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**Original Research Article**

# Diabetic nephropathy and its risk factors among patients with diabetes mellitus-an observational study

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## ABSTRACT

**Background:** Diabetic nephropathy (DN) is frequently associated with T2DM and the leading cause of chronic kidney disease and end-stage renal disease. Diabetic nephropathy is one of the three classic micro-vascular complications of diabetes mellitus (DM), traditionally described among patients with long duration and poor control of DM. The aim of this study was to identify and evaluate the risk factors for diabetic nephropathy among patients with DM.
**Methods:** This was a retrospective observational study and was conducted in the department of medicine, LABAID specialized hospital, Dhaka, Bangladesh during the period from March 2022 to March 2023. We included 345 patients with DM and diabetic nephropathy in our study.
**Results:** In our study the mean age was 43.1±9.3 years and majority (57%) of patients were female. Among all patients 48% had diabetes for less than 8 years. Majority (72%) patients got nephropathy because of elevated glucose levels. We found other risk factors like advanced age (37.39%), smoking (27.83%), obesity (61.16%), elevated blood pressure (53.33%), dyslipidemia (20%), longer duration of diabetes (47.25%), family history of DM and DN (21.45% and 24.35%) and retinopathy (25.80%).
**Conclusions:** In our study, we found advanced age, high glucose level, high blood pressure, obesity, long duration of DM, family history of DM and diabetic nephropathy, smoking, dyslipidemia and concomitant diabetic retinopathy were significant risk factors for diabetic nephropathy among selected diagnosed diabetic patients.

**Keywords:** Diabetic nephropathy, DM, Risk factors

## INTRODUCTION

Diabetes mellitus (DM) is a worldwide public health challenge. WHO estimated that there were around 422 million people living with diabetes and that there was a rising trend in the number of people living with DM.[1] Among these people, type 2 diabetes (T2DM) accounts for over 90% of all persons with diabetes.[2] The increasing prevalence of DM has become epidemic and this rise is mostly contributed by the increasing prevalence of type 2 DM (T2DM). Factors contributing to this rise of T2DM in susceptible individuals are mainly environmental and include rapid urbanization, physical inactivity, increasing body mass index (BMI) and occurring largely in low- and middle-income countries (LMICs).[3,4] Diabetic nephropathy (DN) is frequently associated with T2DM and the leading cause of chronic kidney disease and end-stage renal disease.[5] Importantly, with the increasing incidence of T2DM, the frequency of DN has also increased.[6] Chronic kidney disease (CKD) is a silent of epidemic, having estimated global prevalence of 13.4%.[7] DM is the leading cause of CKD and end stage renal disease (ESRD), both in developed and developing

countries.[8] Diabetic nephropathy is one of the three classic micro-vascular complications of DM, traditionally described among patients with long duration and poor control of DM. Appearance of abnormal level of proteinuria, new onset hypertension, concomitant diabetic retinopathy and importantly, the absence of an alternative diagnosis for proteinuria are taken to make a diagnosis of diabetic nephropathy.[9] Generally, all these are present in patients with known DM, either type 1 or T2DM but patients with T2DM pass through pre-diabetic stages, including impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) for a reasonable period before establishing the diagnosis and at the time of diagnosis, half of the T2DM patients may have different macro- and micro-vascular complications including diabetic nephropathy.[10-12] Though patients with T2DM pass through prediabetic stages [impaired fasting glucose (IFG) and impaired glucose tolerance (IGT)] but half of the T2DM patients remain undiagnosed.[13] Examining the prevalence and influencing factors of DN in patients with T2DM is, therefore, an important first step in understanding the disease burden and developing additional research priorities as well. In China, with the rapid economic growth and urbanization, lifestyle changed significantly. At the same time, the prevalence of T2DM has been increasing dramatically. IDF diabetes atlas estimated that in 2017, the prevalence of diabetes was 10.9%, and it estimated that there were 114 million people living with diabetes and 61 million people with undiagnosed diabetes.[14] Besides, the national survey in China also showed that a large proportion of diabetes was undiagnosed and that patients with newly diagnosed diabetes accounted for 60% of the total diabetic population.[15] Consequently, it is striking that DN among those with T2DM has become one of the most important public health crises in China, and there is an urgent need to assess the epidemiological characteristics and risk factors of DN in T2DM in China to implement effective interventions. Such statistics and related risk factors among Bangladeshi population are lacking. So, the present study was designed to evaluate risk factors for diabetic nephropathy among patients with DM.

### *Objective*

The main objective of the study was to identify and evaluate the risk factors for diabetic nephropathy among patients with DM.

## METHODS

This was a retrospective observational study and was conducted in the department of medicine, LABAID Specialized Hospital, Dhaka, Bangladesh during the period from March 2022 to March 2023. We included 345 patients with DM and diabetic nephropathy in our study.

These are the following criteria to be eligible for the enrollment as our study participants: a) patients aged ≥30 years old; b) patients with DM; c) patients with diabetic nephropathy; d) DM duration more than 5 years; e) patients who were willing to participate were included in the study and a) patients taking antihypertensive medications; b) patients with history of recent fever and exercise; c) patients with previous surgical history; d) patients with urinary tract infection and pregnancy; e) patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease etc.) were excluded from our study.

