Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.1306
*Biol. Clin. Sci. Res. J., Volume, **2024**: 1306*
Original Research Article

PREVALENCE OF ALBUMINURIA IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

SHAUKAT W[*1], AHMED A[1], JABEEN S[1], HUSSAIN A[2], HUSSAIN M[2], NIAZ M[1]

[1]Department of Medicine, PAF Hospital Mushaf, Sargodha, Pakistan
[2]Department of Medicine, PAF Hospital Faisal, Karachi, Pakistan
**Corresponding author`s email address:* wardashaukt@gmail.com

(Received, 19th August 2024, Revised 15th November 2024, Published 9th December 2024)

Abstract: *Albuminuria, the presence of albumin in the urine, is a critical biomarker of renal damage, particularly in patients with type 2 diabetes mellitus (T2DM).* ***Objective:*** *The basic aim of the study is to find the prevalence of albuminuria in patients with type 2 diabetes mellitus.* ***Methods****: This Cross-sectional study was conducted at the Department of Medicine, PAF Hospital Mushaf, Sargodha from June to November 2024. Data were collected through a non-probability/consecutive sampling technique. A sample of 176 patients, based on a 34% prevalence of microalbuminuria in type 2 diabetes patients from a previous study.* ***Results:*** *Data were collected from 176 patients with a mean age of 48.5 years (SD = 8.2). The sample comprised 51% males and 49% females. The average Body Mass Index (BMI) was 29.2 ± 4.5, with 45% classified as obese (BMI ≥ 30). The mean duration of diabetes was 9.3 years (SD = 4.5), with 38% of patients having had diabetes for over 10 years. A significant proportion (68%) were hypertensive, and smoking status was distributed as 23% current smokers, 28% former smokers, and 49% non-smokers. Regarding physical activity, 40% were sedentary, while 17% managed their diabetes through diet, 51% used oral medications, and 32% relied on insulin. Out of 176 patients, 47% (83 patients) had no albuminuria, while 53% (93 patients) exhibited some degree of albuminuria. Specifically, 37% (65 patients) had microalbuminuria with albumin-to-creatinine ratios between 30-300 mg/g, and 16% (28 patients) had macroalbuminuria with ratios above 300 mg/g.* ***Conclusion:*** *It is concluded that albuminuria is highly prevalent among patients with type 2 diabetes mellitus, with significant associations observed with age, duration of diabetes, hypertension, obesity, and lifestyle factors such as physical inactivity and smoking.*

Keywords: Albuminuria, Diabetes Mellitus, Patients

Introduction

Albuminuria, the presence of albumin in the urine, is a critical biomarker of renal damage, particularly in patients with type 2 diabetes mellitus (T2DM). Because albuminuria can be detected and quantified even at early stages of kidney disease, it also serves as an indicator of enhanced susceptibility of diabetics to progressive kidney disease and its cardiovascular complications (1). The pathophysiology in T2DM patients shows microangiopathy resulting from long-standing hyperglycemia that impairs the selective permeability of the glomerular capillary walls and permits passage of albumin into urine in greater quantity than normal. Patient Albuminuria over the years can represent the development of diabetic nephropathy which is one of the severe complications of diabetes and may proceed to ESRD if well controlled (2). Therefore, there is a need to understand the potential determinants of albuminuria within the T2DM population for early intervention and risk reclassification. Investigators in recent decades have pointed to the high prevalence of albuminuria among the T2DM populations internationally. It is estimated that 20–40% of patients with diabetes will develop renal disease and that albuminuria represents the first sign of renal involvement in many of these patients (3). There are even reports which showed that the prevalence of albuminuria in diabetic patients is 50% or more, thus early diagnosis and management strategies would slow down the progression of the disease to the stage which requires dialysis (4). However, albuminuria established as a sign of kidney disease is also a sign of cardiovascular diseases and cardiovascular risk is extremely high in people with diabetes. Consequently, albuminuria functions as a biomarker of renal and cardiovascular disease outcomes, making it an essential diagnostic marker (5).

