.1%	10	23.8%	10	23.8%	19	45.2%	
On Insulin Only	Yes	0	0.0%	3	25.0%	2	16.7%	7	58.3%	0.131
	No	37	19.7%	58	30.9%	38	20.2%	55	29.3%	
Combination	Yes	0	0.0%	7	28.0%	8	32.0%	10	40.0%	0.043*
	No	37	21.1%	54	30.9%	32	18.3%	52	29.7%	

In the study, age, gender, education, OHA and combination of insulin and OHA for treatment were the factors significantly associated with glycemic control. Good glycemic control was found most in the young age group (66.7%) and least in the old age group (16%). With the increase in age, there was a decrease in good glycemic control. Females had the highest percentage of poor glycemic control compared to males (39.5% vs.25.2%). Graduates had a higher percentage of good glycemic control compared to subjects with lower educational status. 33.3% of the graduates had HbA1c <7% while only 13.6% of the subjects with no literacy and 11.4% of subjects with secondary education had HbA1c <7%. Poor glycemic control was highest in subjects with normal BMIs. 39.5%of subjects with normal BMI had HbA1c >9%. This association was not statistically significant. Subjects on OHA had a higher frequency of good glycemic control (21.5% had HbA1c <7%) and lower rates of poor glycemic control. None of the subjects on combined OHA and Insulin had HbA1c <7%. But poor control was lowest in the combined group (**Table 9**).

Discussion

In our study, majority of the subjects were old. More than two-thirds of the studied subjects were from urban areas, signifying the health-seeking behaviour of the urban population compared to the rural population. It also suggests that the proximity of healthcare facilities is an important factor responsible for the frequency of health-seeking. The education level of the studied population was varied but 89% of the subjects had secondary education and above. The mode of diagnosis in our population indicates that the majority of them were diagnosed during routine check-ups and incidentally. Only 50% of them had a family history of Diabetes. This implies that screening for diabetes shouldn't be based only on risk factors or symptoms.

In the study, two-thirds of the studied population was overweight and obese, more than half of them had hypertension, more than one-third had dyslipidemia and one-fourth had hypothyroidism. The coexistence of these diseases necessitates the need for frequent screening for these comorbidities in subjects with type 2 diabetes. In the study, only one-fourth of the studied subjects had HbA1c <7, more than one-third had HbA1c of 7 to 8, and the remaining had HbA1c above 8%.

Poor glycemic control is the most common concern that brings these subjects to tertiary centres seeking better glycemic control.

Amongst the subjects studied, retinopathy was the most common complication, followed by neuropathy. Less than 10% had IHD and nephropathy. This highlights that regular retinal screening and neuropathy evaluation are essential for the early detection of these complications and must be followed by all clinicians caring for subjects with diabetes.

In the study, OHA was the most common antidiabetic drug used and among the subjects on oral drugs, most of them were on multiple drugs. Many subjects were on more than 4 drugs per day, reflecting the use of polypharmacy with the sole purpose of avoiding insulin therapy. Amongst subjects on insulin, most of them were on premixed insulin.

In the study, age, gender, education, BMI, OHA and a combination of insulin and OHA for treatment were the factors significantly associated with glycemic control. Good glycemic control defined by HbA1c <7% was seen most in the young age group and least in the old age group. With the increase in age, there was a decline in good glycemic control. Women had poorer glycemic control compared to men. Multiple causative factors might be responsible for this disparity and need special attention. Our study showed that education level correlated with better glycemic control. Graduates had a higher percentage of good glycemic control compared to subjects with lower educational status. Poor glycemic control was highest in subjects with normal BMIs. Subjects on OHA had a higher percentage of good glycemic control and lower poor glycemic control.

Similar findings have been noted in other studies. A study of 132 T2DM patients in a tertiary care hospital in Dibrugarh, Assam found similar age prevalence with higher prevalence in the age group 41–50 years (28%). In this study, only 9% of the patients had managed to achieve good glycemic control (<6.5%). Compared to our study, a similar proportion of the study subjects had associated comorbidities such as hypertension (50%), obesity (42%), and dyslipidemia (37%) [5].

In another study of 4,556 patients with type 2 DM in Southern Punjab, Pakistan

79% of the patients belonged to urban areas. Symptoms of polyuria, polydipsia, and polyphagia were found in 72%, 67%, and 59% of patients, respectively. Hypertension was found in 74% of patients, which was more than in our study. Obesity was found in 41.5% of patients. Females were more likely to be obese than males in all parameters of obesity [11].

Another descriptive study of 1495 patients in Barcelona, found that 51% had hypertension; 26% were obese and 28% had dyslipidemia. These findings were similar to our study. 32% of subjects were only on diet, 51% were on oral antidiabetic drugs, 13% were on insulin only and 4% were on insulin and oral drug combination. Better control was seen in subjects with a shorter duration of diabetes ($p = 0.001$). In subjects with type 2 DM, similar to our study, retinopathy (14%) was the most common complication. This was closely followed by nephropathy (13%), ischemic heart disease (12%), peripheral arterial disease (9%), cerebrovascular accident (5%) and peripheral neuropathy (4%) [12].

What does this study add to the existing knowledge?

Our study is a descriptive study that provides insight into the socio-demographic features of the subjects with T2DM, who presented to our institute. It highlights the presence of inadequate glycemic control, multiple comorbidities, and complications in a large percentage of our population and the need to focus our attention on improving the diabetes care model at the community level.

Limitations of the Study

The study is a cross-sectional study and hence temporal correlation couldn't be established. This is an urban tertiary hospital-based study and may not be a representative sample of the general population.

Conclusion

The present study revealed that poor glycemic control, comorbidities like hypertension, obesity dyslipidemia and complications were highly prevalent in people with T2DM. Clinicians involved with managing diabetes should give adequate importance to lifestyle modifications, healthy diet and physical activity to achieve better Glycemic control. Emphasis should also be given to periodic check-ups for evaluation of the glycemic status, presence of comorbidities, and development of complications. These steps will help clinicians effectively provide a comprehensive approach to the management of T2DM.

Our Recommendations: Based on the findings of the study, it can be concluded that diabetes is a highly prevalent health challenge and needs a multi-pronged approach. Hence, we recommend that diabetes must be prevented sooner, diagnosed earlier and once diagnosed managed aggressively. The chronic care model for diabetes should work on the following principles:

1. Use aggressive screening programmes to identify people with undiagnosed diabetes and pre-diabetes.

2. Manage pre-diabetes to prevent or delay the onset of T2DM and its complications.

3. Once diabetes is established, provide care focusing on appropriate antihyperglycemic agents, glycemic monitoring and screening for comorbidities and complications.

4. Create a diabetes care model that is accessible, affordable and acceptable to the whole community and achieves the glycemic goals for the whole diabetic population.

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