### *Statistical analysis*

All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS 23 (Statistical Package for Social Sciences) for windows version 10. Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of LABAID Specialized Hospital, Dhaka, Bangladesh

## RESULT

Figure 1 shows that majority (41%) of our patients were more than 49 years old, followed by 33% and 26% patients were 40-49 years and 30-39 years old respectively.

In Figure 2 we showed gender distribution of our study patients. Most of our patients were female (57%) compared to male (43%).

Table 1 shows the baseline parameters of our patients. We found the mean age 43.1±9.3 years. Majority (56%) had type 2 DM and 44% had type 1 diabetes. Among all patients 48% had diabetes for less than 8 years, followed by 30% patients DM duration was 8-10 years and 21% had DM more than 10 years. The mean BMI was 28.27±3.24 kg/m$^2$. We found the mean FBG was 10.1±3.3 mmol/l, mean 2-h value was 15.11±2.52 mmol/l, mean HbA1c was 7.85±1.44 and mean triglyceride was 187.85±55.04 mg/dl.

Majority (61%) had TC more than 203 mg/dl, 59% had HDL less than 44 mg/dl and 66% had LDL more than 124 mg/dl.

Table 2 shows the risk factors for diabetic retinopathy. Majority (72%) patients got nephropathy because of elevated glucose levels. There are other risk factors like advanced age (37.39%), smoking (27.83%), obesity (61.16%), elevated blood pressure (53.33%), dyslipidemia (20%), longer duration of diabetes (47.25%), family history of DM (21.45%), family history of diabetic nephropathy (24.35%), increased urinary albumin excretion (14.20%), retinopathy (25.80%) and oxidative stress (30.14%).

**Table 1: Baseline characteristics of our study subjects.**

| Baseline | N | P (%) | P value |
|---|---|---|---|
| **Mean age (years)** | 43.1±9.3 | | 0.186 |
| **DM** | | | |
| Type 1 | 152 | 44.06 | 0.214 |
| Type 2 | 193 | 55.94 | |
| **DM duration (years)** | | 0.00 | |
| <8 | 167 | 48.41 | 0.145 |
| 8-10 | 104 | 30.14 | |
| >10 | 74 | 21.45 | |
| **BMI (kg/m$^2$)** | 28.27±3.24 | | 0.614 |
| **Systolic blood pressure (mm Hg)** | | | |
| ≥ 140 | 211 | 61.16 | 0.741 |
| <140 | 134 | 38.84 | |
| **Diastolic blood pressure (mm Hg)** | | | |
| ≥ 80 | 192 | 55.65 | |
| <80 | 153 | 44.35 | 0.651 |
| **Mean FBG (mmol/l)** | 10.1±3.3 | | 0.015 |
| **Mean 2-h value (mmol/l)** | 15.11±2.52 | | 0.027 |
| **Mean HbA1c (%)** | 7.85±1.44 | | 0.074 |
| **Triglycerides (mg/dl)** | 187.85±55.04 | | 0.086 |
| **Total cholesterol (mg/dl)** | | | |
| <203 | 209 | 60.58 | 0.315 |
| ≥203 | 136 | 39.42 | |
| **HDL (mg/dl)** | | | |
| <44 | 204 | 59.13 | 0.631 |
| ≥ 44 | 141 | 40.87 | |
| **LDL (mg/dl)** | | | |
| <124 | 116 | 33.62 | 0.142 |
| ≥124 | 229 | 66.38 | |

BMI=body mass index, FBS=fasting blood glucose, HbA1c=glycated haemoglobin, HDL=high-density lipoprotein, LDL=low-density lipoprotein.

**Table 2: Risk factors of diabetic nephropathy.**

| Risk factors | N | P (%) | P value |
|---|---|---|---|
| **Advanced age** | 129 | 37.39 | 0.594 |
| **Smoking** | 96 | 27.83 | 0.037 |
| **Obesity** | 211 | 61.16 | 0.035 |
| **Elevated glucose levels** | 247 | 71.59 | 0.041 |
| **Elevated blood pressure** | 184 | 53.33 | 0.024 |
| **Dyslipidemia** | 69 | 20.00 | 0.187 |
| **Longer duration of diabetes** | 163 | 47.25 | 0.007 |
| **Family history of DM** | 74 | 21.45 | 0.065 |
| **Family history of diabetic nephropathy** | 84 | 24.35 | 0.002 |
| **Increased urinary albumin excretion** | 49 | 14.20 | 0.154 |
| **Retinopathy** | 89 | 25.80 | 0.214 |
| **Oxidative stress** | 104 | 30.14 | 0.189 |
| **Subclinical inflammation** | 49 | 14.20 | 0.412 |
| **Glomerular hyperfiltration** | 78 | 22.61 | 0.314 |

