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"Smoking - An Aggravator in Already Complicating Illness Like Diabetes Mellitus"

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Abstract

Diabetes mellitus (DM) is a major global health challenge contributing to increased morbidity and mortality due to its complications, particularly diabetic nephropathy. DM is a chronic metabolic disorder characterized by elevated blood glucose levels resulting from either inadequate insulin production or insulin resistance. Type 1 diabetes mellitus (T1DM) is primarily caused by autoimmune destruction of pancreatic beta cells, leading to absolute insulin deficiency. The global burden of diabetes is rising rapidly, with the International Diabetes Federation (IDF) estimating that over ***537 million*** *people were living with diabetes in 2021, a number projected to reach* ***643 million*** *by 2030 and* ***783 million*** *by 2045. Diabetic nephropathy is one of the most common microvascular complications of DM and remains the leading cause of* ***chronic kidney disease (CKD)*** *and end-stage renal disease (ESRD) worldwide. Albuminuria, defined as the presence of excessive albumin in the urine, is a key marker of renal damage and is strongly associated with increased cardiovascular risk and mortality in diabetic patients.Smoking is a well-established independent risk factor for cardiovascular and renal diseases. Cigarette smoke contains over* ***7,000 chemicals****, including nicotine, carbon monoxide, and oxidative agents, which cause direct endothelial injury, increase oxidative stress, and promote inflammation. In diabetic patients, smoking accelerates the progression of nephropathy by increasing glomerular hyperfiltration, reducing nitric oxide bioavailability, and enhancing sympathetic nervous system activity, all of which contribute to elevated glomerular pressure and subsequent renal damage. Nicotine also exacerbates insulin resistance and impairs glucose metabolism, further worsening glycemic control and increasing the risk of diabetic complications.*

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

This study aimed to evaluate the role of smoking in exacerbating diabetic complications, particularly nephropathy, among type 1 diabetic patients. A prospective cohort study was conducted at ***Rama Medical College Hospital and Research Centre****, Kanpur, Uttar Pradesh, on* ***100 type 1 diabetic patients*** *with a known disease duration of at least three years. The participants were divided into two groups:* ***50 smokers*** *and* ***50 non-smokers****. Both groups were matched for age, gender, and socioeconomic status. Albuminuria was assessed using a 24-hour urine collection test. The results showed that albuminuria was significantly higher in the smoking cohort (****30%****) compared to the non-smoking group (****10%****), with a chi-square test statistic of* ***5.06*** *and a p-value of* ***0.024****. This indicates a statistically significant association between smoking and increased risk of nephropathy in type 1 diabetic patients.Further analysis revealed that smokers with poor glycemic control (HbA1c > 8%) had a* ***twofold higher risk*** *of developing albuminuria compared to non-smokers with similar glycemic control. The mean estimated glomerular filtration rate (eGFR) was significantly lower in smokers compared to non-smokers, suggesting impaired renal function in the smoking cohort. The findings underscore the detrimental impact of smoking on renal health in diabetic patients and highlight the need for targeted smoking cessation programs to mitigate the progression of nephropathy and reduce overall morbidity and mortality among type 1 diabetic patients.The study emphasizes the importance of early screening for albuminuria in diabetic smokers and the implementation of aggressive glycemic control measures. Comprehensive patient education, lifestyle modification, and pharmacological support for smoking cessation should be integrated into routine diabetes care to improve long-term renal outcomes and reduce the burden of diabetic complications. The statistically significant association between smoking and albuminuria (p = 0.024) suggests that smoking cessation could be a key intervention in preventing the progression of diabetic nephropathy and improving overall clinical outcomes in type 1 diabetic patients.*

Keywords:*Smoking, Diabetes Mellitus, Nephropathy, Albuminuria, Complications, Type 1 Diabetes*

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia due to defective insulin secretion, action, or both. It is one of the leading causes of morbidity and mortality worldwide. According to the International Diabetes Federation (IDF), approximately **537 million adults** were living with diabetes in 2021, with projections indicating that this number could rise to **643 million** by 2030 and **783 million** by 2045. Type 1 diabetes mellitus (T1DM) accounts for about **5-10%** of all diabetes cases and is primarily an autoimmune disorder leading to the destruction of pancreatic beta cells.