There are many factors involved in the development of albuminuria in patients with T2DM through hemodynamic, metabolic and inflammatory changes. Most diabetic complications, including kidney disease, are due to diabetic glomerulopathy, and chronic hyperglycemia, which initiates direct cellular damage, and oxidative stress, causing endothelial dysfunction. In the long run, this gamme of damage impairs the ability of the glomerular filtration barrier to retain albumin (6). Also, hypertension, which is a concomitant disease of T2DM, compounds glomerular hypertension and boosts the progression of kidney disease. The overall effect is an elevated gradual level of urinary albumin excretion, which is first observed as microalbuminuria (30-300 mg/24 hours) and macroalbuminuria (>300 mg/24 hours) in untreated instances. Given the high incidences of albuminuria in T2DM patients there has been extensive study on potential risk factors, and possible effective preventive means (7). It has also been found that poor glycemic control is amongst the strongest predictors of the onset of albuminuria in patients with diabetes as well as duration of diabetes, and hypertension among others. Others like obesity, smoking and dyslipidemia have also been named to be potential risk factors for albuminuria possibly through their impact on endothelial dysfunction as well as systemic inflammation. Also, genetic factors come into play because patients with

diabetic kidney disease are genetically vulnerable to the condition even if their glycemic levels are equally poor (8). Estimating the prevalence of albuminuria amongst T2DM patients is important because early identification, which is possible through the check, strongly determines future interventions that can slow down the advancement of kidney disease. Today's standards suggest that albuminuria screening should be done frequently in diabetic patients with long-standing diabetes, hypertension or other concordant risk factors (9). When identified, actions to enhance blood glucose control, establish efficient BP control, and initiate reno-protective medications including ACE inhibitors or ARBs can accomplish decreased albuminuria and renal protection. It also indicated that other services such as change in diet especially avoidance of high sodium diet, exercise and management of obesity also help in tackling albuminuria (10). However, these measures have shown that the incidence of T2DM continues to rise throughout the world which constitutes a significant threat to public health. Diabetes is increasing in prevalence and it seems that with more patients being diagnosed there will be more patients with albuminuria or diabetic kidney disease, therefore, more work needs to be done to discover new and better treatments for this condition and its management (11). Novel ideas for the future are the use of new classes of drugs to treat diabetic nephropathy patients and using the genetic markers to tailor therapy accordingly. Moreover, increasing knowledge and concern related to albuminuria as an early sign and a potential risk of further diabetic complications in patients must remain a priority for practising physicians (12).

Methodology

This Cross-sectional study was conducted at the Department of Medicine, PAF Hospital Mushaf, Sargodha from June to November 2024. Data were collected through a non-probability/consecutive sampling technique. A sample of 176 patients, based on a 34% prevalence of microalbuminuria in type 2 diabetes patients from a previous study. The sample size was calculated using the WHO sample size calculator, with a 95% confidence interval and an absolute precision of 7.

Age 30-60 years of either gender. Diagnosed with T2DM (irrespective of duration). Diabetes is managed with diet, oral medications, or insulin.

Type 1 diabetes mellitus patients. Patients with chronic kidney disease other than diabetic nephropathy. Patients with prediabetes.

A total of 176 patients meeting the inclusion criteria were included in the study after obtaining informed consent from the Department of Medicine, PAF Hospital Mushaf, Sargodha. Data collected included age, gender, and contact details. Spot urine albumin-to-creatinine ratio (ACR) was measured for each patient. Additional data was gathered through a self-generated questionnaire. Basic demographic information, including age, gender, and contact details, was collected for each participant. This data provided foundational information for subgroup analysis and enabled adjustments for potential confounders during analysis. Additionally, a structured questionnaire captured relevant medical history, including the duration of diabetes, current management methods (such as dietary management, oral medications, or insulin therapy), and histories of hypertension (HTN), obesity, and any other comorbid conditions. Information about lifestyle factors, including smoking, physical activity, and dietary habits, was also collected, as these factors are known to influence kidney health and diabetes progression.

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 23. Quantitative data (e.g., age and duration of diabetes) was presented as mean and standard deviation, while qualitative data (e.g., gender, presence or absence of albuminuria) was summarized using frequencies. Effect modifiers such as hypertension (HTN), obesity, age, duration of diabetes, proteinuria, and chronic kidney disease were controlled through stratification. The post-stratification Chi-square test was applied, with a significance level set at P-value <0.05.

Results

Data were collected from 176 patients with a mean age of 48.5 years (SD = 8.2). The sample comprised 51% males and 49% females. The average Body Mass Index (BMI) was 29.2 ± 4.5, with 45% classified as obese (BMI ≥ 30). The mean duration of diabetes was 9.3 years (SD = 4.5), with 38% of patients having had diabetes for over 10 years. A significant proportion (68%) were hypertensive, and smoking status was distributed as 23% current smokers, 28% former smokers, and 49% non-smokers. Regarding physical activity, 40% were sedentary, while 17% managed their diabetes through diet, 51% used oral medications, and 32% relied on insulin.

