

ISSN: 2782-7550 (Print)
ISSN: 2782-7542 (Online)

ABMS

ANNALS OF BASIC AND MEDICAL SCIENCES

A Scientific Peer Reviewed Publication of The Faculties of Basic Medical and Basic Clinical Sciences, Usmanu Danfodiyo University Sokoto, Nigeria





Prevalence of Proteinuria among Type 2 Diabetic Patients Attending Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria

Muhammad B. AbdulRahman, Saidu Kasimu

Department of Chemical Pathology and Immunology, Faculty of Basic Clinical Sciences, College of Health Sciences, Usmanu Danfodiyo University, Sokoto.

Abstract

Background: Diabetes mellitus has been reported to be the primary cause of end-stage renal disease in some Asian and American countries. However, no such data were available among type 2 diabetic patients in North-Western Nigeria. This study was aimed to assess the prevalence and associated risk factors of proteinuria among type- 2 diabetic patients by measuring the total protein-to-creatinine ratio (TPCR) and to provide some possible recommendations to enhance the level of health care rendered to the patients.

Methods: This was a cross-sectional study. Spot urine TPCR was performed on 182 diabetic patients who attended the diabetic clinic at Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria, from January 2018 to December 2018. Other relevant parameters were extracted from the Chemical Pathology Department register, and the patients' case folders. The data were statistically analysed using SPSS version 23.0 (Chicago IL).

Results: Among the total of 182 diabetic patients recruited during the study period, 66(36.3%) were males and 116(63.7%) were females. Out of the patients, (82)45.1% had hypertension; and (105)57.7% of the study populations were obese. The overall prevalence of pathological proteinuria (TPCR \geq 150 mg/mmolcreatinine) was found in 116 (63.7%) of the study population.

Conclusions: The prevalence of proteinuria is high in the study subjects (63.7%). The high prevalence observed might be a result of kidney disease in primary health care setting. However, this study is a hospital based finding with a small sample size, therefore, a larger study population size is recommended for future studies.

Keywords: prevalence, proteinuria, type 2 diabetes, total protein-to-creatinine ratio (TPCR), risk factor

Corresponding author:

Muhammad Bashiru AbdulRahman,

Department of Chemical Pathology
and Immunology,
Faculty of Basic Clinical Sciences,
College of Health Sciences,
Usmanu Danfodiyo University,
Sokoto, Nigeria
Email: abfmhzs69@gmail.com
Phone: 08032375659

Introduction

Proteinuria is an established marker of chronic kidney disease. A meta-analysis of studies on chronic kidney disease (CKD) noted that proteinuria was used to determine the presence of kidney damage in only 69% of the studies, while estimated glomerular filtration rate (GFR) was used in the remaining 31% (1). The incidence of end-stage renal failure in patients with type-2 diabetes mellitus (T2DM) has dramatically increased in recent years. Diabetes mellitus was reported to be the primary cause of the end-stage renal disease (ESRD) in about 60% of patients in Malaysia, Mexico, Singapore, and 40%-60% in the US, Israel, Korea and Taiwan between 2009-2011(2). Diabetic nephropathy has been didactically categorized into stages based on the values of urine albumin/creatinine ratio (ACR): microalbuminuria (ACR = 30-300 mg/g of creatinine) and macroalbuminuria (ACR > 300 mg/g of creatinine) (3).

According to the Japanese Society of Nephrology and the Kidney Disease, Improving Global Outcomes Chronic Kidney Disease guidelines state that urine TPCR of 150 mg/mmol of creatinine is equal to an ACR of 30 mg/g of creatinine (4). Several studies reported that the upper limit of normal for urine total protein excretion for adults is generally 150 to 200 mg/day (5, 6) and there appears to be general agreement that values of 300 mg/ day or higher are abnormal (7, 8).

This study aimed to estimate the prevalence of diabetic proteinuria and to identify possible risk factors for the development of proteinuria among the subject with T2DM in Sokoto, Nigeria.

Materials and Methods

This was a cross-sectional study, spot urine TPCR was performed on 182 diabetic patients who attended the diabetic clinic at Usmanu Danfodiyo University Teaching Hospital,

Sokoto, Nigeria, from January 2018 to December 2018. The patients were consecutively selected for the study. Only type 2 diabetic patients aged between 18 and 60 years and agreed to participate in the study were recruited. Patients with heart failure and renal failure were excluded from the study. Other relevant parameters were extracted from the chemical pathology register, and the patient's case folder. Pathological proteinuria was defined using spot urine TPCR cut off 150mg/mmol of creatinine (indicate reference) (Yamamoto, et al 2014 9). Microsoft Excel version 13 was used for entry and validation of the data for statistical analysis. The data were exported into SPSS version 23.0 (Chicago IL) for windows. All variables were coded as binary dummy variables. For example, gender (male = 1, female = 2), and so on. Age was categorized into two groups (<50 and ≥50 years old), numerical data were summarized using measures of central tendency with their respective measures of dispersions. Frequency and percentages were used to summarize categorical data. Chi-square test (χ^2) was used to determine the association between the prevalence of proteinuria and demographic characteristics. Bivariate logistic regression analysis was used to determine a patient's characteristics predicting proteinuria among the study population. Odds ratio (OR) with their corresponding 95% confidence intervals (CIs) were used to determine the strengths of association in a Bivariate analysis. P-value < 0.05 was considered statistically significant.

