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Prevalence Of Diabetic Nephropathy In The Urban Diabetic Population Of Mysuru

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Abstract

Aim: Diabetes Mellitus (DM) is becoming a serious public health concern in India, with increasing incidence in urban areas. Among its chronic complications, Diabetic nephropathy (DN) significantly contributes to morbidity and development to end-stage renal disease (ESRD). The goal of the study was to understand the prevalence and risk factors associated with diabetes complications, particularly nephropathy, in the urban Mysuru diabetic community.

Subject & Methods: Observational cross-sectional research was conducted among two hundred individuals diagnosed with type 2 diabetes(T2DM) from selected urban healthcare centres in Mysuru. Diabetic nephropathy was diagnosed based on the established criteria with data collected using structured questionnaires, clinical assessments, and laboratory investigations including HbA1c, and urine albumin. Statistical analysis was carried out to identify associations between nephropathy and demographic or clinical variables.

Results: Among the 200 participants, 54 (27%) were found to have DN. Significant associations were observed between nephropathy and older age ($p = 0.001$), extended duration of diabetes ($p < 0.001$), presence of hypertension ($p < 0.001$), poor glycaemic control (average HbA1c 8.8% vs. 7.8%, $p < 0.001$), and smoking ($p = 0.03$). Gender and BMI did not significantly associate with nephropathy.

Conclusion: The current study demonstrates a higher prevalence of DN in the urban diabetic population of Mysuru. Early screening, lifestyle modification, and aggressive management of blood pressure and glucose are suggested to reduce the burden of complications. These findings call for targeted urban public health strategies for diabetes management and complication prevention.

Key words: Diabetes Mellitus, Diabetic Nephropathy, Mysuru Urban population.

Introduction

Diabetes mellitus is a chronic illness that is on the rise and is a serious public health concern in low- and middle-income nations like India. Characterized by persistently high blood sugar, DM leads to microvascular and macrovascular problems that significantly increase morbidity and mortality (1). About 40% of cases that require renal replacement are caused by DN, the chronic complication of which leads to ESRD (2)

Early hyperfiltration and albuminuria in the early stages of DN's classical presentation are followed by deterioration in renal function. When T2DM patients develop diabetic kidney disease (DKD), other glomerular/tubular pathologies and severe peripheral vascular disease may also become important confounders. (3)

According to Sarah et al. (4), the prevalence of type 2 diabetes is predicted to increase from 2.8% in 2000 to 4.4% in 2030 globally. The WHO estimates that there are 589 million diabetics worldwide, and that number is growing annually (5). India, considered as the “diabetes capital of the world,” harbors nearly 77 million affected individuals and is projected to sharply rise (6). The prevalence of hypertension (HTN) is also expected to surge

with a 60% increase in the incidence among adults. About 70% of diabetics also have hypertension since they are twice as likely to have it as those without the condition (7). Even though prevalence of progressive renal disease is expected to be lower in T2D, data indicates that renal risk is equal, and the time to proteinuria from the onset of diabetes and the time to ESRD from the onset of proteinuria were comparable in both conditions (8). Recent research studies have revealed that early-onset T2D was an independent risk factor for ESRD (9). Recent estimates indicate that the age-adjusted incidence of ESRD in India is 229 per million, and that over 100,000 new patients enter in renal replacement programs annually (10), with approximately 20–40% of individuals with diabetes predicted to get DN at some time in their lives. (11). Urban populations are disproportionately impacted by increased obesity rates, unhealthy eating habits, sedentary lifestyles, and urbanization (12). Mysuru, a fast-expanding Urban hub in Karnataka, is a crucial location for researching issues associated to diabetes since it mirrors these larger demographic and epidemiological changes. Several studies have demonstrated geographical variations in the incidence of DN throughout India, which are impacted by variables such as socioeconomic position, healthcare access, glycaemic management, the length of diabetes and associated hypertension (13). Yet, the data specific to "Mysore's urban diabetic population are lacking", impeding targeted public health interventions and resource allocation. Therefore, our study aims to determine the prevalence of DN in Mysore's urban diabetic population and to investigate the sociodemographic and clinical factors associated with its occurrence. By identifying the burden and determinants of nephropathy in this context, the findings may inform screening strategies, early intervention programs, and policy development to mitigate the rising burden of diabetic related kidney disease in urban India**.**

Aim and Objectives

This study aims to determine the prevalence of diabetic complications in Mysore's urban population, such as DN to comprehend the effects on patient health and guide efficient public health interventions. Additionally, it seeks to evaluate demographic characteristics associated with a higher risk of these issues in an urban environment aiming to identify vulnerable groups and support the development of effective public health strategies, to prevent or manage diabetic complications more effectively in urban settings.