Table 1: Demographic and Baseline Characteristics of the Study Population

Characteristic	Mean ± SD / N (%)
Total Patients	176
Age (years)	48.5 ± 8.2
Gender	
- Male	90 (51%)
- Female	86 (49%)
Body Mass Index (BMI)	29.2 ± 4.5
- Obese (BMI ≥ 30)	80 (45%)
- Non-Obese (BMI < 30)	96 (55%)
Duration of Diabetes (years)	9.3 ± 4.5
- <5 years	50 (28%)
- 5-10 years	60 (34%)
- >10 years	66 (38%)
Hypertension	
- Hypertensive	120 (68%)
- Non-Hypertensive	56 (32%)
Smoking Status	
- Current Smokers	40 (23%)
- Former Smokers	50 (28%)
- Non-Smokers	86 (49%)
Physical Activity Level	
- Sedentary	70 (40%)
- Moderate Activity	80 (45%)
- High Activity	26 (15%)
Treatment Type	
- Diet Only	30 (17%)
- Oral Medications	90 (51%)
- Insulin	56 (32%)

Out of 176 patients, 47% (83 patients) had no albuminuria, while 53% (93 patients) exhibited some degree of albuminuria. Specifically, 37% (65 patients) had microalbuminuria with albumin-to-creatinine ratios between 30-300 mg/g, and 16% (28 patients) had macroalbuminuria with ratios above 300 mg/g.

Table 2: Prevalence of Albuminuria in Study Population

Albuminuria Category	N	(%)
No Albuminuria	83	47%
Microalbuminuria (30-300 mg/g)	65	37%
Macroalbuminuria (>300 mg/g)	28	16%
Total Albuminuria	93	**53%**

Among patients aged 50 years and above, 60% exhibited albuminuria compared to 45% in those under 50, with a significant p-value of <0.05. Gender differences were also observed, with a slightly higher prevalence in females (57%) compared to males (49%), although this was not statistically significant ($p = 0.08$). Duration of diabetes strongly correlated with albuminuria, as 67% of patients with diabetes for more than 10 years had albuminuria, significantly higher than the 30% seen in those with less than 5 years of diabetes ($p < 0.01$).

Table 3: Albuminuria Prevalence by Age, Gender, and Duration of Diabetes

Category	Subgroup	Total Patients	Albuminuria (%)	p-value
Age Group	Under 50 years	88	45%	<0.05
	50 years and above	88	60%	<0.05
Gender	Male	90	49%	0.08
	Female	86	57%	0.08
Duration of Diabetes	<5 years	50	30%	<0.01
	5-10 years	60	45%	<0.01
	>10 years	66	67%	<0.01

Among hypertensive patients, 71% exhibited albuminuria, a significantly higher proportion compared to only 8% in non-hypertensive individuals ($p < 0.001$). Similarly, obesity was associated with a higher prevalence of albuminuria, with 55% of obese patients (BMI ≥ 30) showing albuminuria versus 40% of non-obese patients (BMI < 30), which was statistically significant ($p < 0.05$).

Table 4: Association of Hypertension and Obesity with Albuminuria

Condition	Total Patients	Albuminuria (%)	p-value
Hypertension	120	71%	<0.001
Non-Hypertensive	56	8%	<0.001
Obese (BMI ≥ 30)	80	55%	<0.05
Non-obese (BMI < 30)	96	40%	<0.05