Results

There was a total of 182 diabetic patients identified during the study period. 66(36.3%) were males and 116(63.7%) were females. Out of the patients, (82)45.1% had hypertension; (105)57.7% of the study populations were obese. The overall prevalence of pathological proteinuria (TPCR ≥ 150 mg/mmol creatinine) was found in 116 (63.7%) of the study population (Figure 1).

The prevalence of albuminuria is shown in Figure 2. ACR was calculated from TPCR by formula; $\text{Ln ACR} = 1.326 \times \text{Ln TPCR} - 2.64$ (10). In a total of 182 T2DM patients who participated in this study, 16.48% have normal ACR. A total of 57.7%, and 25.8% were found to have microalbuminuria (ACR 30-300 mg/g) and macroalbuminuria (ACR > 300 mg/g) respectively. One hundred and twenty-two patients (67%) were within the age group of ≥50 years and the majority of the participants 116 (63.7%) were females. Nearly half of the patients 82(45.1%) were hypertensive while the preponderance of the population 105(57.7%) were obese (Table 1). Age and hypertension showed

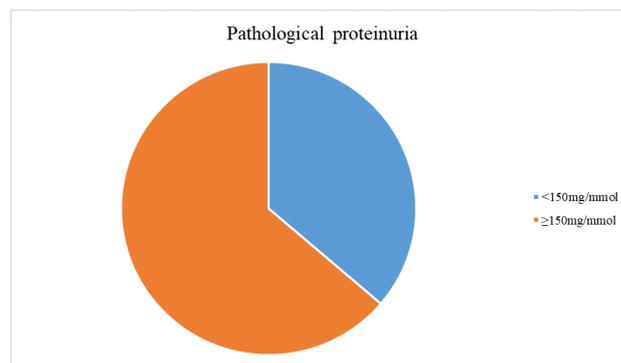


Figure 1: Prevalence of pathological proteinuria (TPCR ≥ 150mg/mmol creatinine).

significant association with pathological proteinuria as dependent and potential risk factors ($P < 0.05$). The result showed that the prevalence of proteinuria was higher within the age group of ≥ 50 years 87(75%) compared to <50 years 29(25%) and the odd of proteinuria in ≥ 50 years age group was almost triple fold (2.7, 95% CI 1.400 - 5.042). This suggests that ≥ 50year old are 2.7 times more likely to have pathological proteinuria. Hypertension was found to be a significant risk factor ($P < 0.05$); the proportion of proteinuria was higher (50.9%) among hypertensive patients with pathological proteinuria (59), with an odds ratio of (1.9, 95% CI 1.037 - 3.610) (Table 2).

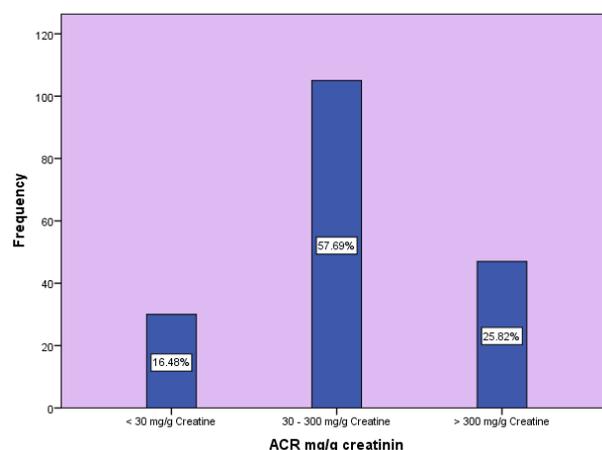


Figure 2: Estimated Albuminuria categories among type 2 diabetic patients (N=182). ACR: Albumin Creatinine Ratio.

Discussion

The prevalence of pathological proteinuria (TPCR ≥ 150 mg/mmol creatinine) among type 2 diabetic patients is 63.7% in the current study, which is similar other studies that reported 64% (11) and 61% (12). However, our findings were in contrast to some other studies that reported 9.3% (13) and 12.5% (14). This variability could be due to the influence of age differences in the study population and environmental factors in our locality, as it was observed that the

Table 1: Demographic Characteristics of the study participants (N=182)

Age	Frequency	Percent
< 50	60	33
≥ 50	122	67
Gender		
Male	66	36.3
Female	116	63.7
Hypertension		
No	100	54.9
Yes	82	45.1
BMI		
<18.5kg/m ²	2	1.1
18.5-24.9kg/m ²	32	17.6
25-29.9kg/m ²	43	23.6
≥30kg/m ²	105	57.7

participants below 30 years of age were higher in the previous studies (13).