Methodology

Study Design

The study used a cross-sectional descriptive methodology to determine the prevalence of DN among known diabetic patients in Mysore's urban areas and who had visited Cauvery Heart and Multi- speciality Hospital, Mysuru, Karnataka, during the period from March 2024 to February 2025.

Study Population

The study population comprised diabetic individuals diagnosed with DN for at least one year, 18 years and above in age, residing in Mysore's urban wards. The study excluded patients with acute illnesses at the time of data collection, pregnant women, and those with documented chronic kidney disease of non-diabetic aetiology.

Sample Size

The sample size was calculated using the formula:

$n=Z2\times p\times(1-p)d2n = \frac{{Z^2 \times p \times (1-p)}}{d^2}$,

Where:

- Z = 1.96 (95% confidence level)
- p = expected prevalence of DN(assumed 20% based on prior studies [1])
- d = absolute precision (5%)

Ethical Approval

The study got approval from the Cauvery Heart and Multispeciality Hospital's Institutional Ethics Committee in Mysuru under the number CHMH/IEC/01/01/CS/2024-25/002. Data was collected from participants following their completion of a written consent form.

Dependent Variable:

This was determined based on clinical diagnostic criteria, including urine albumin levels (microalbuminuria or macroalbuminuria), assessed glomerular filtration rate (eGFR), and/or relevant clinical records.

Persistent albuminuria (>30 mg/g creatinine) and/or decreased eGFR (<60 mL/min/1.73 m2), verified at least twice, three months apart, were considered indicators of diabetic nephropathy.

Using the formula, the minimum sample size required was 200 participants, adjusted to 220 to account for incomplete data and non-Diabetic CKD. Participants were selected using systematic random sampling from clinic registers and screening lists.

Data was collected using a structured questionnaire and laboratory investigations, administered by trained healthcare professionals.