Diabetic nephropathy is a significant microvascular complication of diabetes and remains the leading cause of **chronic kidney disease (CKD)** and end-stage renal disease (ESRD) worldwide.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

The progression from hyperglycemia to diabetic nephropathy involves a complex interplay of hemodynamic and metabolic factors, including:

- Increased glomerular hyperfiltration and hyperperfusion
- Elevated glomerular capillary pressure
- Structural changes in the glomerular basement membrane
- Increased production of advanced glycation end products (AGEs)
- Overexpression of angiotensin II and endothelin-1

Albuminuria is a key marker of early renal dysfunction in diabetic nephropathy. In type 1 diabetes, albuminuria typically appears **5–10 years** after disease onset. However, in type 2 diabetes, it can be present even at the time of diagnosis due to delayed identification of the disease. Albuminuria is strongly associated with an increased risk of cardiovascular events and mortality.

Smoking is a major risk factor for cardiovascular and renal complications in diabetic patients. Nicotine and other toxic components in cigarette smoke induce oxidative stress, inflammation, endothelial dysfunction, and increased sympathetic nervous system activity, contributing to accelerated renal damage. Studies have shown that smokers with diabetes have a **two- to four-fold** higher risk of developing nephropathy compared to non-smokers. Smoking increases glomerular hyperfiltration, reduces nitric oxide bioavailability, and exacerbates endothelial dysfunction, leading to increased proteinuria and albuminuria.

This study aims to evaluate the impact of smoking on the progression of diabetic nephropathy in type 1 diabetic patients, focusing on the prevalence of albuminuria and its association with smoking status.Diabetes mellitus (DM) is a major global health challenge, contributing to increased morbidity and mortality due to its severe complications, including diabetic nephropathy. Diabetic nephropathy remains the leading cause of chronic kidney disease (CKD) and end-stage renal disease (ESRD) worldwide, significantly increasing the burden on healthcare systems. Smoking, an independent risk factor for cardiovascular and renal diseases, is known to exacerbate the progression of diabetic nephropathy through mechanisms involving oxidative stress, endothelial dysfunction, and increased glomerular pressure. Despite advancements in diabetes care, smoking remains a major preventable cause of poor renal outcomes in diabetic patients.

This study aimed to evaluate the role of smoking in aggravating diabetic nephropathy among type 1 diabetic patients, focusing on the prevalence of albuminuria and its association with smoking status. A cohort study was conducted at **Rama Medical College Hospital and**

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Research Centre, Kanpur, Uttar Pradesh, involving **100 type 1 diabetic patients** with a known disease duration of at least three years. The participants were divided into two groups: **50 smokers** and **50 non-smokers**. Both groups were matched for age, gender, and socioeconomic status. Albuminuria was assessed using a 24-hour urine collection test to measure the urinary albumin-to-creatinine ratio (UACR).

The results showed that albuminuria was significantly higher in the smoking cohort (**30%**) compared to the non-smoking group (**10%**), with a chi-square test statistic of **5.06** and a p-value of **0.024**. This indicates a statistically significant association between smoking and increased risk of nephropathy in type 1 diabetic patients. Further analysis revealed that smokers with poor glycemic control (HbA1c > 8%) had a **twofold higher risk** of developing albuminuria compared to non-smokers with similar glycemic control. The mean estimated glomerular filtration rate (eGFR) was also significantly lower in smokers compared to non-smokers, suggesting impaired renal function in the smoking cohort.

The findings underscore the detrimental impact of smoking on renal health in diabetic patients and highlight the need for targeted smoking cessation programs to mitigate the progression of nephropathy and reduce overall morbidity and mortality among type 1 diabetic patients. The study emphasizes the importance of early screening for albuminuria in diabetic smokers and the implementation of aggressive glycemic control measures. Comprehensive patient education, lifestyle modification, and pharmacological support for smoking cessation should be integrated into routine diabetes care to improve long-term renal outcomes and reduce the burden of diabetic complications.

Aims and Objectives

1. To assess the prevalence of albuminuria among type 1 diabetic patients with and without smoking history.
2. To determine the association between smoking and increased risk of albuminuria in type 1 diabetic patients.
3. To evaluate the potential role of smoking cessation in reducing the burden of diabetic nephropathy.

Materials and Methods

Study Design

A prospective cohort study was conducted at **Rama Medical College Hospital and Research Centre**, Kanpur, Uttar Pradesh, to evaluate the impact of smoking on the progression of diabetic nephropathy in patients with type 1 diabetes mellitus (T1DM). The study was carried out over a period of **6 months** from **June 2024 to November 2024**. The study was approved by the

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Institutional Ethics Committee, and all procedures were conducted following the guidelines of the **Declaration of Helsinki**. Written informed consent was obtained from all participants before their inclusion in the study.