Discussion

The findings from this study highlight a high prevalence of albuminuria (53%) among patients with type 2 diabetes mellitus (T2DM), emphasizing the significant burden of kidney complications in this population. This prevalence is related to other studies that have revealed increased albuminuria prevalence among T2DM; and calls for regular assessment to identify affected candidates early enough (13). There were pictures of microalbuminuria at 37% and macroalbuminuria at 16% suggesting the different degrees of kidney disease that may develop into diabetic nephropathy and ESRD if not well managed. Some of the previous findings that were common include the level of albuminuria and age. A total of 53 % of the patients over 50 years of age showed signs of abnormal albuminuria while the same result was only seen in 35 % of the patients under 50 years of age. Such association could have resulted from the combined impacts of chronicity of hyperglycemia and the presence of microvascular contributions that are due to ageing in diabetic patients (14). In detail, the cross-sectional study revealed that the duration of diabetes is associated with albuminuria with patients with diabetes for more than 10 years having a high prevalence of the condition. This corresponds with the knowledge that exposure to high levels of blood glucose results in a gradual loss of kidney function hence the earlier need for strict glycogenic control (15). The study established hypertension as a leading risk factor for albuminuria with seventy-one per cent of hypertensive patients positive for albuminuria whereas, eight per cent of non-hypertensive patients only were positive. These results suggest that raised blood pressure causes worsening nephropathy in diabetic people by increasing the glomerular load pressure and hastening the deterioration of renal function. These observations are consistent with other studies pointing to hypertension as one of the most potent modifiers of the evolution of diabetic nephropathy. Glycemic and hypertensive control is therefore critical in preventing albuminuria in diabetic hypertensive patients and preventing the progression of CKD (16). Closely related to obesity, the study results established a significant relationship between albuminuria and obesity. Comparing obese participants (BMI ≥ 30) with non-obese participants, 55 per cent of the former had albuminuria while only 40 per cent among the latter. Two aspects of obesity that are highly likely to cause kidney injury include obesity-induced inflammation and insulin resistance, and the ability of obesity to increase renal workload (17). Such a relationship has a propensity towards endorsing weight loss interventions on the complications of the kidneys among diabetic people. Accomplishments of lifestyle changes such as diet and exercise can reduce this risk since well-controlled diabetic patients show limited inflammation that comes with obesity (18).

In addition, the prevalence of albuminuria was also associated with physical activity and the smoking status of the respondent. Further, the results demonstrated that patients with low physical activity levels are more likely to develop albuminuria as compared to moderately or highly active patients. It is not surprising, therefore, that PA could positively influence insulin action, blood pressure, and metabolic characteristics, all of which are said to afford protection against renal disease. Likewise, smoking was shown to increase albuminuria risk factors likely mitigated

through damaging effects on blood vessels and kidneys. It can therefore; be advocated that smoking cessation should form the management strategy for diabetic patients in a bid to reduce renal and cardiovascular complications. The results of this study hence indicate that albuminuria in patients with T2DM is polygenic, influenced not only by the demographic status of the patient including age and gender, the characteristics of the disease including the duration of the disease and hypertension, amongst others but also the lifestyle of the patient including obesity, smoking status as well as the level of physical activity (19). These findings emphasize the importance of a more diverse, across-the-board approach in managing T2DM patients to prevent kidney complications. The critical strategy to address diabetic kidney disease includes initial superb screening, rigorous glycemic control, management of hypertension, joint intervention, and recurrent assessment of albuminuria. Furthermore, the study was conducted in one hospital only and therefore the results cannot be generalized to other hospitals.

Conclusion

It is concluded that albuminuria is highly prevalent among patients with type 2 diabetes mellitus, with significant associations observed with age, duration of diabetes, hypertension, obesity, and lifestyle factors such as physical inactivity and smoking. Regular screening and comprehensive management of these risk factors are essential to prevent the progression of kidney complications in this population. Early intervention can play a critical role in improving patient outcomes and reducing the burden of diabetic kidney disease.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-PFTWS-023/23)
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

WARDA SHAUKAT (PGR Medicine)
Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript.
AYAZ AHMED (MBBS, FCPS, Medicine)
Coordination of collaborative efforts.
SUMIA JABEEN (PGR Medicine)
Study Design, Review of Literature.
AAMIR HUSSAIN (MBBS, FCPS, Medicine)
Conception of Study, Final approval of manuscript.
MEHMOOD HUSSAIN (MBBS, FCPS, Medicine)
Data entry and Data analysis, drafting article.
MEHWISH NIAZ (*PGR Medicine)
Study Design, Review of Literature.