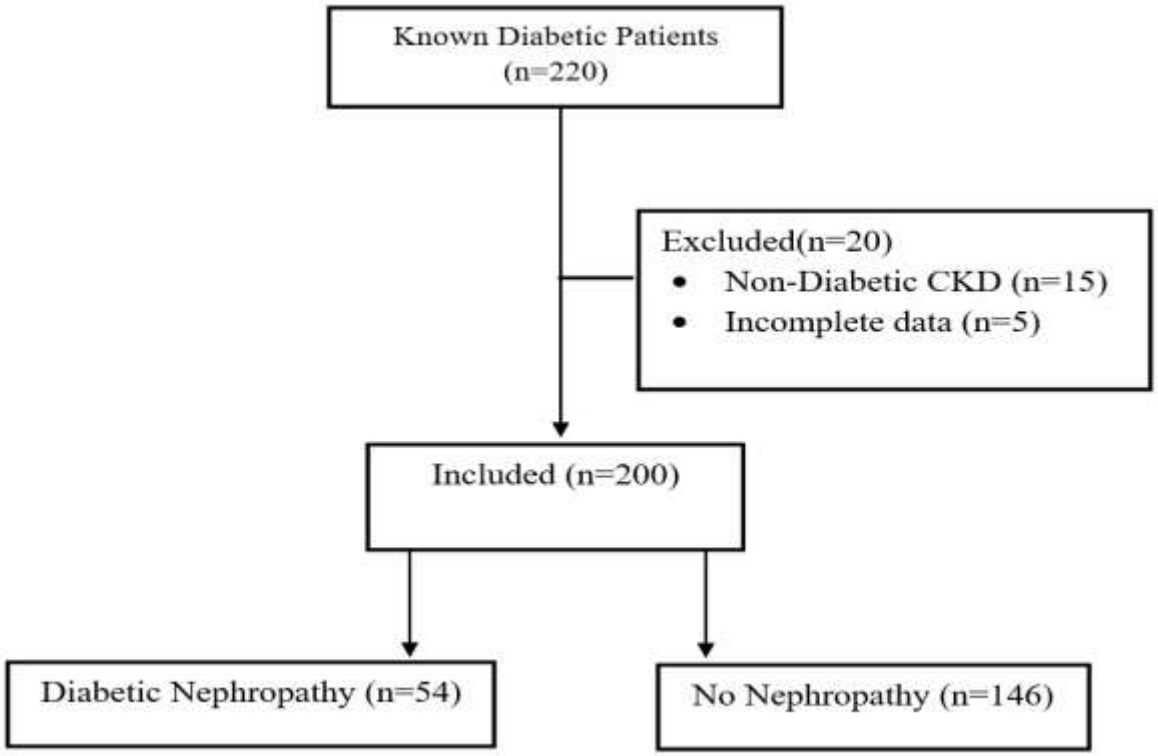

Fig 1. Flowchart of Participant Recruitment

Independent Variable

The independent variables included a range of demographic, clinical, and lifestyle-related factors that may influence the development of diabetic nephropathy. These variables were collected using a structured questionnaire, clinical examination, and laboratory investigations, and included are age, sex, diabetes duration (measured in years since diagnosis), diabetes types, Glycaemic control, Body Mass Index (BMI), Blood pressure status, Physical activity, HbA1c level, family and medication history, alcohol use, and smoking. Confidentiality of data was ensured that data will not be utilized except for the academic purpose.

Individuals' blood and urine samples were collected and examined. Laboratory tests including Urine microalbuminuria, Serum creatinine levels, eGFR, fasting blood glucose and HbA1c levels was conducted.

Statistical Analysis

The SPSS V-25.0 software from IBM Inc. in Chicago, USA was used to analyse the data that was gathered in this way and entered into a Micro-Soft Excel work sheet. Data analysis and interpretation were conducted using the chi square test and univariate logistic regression analysis. Prevalence of DN was reported as percentage with 95% confidence interval. Frequencies and percentages were calculated, and data was presented in tables.

Result

In the present study, average age of individuals with nephropathy was higher than those without the complication (58.9 ± 9.2 vs. 53.7 ± 10.4 years; $p = 0.001$), indicating an age-related association. The proportion of male participants was marginally higher in the nephropathy group (57.4%) compared to those without nephropathy (49.3%), though this difference was not significant statistically ($p = 0.25$).

The mean duration of diabetes was comparatively greater in participants with nephropathy (12.0 ± 5.1 years) than in those without (8.5 ± 4.0 years, $p < 0.001$). The data also suggests the noticeably higher proportion of participants with nephropathy and their coexisting hypertension (79.6%) compared to the non-nephropathy group (54.1%; $p < 0.001$).

Mean BMI was higher in those with nephropathy (26.7 ± 3.4 kg/m²) than in those without (25.7 ± 3.5 kg/m²), though the data was not significant statistically ($p = 0.09$).

Glycaemic control differed notably between groups, with higher mean HbA1c values among those with nephropathy (8.8 ± 1.5%) compared to non-nephropathic (7.8 ± 1.3%; $p < 0.001$). Smoking was more common among nephropathy patients (18.5%) than in the non-nephropathy group (8.9%), a difference that reached statistical significance ($p = 0.03$).

Variable	**Nephropathy (n = 54)**	**No Nephropathy (n = 146)**	**p-value**
Age (in years), mean ± SD	58.9 ± 9.2	53.7 ± 10.4	0.001
Male, n (%)	31 (57.4%)	72 (49.3%)	0.25
Duration of diabetes (in years), mean ± SD	12.0 ± 5.1	8.5 ± 4.0	<0.001
Hypertension, n (%)	43 (79.6%)	79 (54.1%)	<0.001
BMI (in kg/m²), mean ± SD	26.7 ± 3.4	26.7 ± 3.5	0.09
HbA1c (in %), mean ± SD	8.8 ± 1.5	7.8 ± 1.3	<0.001

Table 1: Table showing Sociodemographic and Clinical Characteristics of Participants by Nephropathy Status (N = 200)

Associations between nephropathy and potential risk factors (age, sex, duration from onset of diabetes, hypertension, BMI, glycemic control) were evaluated using t-test for continuous variables and Chi-square test for categorical variables. Variables significant at $p < 0.05$ were entered into a multivariate logistic regression model to identify independent predictors of DN.

The comparative analysis of laboratory parameters between participants with and without DN revealed statistically and clinically significant differences indicative of progressive renal dysfunction and inadequate metabolic control in the nephropathy group. Mean serum creatinine levels markedly were elevated in the nephropathy group (1.3 ± 0.4 mg/dL) in comparison to those without nephropathy (1.0 ± 0.2 mg/dL), indicating reduced kidney function. The eGFR was consistently, and significantly lower in participants with nephropathy (66.8 ± 11.9 mL/min/1.73m²) than those without (95.5 ± 10.1 mL/min/1.73m²), further supporting the presence of renal impairment in the affected group.