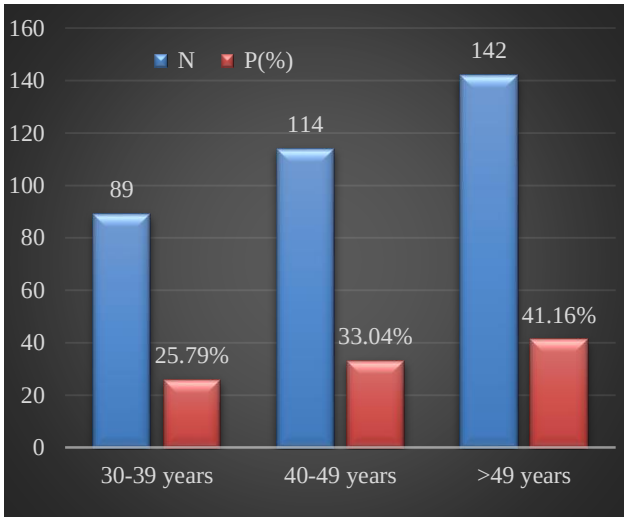


**Figure 1: Age distribution among our study subjects.**

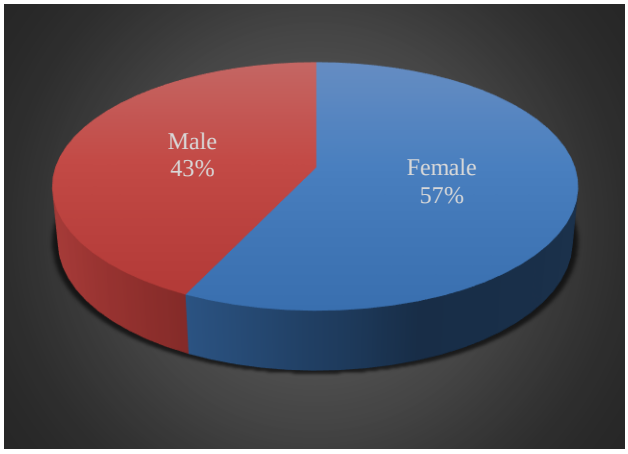


**Figure 2: Gender distribution among study patients.**

## DISCUSSION

Diabetic nephropathy is rapidly becoming the primary cause of CKD and end-stage renal disease worldwide. Long duration of diabetes, poor glycaemic control, concomitant hypertension, smoking, family history of nephropathy is established risk factors for diabetic nephropathy.[16-18] Because T2DM patients may go untreated, they may have consequences before the disease is recognized. A family history of diabetes and diabetic nephropathy, a higher BMI, the prevalence of hypertension, and diabetic retinopathy were all risk factors for diabetes nephropathy.

In our study we found the mean age 43.1±9.3 years and most of our patients were female (57%) compared to male (43%). Martin et al reported over 51% of their newly detected diabetic patients were males with mean age of 46 years in Uganda while Sosale et al reported over two-thirds being males in India.[19,20] Aboelnasr et al from Egypt reported two-thirds of newly detected diabetic patients being females and mean age was over 48 years.[21] Bansal et al reported female predominance of

newly detected diabetic patients in another Indian report with mean age of nearly 50 years.[22]

Patients with T2DM and diabetic nephropathy have genetic influences.[23,24] Our findings were no exception. In our study, 21.45% had family history of DM and over 24% had family history of diabetic nephropathy. Mayega and Rutebemberwa et al reported that over half of their newly diagnosed diabetic patients were females and one-fifth had a family history of DM.[25]

In our study we found elevated glucose levels, advanced age, smoking, obesity, elevated blood pressure, dyslipidemia, longer duration of diabetes, increased urinary albumin excretion, retinopathy and oxidative stress as risk factors for diabetic nephropathy. While Rahim et al found that family history of DM and diabetic nephropathy, higher BMI, presence of hypertension and diabetic retinopathy were significant risk factors for diabetic nephropathy.[26] Risk factors in our study reports were not different from different studies conducted in many Asian countries including India and Pakistan.[27-31] Frequency of diabetic nephropathy varied widely in these reports principally due to different diagnostic criteria being used. But risk factors remained same. The scenario regarding frequency and risk factors for nephropathy among incident T2DM patients are not different in developed countries and pathogenic mechanisms linked are oxidative stress, low level inflammation and genetic factors. They also found high HbA1c at diagnosis of diabetes as an important risk factor. Other risk factors included family history, hypertension and other microvascular complications in western societies.[32]

### *Limitations*

Our study was a single centre study. We found a few risk factors because of our small sample size and limited resources. There are more risk factors like hypertension, ethnicity, HbA1c needs to be evaluated. After evaluating once those patients did not follow them up for a long term and have not known other possible interference that may happen in the long term with these patients.

## CONCLUSION

In this study, found advanced age, high glucose level, high blood pressure, obesity, long duration of DM, family history of DM and diabetic nephropathy, smoking, dyslipidemia and concomitant diabetic retinopathy significant risk factors for diabetic nephropathy among selected diagnosed diabetic patients. So, further study with prospective and longitudinal study design including larger sample size needs to be done to identify more risk factors of diabetic nephropathy among diabetic patients.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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