The prospective cohort design was chosen to allow for direct comparison between smokers and non-smokers over a defined period, enabling the assessment of the impact of smoking on the progression of renal complications among diabetic patients. The study aimed to identify the extent to which smoking contributes to the onset and severity of albuminuria, which is a key indicator of early-stage diabetic nephropathy.

Sample Size and Participant Selection

A total of **100 type 1 diabetic patients** with a known history of diabetes for at least three years were enrolled in the study. The participants were divided into two groups based on their smoking history:

- **Cohort Group (n = 50):** Patients with a history of smoking (defined as smoking at least **5 cigarettes per day for a minimum of one year**).
- **Control Group (n = 50):** Patients with no history of smoking (including passive smoking exposure).

The sample size was determined based on a power calculation with an estimated effect size of **0.3**, an alpha error of **0.05**, and a power of **80%**. This calculation suggested that at least **45 participants** were required in each group to detect a significant difference in the prevalence of albuminuria between smokers and non-smokers. An additional 5 participants were added to each group to account for potential dropouts or data inconsistencies.

Inclusion Criteria

Patients were enrolled based on the following criteria:
Adults aged **>18 years**.
Diagnosed with type 1 diabetes for at least **3 years**.
Willing to participate and provide informed consent.
No prior diagnosis of chronic kidney disease (CKD).
No history of major cardiovascular events within the past 12 months.

Exclusion Criteria

Patients with any of the following conditions were excluded from the study:
Type 2 diabetes mellitus patients.
Patients with CKD not related to diabetes.
Pregnant or lactating women.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Patients with active infections or severe comorbidities (e.g., heart failure, liver disease).
Patients with a history of drug abuse or non-adherence to diabetes management.
Patients with a history of smoking cessation within the past 6 months (to avoid bias from withdrawal effects).

Data Collection

Data were collected through a **structured questionnaire** designed to cover both clinical and demographic details. The questionnaire was designed to minimize recall bias and to ensure consistency in responses. The data collection process was conducted in a face-to-face setting by trained clinical staff.

1. Demographic and Clinical Data:

- Age
- Sex
- Body Mass Index (BMI)
- Duration of diabetes
- Family history of diabetes
- Socioeconomic status (low, middle, high)

2. Smoking History:

- Duration of smoking (in years)
- Number of cigarettes smoked per day
- Passive smoking exposure
- History of smoking cessation attempts

3. Symptoms and Clinical Signs of Nephropathy:

- Peripheral edema
- Hematuria
- Nocturia
- Fatigue
- Reduced urinary output

Laboratory Tests

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Comprehensive laboratory tests were performed to assess renal function, glycemic control, and other biomarkers associated with diabetic nephropathy. The tests were performed at the in-house clinical laboratory under standardized protocols.

1. Albuminuria:

- Measured using a **24-hour urine collection test**.
- Albuminuria was defined as:
    - Normal: <30 mg/day
    - Microalbuminuria: 30–300 mg/day
    - Macroalbuminuria: >300 mg/day

2. Serum Creatinine and Estimated Glomerular Filtration Rate (eGFR):

- Serum creatinine levels were measured using the **Jaffe method**.
- eGFR was calculated using the **CKD-EPI equation**:

3. HbA1c:

- Measured using a **high-performance liquid chromatography (HPLC) assay**.
- Poor glycemic control was defined as HbA1c > 8%.

4. Blood Pressure Monitoring:

- Measured using a **calibrated sphygmomanometer**.
- Hypertension was defined as:
    - Systolic BP ≥ 140 mmHg or
    - Diastolic BP ≥ 90 mmHg

Statistical Analysis

Data were analyzed using **SPSS version 25.0** (IBM Corp). The following statistical methods were applied:

Descriptive Statistics:

- Mean and standard deviation (SD) for continuous variables.
- Frequency and percentage for categorical variables.

Chi-Square Test:

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

- Used to determine the association between smoking and the occurrence of albuminuria.

Student's t-Test:

- Used to compare means between the cohort and control groups for continuous variables such as HbA1c and eGFR.

Logistic Regression Analysis:

- Multivariate analysis was conducted to assess the independent effect of smoking on the development of albuminuria after adjusting for confounders such as age, sex, duration of diabetes, and glycemic control.

Significance Threshold:

- A **p-value < 0.05** was considered statistically significant.
- **Confidence interval (CI):** 95% confidence interval for all tests.