The ratio of urinary albumin-to-creatinine (ACR), a key marker in early kidney damage, was substantially higher in the nephropathy group [median 70 mg/g, interquartile range (IQR): 48–96] compared to the non-nephropathy group [median 20 mg/g, IQR: 13–26], highlighting the progression of microalbuminuria in DN cases.

Glycaemic parameters also differed between the groups. The mean fasting blood glucose level was higher among individuals with nephropathy (170 ± 41 mg/dL) compared to those without (153 ± 34 mg/dL), suggesting poorer glycaemic control, which was further corroborated by higher mean HbA1c levels in the nephropathy group (8.1 ± 1.4%) compared to the non-nephropathy group (7.8 ± 1.3%). These findings underscore the association between poor long-term glycaemic control and the development of DN.

Laboratory Parameter	**Total (n = 200)**	**Nephropathic (n = 54)**	**Non-Nephropathic (n = 146)**
Serum Creatinine (in mg/dL)	1.1 ± 0.3	1.3 ± 0.4	1.0 ± 0.2
eGFR (in mL/min/1.73m²)	87.3 ± 15.7	66.8 ± 11.9	95.5 ± 10.1
Urinary ACR (mg/g), median (IQR)	30 (16–46)	70 (48–96)	20 (13–26)
Fasting Blood Glucose (mg/dL)	158 ± 37	170 ± 41	153 ± 34
HbA1c (%)	8.1 ± 1.4	8.8 ± 1.4	7.8 ± 1.3

Table 2: Laboratory Parameters of Study Participants (N = 200)

The presence of DN and proteinuria is significantly and positively related with age, duration of diabetes, hypertension, HbA1c, and smoking; eGFR is inversely correlated with these variables, indicating that kidney function decreases with age, disease duration, and HbA1c. Whereas the BMI and gender show weak or non-significant correlations in this sample.

Table 3., summarizes the statistical relationships between various demographic and clinical independent variables and the dependent outcomes: proteinuria (as a renal damage marker) and estimated Glomerular Filtration Rate.

Independent Variable	**Correlation with Proteinuria**	**Correlation with eGFR**	**Type of Analysis**	**Significance Notes**
Age	+0.35	–0.40	Pearson correlation	Significant ($p < 0.01$)
Duration of Diabetes	+0.42	–0.38	Pearson correlation	Significant ($p < 0.01$)

HbA1c	+0.31	–0.28	Independent t-test / ANOVA	Significant ($p < 0.04$)
BMI	+0.12	–0.15	Pearson correlation	0.09
Hypertension	158.2 ± 50.3	62.1 ± 14.6	Independent t-test	Significant ($p < 0.01$)
Smoking	162.4 ± 42 Increased proteinuria in smokers	60.4 ± 13.8 Lower eGFR in smokers	Pearson correlation	0.03
Gender	Male 135.7 ± 45.1	68.2 ± 14.2	Independent t-test	Not significant
	Female 128.9 ± 44.2	70.4 ± 13.7		0.18

Table 3: Statistical Correlation of Proteinuria and eGFR with Independent Variables

Discussion

India is predicted to have the highest rate of diabetes worldwide in 2000, and by 2030, the majority of the predicted population will be confined to the country's cities, according to reports by King H et al. (14). The IDF 2021 estimates that the number of affected individuals has grown by 46.0% to around 783 million, putting a significant socioeconomic strain on patients, medical staff, and the country. The prevalence of DN worldwide is caused by the notable increase in the incidence of diabetes worldwide and the frequency of DN varies from 0.9% to 62.3% in India. (15).

According to research by Mir et al. (16), 32.9% of newly diagnosed type 2 diabetics had nephropathy overall. To determine the prevalence of DM as a cause of chronic kidney disease (CKD) and the correlation between diabetic CKD, hypertension, and obesity, a prospective observational study was carried out by Dash et al. (17). According to the main findings of a study by Ranjit Unnikrishnan et al. (18), the prevalence of overt DN was 2.2% and microalbuminuria was 26.9% in urban Asian Indians. Additionally, risk factors for DN included systolic blood pressure, duration of diabetes, and A1C, while risk factors for microalbuminuria included smoking and diastolic blood pressure. The present study found a prevalence of DN of 26.7% among the urban diabetic population of Mysore. This prevalence is comparable to findings from other urban regions in India, such as the Chennai Urban Rural Epidemiology Study (CURES), which reported a nephropathy prevalence of 26.9%, and aligns with other studies reporting rates between 20–30% (19).