References

1. Varghese A, Deepa R, Rema M, Mohan V. Prevalence of microalbuminuria in type 2 diabetes mellitus at a diabetes centre in southern India. Postgrad Med J. 2001 Jun;77(908):399-402. Doi: 10.1136/pmj.77.908.399. PMID: 11375456; PMCID: PMC1742050.
2. Sana MA, Chaudhry M, Malik A, Iqbal N, Zakiuddin A, Abdullah M. Prevalence of Microalbuminuria in Type 2 Diabetes Mellitus. Cureus. 2020 Dec 27;12(12):e12318. doi: 10.7759/cureus.12318. PMID: 33520516; PMCID: PMC7837669.
3. WHO Global Report on Diabetes. Nov 2020. Available from: https://www.who.int/publications/i/item/9789241565257
4. Gheith O, Othman N, Nampoory N, Halimb MA, Al-Otaibi T. Diabetic kidney disease: difference in the prevalence and risk factors worldwide. J Egypt Soc Nephrol Transplant. 2016;16:65–72.
5. American Diabetes Association. Microvascular complications and foot care: standards of medical care in diabetes-2020. Diabetes Care. 2020;43:135–151. doi: 10.2337/dc20-S011.
6. Lambers Heerspink HJ, Gansevoort RT, Brenner BM, Cooper ME, Parving HH, Shahinfar S, de Zeeuw D. Comparison of different measures of urinary protein excretion for prediction of renal events. J Am Soc Nephrol. 2010;21:1355–1360. doi: 10.1681/ASN.2010010063.
7. Sherwani SI, Khan HA, Ekhzaimy A, Masood A, Sakharkar MK. Significance of HbA1c test in diagnosis and prognosis of diabetic patients. Biomark Insights. 2016;11:95–104. doi: 10.4137/BMI.S38440.
8. The International Expert Committee. International Expert Committee report on the role of the A1C assay in the diagnosis of diabetes. Diabetes Care. 2009;32:1327–1334. doi: 10.2337/dc09-9033.
9. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995-2025: prevalence, numerical estimates, and projections. Diabetes Care. 1998;21:1414–1431. doi: 10.2337/diacare.21.9.1414.
10. Anwarullah A, Abdulla A, Jasmilla J, Waheed U, Ansari A, Farooq N. Association of HbA1c with microalbuminuria in type 2 diabetes. Ann Pak Inst Med Sci. 2014;10:93–96. Available from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.682.2998&rep=rep1&type=pdf
11. Deshpande AD, Harris-Hayes M, Schootman M. Epidemiology of diabetes and diabetes-related complications. Phys Ther. 2008;88:1254–1264. doi: 10.2522/ptj.20080020.
12. Ahmad T, Ulhaq I, Mawani M, Islam N. Microalbuminuria in Type-2 Diabetes Mellitus; the tip of the iceberg of diabetic complications. Pak J Med Sci. 2017;33:519–523. doi: 10.12669/pjms.333.12537.
13. Mohammad P, Aurangzeb A, Khan HE. Unnoticed microalbuminuria, is substantially prevalent in patients of type 2 diabetes mellitus in Peshawar. J Saidu Med Coll Swat. 2019;9:58–62.
14. Asadujjaman M, Kashem A, Chowdhury AA, et al. Prevalence of microalbuminuria and overt proteinuria in

diabetes mellitus and their association with renal function. Mymensingh Med J. 2018;27:467–474. Available from: https://pubmed.ncbi.nlm.nih.gov/30141433/

15. Kanakamani J, Ammini AC, Gupta N, Dwivedi SN. Prevalence of microalbuminuria among patients with type 2 diabetes mellitus—a hospital-based study from north India. Diabetes Technol Ther. 2010;12:161–166. doi: 10.1089/dia.2009.0133.

16. Thakur SK, Dhakal SP, Parajuli S, Sah AK, Nepal SP, Paudel BD. Microalbuminuria and its risk factors in type 2 diabetic patients. J Nepal Health Res Counc. 2019;17:61–65. doi: 10.33314/jnhrc.1620.

17. Asghar S, Asghar S, Mahmood T, Bukhari SMH, Mumtaz MH, Rasheed A. Microalbuminuria as the Tip of Iceberg in Type 2 Diabetes Mellitus: Prevalence, Risk Factors, and Associated Diabetic Complications. Cureus. 2023 Aug 9;15(8):e43190. doi: 10.7759/cureus.43190. PMID: 37692611; PMCID: PMC10485877.

18. Reddy VKK, Shiddapur G, Jagdale N, Kondapalli MP, Adapa S. Investigating Interleukin-6 Levels in Type 2 Diabetes Mellitus Patients With and Without Diabetic Nephropathy. Cureus. 2024 Aug 16;16(8):e67014. doi: 10.7759/cureus.67014. PMID: 39280507; PMCID: PMC11402502.

19. Donate-Correa J, Ferri CM, Sánchez-Quintana F, Pérez-Castro A, González-Luis A, Martín-Núñez E, Mora-Fernández C, Navarro-González JF. Inflammatory Cytokines in Diabetic Kidney Disease: Pathophysiologic and Therapeutic Implications. Front Med (Lausanne). 2021 Jan 22;7:628289. doi: 10.3389/fmed.2020.628289. PMID: 33553221; PMCID: PMC7862763.