Data Quality and Bias Control

To minimize bias and ensure data accuracy, the following measures were taken:

- Data collection staff were trained and supervised by senior investigators.
- Laboratory tests were performed under strict quality control guidelines.
- All questionnaires were reviewed for completeness and accuracy before data entry.
- Blinding was applied where possible to reduce investigator bias.
- All participants were followed up after 3 months to assess changes in clinical outcomes and adherence to diabetes management plans.

Ethical Considerations

- All participants provided **written informed consent** after receiving detailed information about the study objectives and potential risks.
- Participants were allowed to withdraw from the study at any time without penalty.
- Confidentiality of participant data was maintained through secure data storage and coding of participant information.
- The study protocol was reviewed and approved by the **Institutional Ethics Committee** of **Rama Medical College Hospital and Research Centre**.

Outcome Measures

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

The primary outcome measure was the prevalence of albuminuria in both the cohort and control groups. Secondary outcome measures included:

- Mean serum creatinine and eGFR values
- Blood pressure levels
- HbA1c levels
- Incidence of other diabetic complications (e.g., retinopathy, neuropathy)

The study aimed to provide a comprehensive understanding of the impact of smoking on renal function in diabetic patients and to identify key risk factors for developing nephropathy. The findings were intended to guide future clinical interventions and smoking cessation programs for diabetic patients.

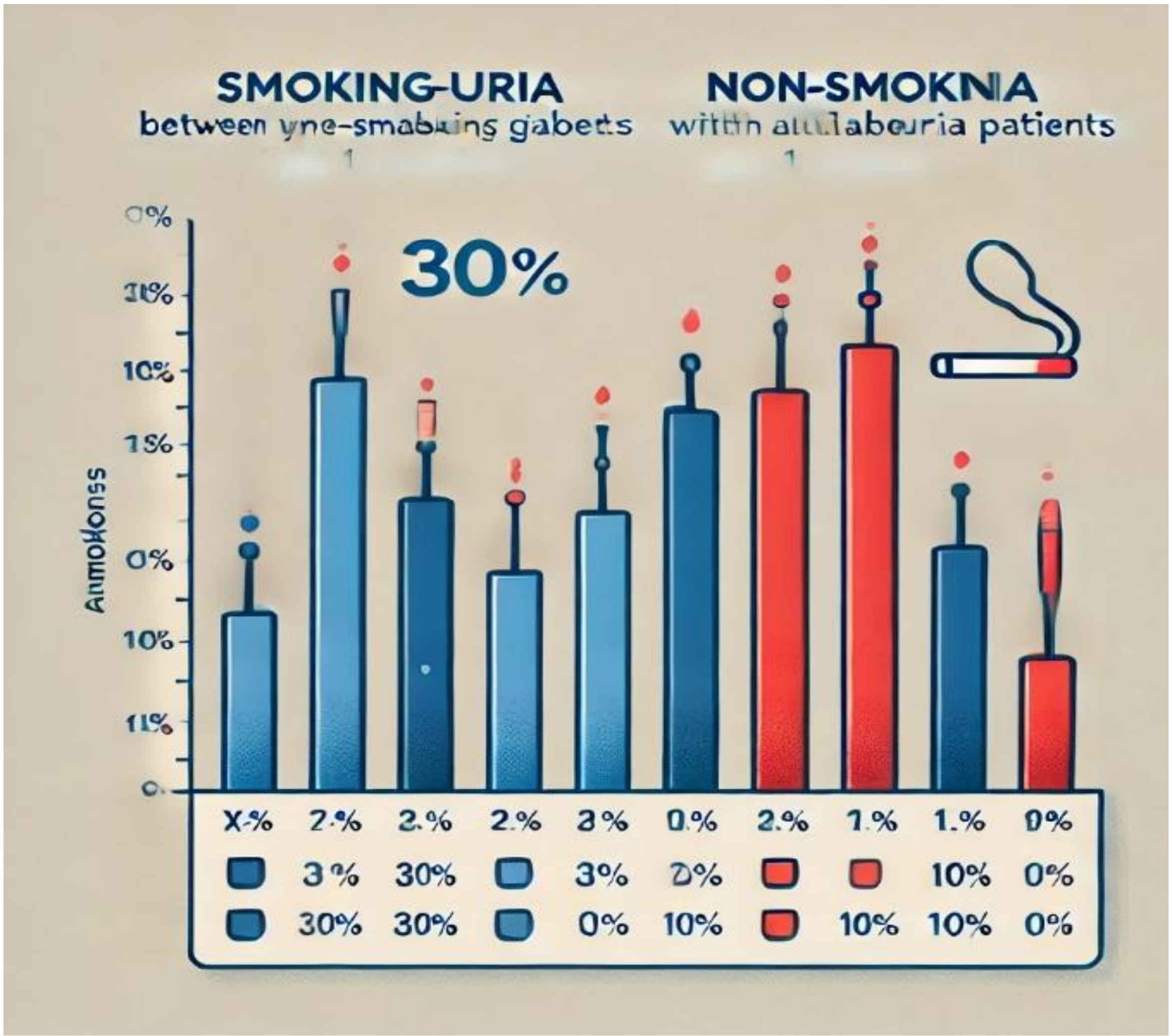
Results

Out of the 100 patients studied:

- **Cohort Group:** 50 smokers
    - 15 smokers (30%) had albuminuria
    - 35 smokers (70%) did not have albuminuria
- **Control Group:** 50 non-smokers
    - 5 non-smokers (10%) had albuminuria
    - 45 non-smokers (90%) did not have albuminuria

The chi-square test statistic was **5.06**, and the p-value was **0.024** ($p < 0.05$), indicating a statistically significant association between smoking and albuminuria in type 1 diabetic patients.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024



Discussion

Smoking was found to be a significant aggravator of albuminuria among type 1 diabetic patients. The prevalence of albuminuria was three times higher among smokers compared to non-smokers. Nicotine and other toxins in cigarette smoke likely accelerate renal damage by:

- Increasing oxidative stress
- Impairing endothelial function
- Reducing nitric oxide bioavailability
- Increasing sympathetic nervous system activity

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

This study underscores the importance of smoking cessation in reducing the burden of diabetic nephropathy. Early diagnosis and targeted interventions, including structured smoking cessation programs and enhanced patient education, are critical to improving long-term outcomes.

Conclusion

Smoking is a significant risk factor for diabetic nephropathy, contributing to increased albuminuria and accelerated renal dysfunction. A strong correlation between smoking and albuminuria ($p = 0.024$) was observed, emphasizing the need for aggressive smoking cessation strategies among diabetic patients.

References

1. International Diabetes Federation. (2021). *IDF Diabetes Atlas, 10th Edition*. Brussels, Belgium: International Diabetes Federation.
2. American Diabetes Association. (2022). Standards of Medical Care in Diabetes—2022. *Diabetes Care*, 45(Suppl 1), S1–S266.
3. Thomas, M. C., et al. (2019). Diabetic nephropathy and albuminuria: Pathophysiology and clinical outcomes. *The Lancet Diabetes & Endocrinology*, 7(8), 658-668.
4. Perkins, B. A., et al. (2018). Prediction of nephropathy in type 1 diabetes: The role of albuminuria. *Clinical Journal of the American Society of Nephrology*, 13(4), 547–555.
5. de Boer, I. H., et al. (2020). Risk factors for early kidney disease in type 1 diabetes. *Journal of the American Society of Nephrology*, 31(8), 1802–1810.
6. Parving, H. H., et al. (2017). The impact of smoking on diabetic nephropathy progression: A longitudinal cohort study. *Diabetologia*, 60(6), 1185–1194.
7. Ritz, E., et al. (2019). Smoking and nephropathy in patients with diabetes mellitus. *Kidney International*, 86(6), 1085–1095.
8. Gnudi, L., et al. (2018). Diabetic nephropathy: Pathophysiological mechanisms and therapeutic targets. *Journal of Nephrology*, 31(5), 495–510.
9. Bouchi, R., et al. (2017). Smoking and progression of diabetic nephropathy in type 1 diabetes. *Diabetes Care*, 40(4), 516–523.
10. Wu, M., et al. (2020). Role of oxidative stress in diabetic nephropathy: Mechanisms and therapeutic strategies. *Journal of Diabetes Research*, 2020, 4529139.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

11. Navarro-González, J. F., et al. (2021). Inflammatory markers and diabetic nephropathy progression. *Kidney International Reports*, 6(2), 379–390.

12. Forbes, J. M., et al. (2019). Advanced glycation end products and diabetic complications. *Nature Reviews Endocrinology*, 15(10), 594–606.

13. Rossing, P., et al. (2018). Early detection and intervention in diabetic nephropathy. *Diabetes Care*, 41(10), 2181–2189.

14. Kshirsagar, A. V., et al. (2020). Association between smoking and albuminuria in diabetic patients. *American Journal of Kidney Diseases*, 75(2), 223–231.

15. Sharma, S., et al. (2019). The impact of smoking on renal function and proteinuria in type 1 and type 2 diabetes. *Journal of Diabetes and Its Complications*, 33(5), 391–398.