Age, diabetes duration, high blood pressure, and inadequate glycaemic management are all considered factors which can aggravate the translation rate of diabetes to DN (20**).** The same aspects also emerged here as significant factors associated with diabetic nephropathy. In a Previous study, individuals with nephropathy were considerably older and had had diabetes for a longer period of time, consistent with the well-established role of cumulative hyperglycemic exposure in the development of microvascular complications (21). In the present study, a strong association of DN with hypertension was seen. Sun D et al (22) through his study reaffirms the documented importance of HTN in the development of T2D and its consequences, after controlling for the confounding effects of age, sex, BMI, glycaemic index (FPG, PPG, and HbA1c), lipid profile, and other pertinent variables. According to a study Salman et al (23) conducted in the Mysore population concluded that HTN plays a significant role in the development of T2D and is associated with vascular issues. The present study notably gives a strong indication on the association of DN with hypertension.

Patients with nephropathy exhibit poor glycaemic control, as seen by noticeably elevated HbA1c values (8.9 ± 1.6% vs. 7.9 ± 1.3%; $p < 0.001$), further highlights the importance of maintaining optimal glycemic targets to prevent progression of renal complications. Unnikrishnan et al, (18) in his study reported that, individuals with a history of diabetes had greater prevalence rates overt nephropathy and microalbuminuria than newly diagnosed patients. In a study by Kanakamani J et al (24) found that the prevalence of microalbuminuria was 24.7% and the prevalence of proteinuria was 6.2% in patients with DN that lasted less than a year. It's interesting to note that the previously cited study found a U-shaped relationship between glucose control and overall mortality, with risks of death increasing at HbA1c levels below 6.5% (48 mmol/mol) and above 8.0% (64 mmol/mol). In his research, MacIsaac R et al (25) emphasized a similar finding, demonstrating that the nature of the association between HbA1c and mortality differed from that between HbA1c and other outcomes like ESRD, hospitalization, and cardiovascular events.

Nicotine is one of the primary chemical components of cigarette smoke which prompts excess release of adrenaline triggering vascular constriction and eventually leading to hypertension. Due to this reason cigarette smoking habit is considered as a major predisposing factor of nephropathy especially in Diabetic patients and is even independent of hypertension and blood glucose control (26). The Mysuru urban population also showed a much greater incidence of nephropathy (19.4% vs. 9.1%; p = 0.02) in smokers, supporting evidence that smoking independently contributes to microvascular damage and progression of nephropathy. This was consistent with research by Yasemin Gündogdu et al. (27), which shown that smoking speeds up the development of DKD in both diabetes.

According to Anjana et al (28), the mean BMI was higher among nephropathy participants, the difference was not statistically significant, indicating that BMI might not be a reliable indicator in this population on its own.

These findings underscore the need for early screening and comprehensive risk factor management in urban diabetic populations.

Conclusion

The high prevalence of DN suggests a need for regular kidney function monitoring in diabetic patients to enable early detection and intervention. The results suggest an urgent need for comprehensive diabetes management programs in urban Mysore, including patient awareness in lifestyle modifications, routine screenings, and accessible healthcare services to prevent and control these complications. Further research could also explore additional factors influencing these complications and evaluate the effectiveness of current healthcare interventions. Chronic complications are highly prevalent among T2D outpatients, and these glycaemic controls of these diabetic patients were poor, and to prevent and reduce the occurrence of problems, future efforts should focus on strict blood glucose control, enhancing early diagnosis, and enhancing case management.

This study shows how common diabetes complications and risk factors are in the chosen urban population of Mysuru, notably contributing to the burden of chronic diseases. The study also emphasizes the importance of routine screening for renal complications in diabetic patients, particularly those at higher risk, and calls for multidisciplinary strategies combining medical management, patient education, and lifestyle interventions to mitigate disease progression. The findings highlight the importance of early intervention and long-term monitoring to prevent or mitigate the severity of these complications.

Mysore's status as a pensioners' paradise is under threat due to urban stress, lifestyle-related diseases, weakened social bonds, and increasing living costs. To preserve its legacy, there is a need for stronger public health initiatives, better urban planning, and targeted support for the aging population.

Abbreviations

DN: Diabetic Nephropathy, DKD: Diabetic Kidney Diseases, ESRD: end-stage renal disease, T2DM: Type 2 Diabetes Mellitus, HTN: Hypertension, HbA1C: Glycated Haemoglobin, BMI: Basal Metabolic INDEX, eGFR: Glomerular filtration rate, CDC: Centre for disease control and prevention, IDF: International Diabetic foundation.

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