Our study observed that the highest prevalence of diabetic-related pathological proteinuria was found in hypertensive patients (50.9%), and hypertension was found to be a risk factor for diabetic nephropathy. This is consistent with the other findings that reported the association between obesity, hypertension and duration of diabetes, with diabetic nephropathy (11,15,16). Based on our findings from this study, people aged greater than 50 years were more likely to have pathological proteinuria (almost three times fold), this study focused on the determinants of proteinuria. In the present study, the prevalence of

proteinuria increased with an increase in age. Other similar studies conducted correlated with our findings, which reported a proportional increase in the prevalence of pathological proteinuria with age. (13, 17). A number of factors have been implicated in the increased prevalence of proteinuric renal illness and nephrotic syndrome in the elderly. Immune status changes associated with ageing have been implicated. T-cell function abnormalities, for example, have been linked to the development of minimal change disease (MCD). Although MCD is largely a childhood disease, its prevalence increases with age. Meanwhile in contrast with our findings, a study from Yemen revealed that there is no significant association between age and pathological proteinuria (11). Furthermore, studies done by Modesti et al., (18) and Ishigami et al., (19) revealed that the prevalence of proteinuria was more in men as compared to women, which is not in agreement to findings of the present study. Other ideas for the lower likelihood of advancement in women compared to males include the hypothesised protective action of oestrogen, the detrimental effects of testosterone, and possibly unhealthier lifestyles in men compared to women. The causes of gender variations are significant and warrant additional investigation.

Estimated microalbuminuria (ACR 30-300 mg/g) and macroalbuminuria (ACR > 300 mg/g) were 57.7% and 25.8% respectively. These results are similar to finding in Tamar University, Yemen (11). However, other similar studies in Yemen are varied with our findings, a study carried out in Al-Kuwait University Hospital Yemen reported an overall prevalence of diabetic nephropathy among type 2-diabetic patients to 33.6% (21.2% had microalbuminuria and 12.4% had macroalbuminuria) (20). Concerning others,

Table 2: Factors associated with pathological proteinuria among type 2 diabetes (N = 182).

Age	< 150 mg/mmol	Prevalence of Pathological proteinuria n (%)	OR (95% CI)	P
≥ 50	35(53%)	87(75%)	2.657(1.400 - 5.042)	0.002
< 50	31(47%)	29(25%)	1	
Gender				
Male	24(36.4%)	42(36.2%)	1.007(0.537 - 1.887)	0.554
Female	42(63.6%)	74(63.8%)		
Hypertension				
Yes	23(34.8%)	59(50.9%)	1.935(1.037 - 3.610)	0.003
No	43(65.2%)	57(49.1%)	1	

microalbuminuria and macroalbuminuria were reported in Saudi Arabia (45.6%) in Sudan 44% (22), and Kuwait 58.2% (23). Moreover, macroalbuminuria was 12.8% in Egypt (24). These variations in the prevalence rate of proteinuria can be attributed to differences in several factors such as; study design, source of the study population, diagnostic criteria, as well as the methods of measurement of proteinuria and urine collection, diabetic duration, diabetic treatment, and presence of hypertension. For instance, some similar reports where a long duration (12years) or nation-wide study involving higher sample size (15, 16). The high prevalence of microalbuminuria and macroalbuminuria in patients with T2DM is attributed to the presence of diabetes many years before it is diagnosed (11).

Conclusion

This study revealed that the prevalence of diabetic proteinuria was found to be high (63.7%) in our study population. The prevalence of diabetic nephropathy based on estimated ACR was 83.5% (57.7 % microalbuminuria and 25.8% macroalbuminuria). Age more than 50 years and hypertension were found to be statistically significant risk factors for proteinuria. Therefore, early detection of kidney disease can prove to be of immense help in predicting exposure to pathological proteinuria.

References

1. Stanifer JW, Jing B, Tolan S, Helmke N, Mukenjee R, et al. The epidemiology of chronic kidney disease in sub-Saharan Africa: a systematic review and meta-analysis. *Lancet Glob Health*. 2014; 2(3): e174-81.
2. Lim AKh. Diabetic nephropathy - complications and treatment. *Int J Nephrol Renovasc Dis*. 2014; 7: 361-381.
3. KDOQI clinical practice guidelines and clinical practice recommendations for diabetes and chronic kidney disease. *Am J Kidney Diseases* 2007; 49: S12-S154.
4. Kidney Disease: Improving Global Outcomes KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. 2013; 3: 1-150.
5. Shihabi ZK, Konen JC, O'Connor ML Albuminuria vs urinary total protein for detecting chronic renal disorders. *Clin Chem* 1991;37: 621-624.
6. Brenner BM Brenner and Rector's the kidney. (8th ed), Saunders Elsevier, Philadelphia, PA, USA, 2008;738.
7. Waller KV, Ward KM, Mahan JD, Wismatt DK (1989) Current concepts in proteinuria. *Clin Chem* 1989;35: 755-765.
8. Abuelo JG Proteinuria: Diagnostic principles and procedures. *Ann Intern Med* 1983;98: 186-191.
9. Yamamoto K, Yamamoto H, Yoshida K, Niwa K, Nishi Y, Mizuno A,

Kuwabara M, Asano T, Sakoda K, Niinuma H, Nakahara F, Takeda K, Shindoh C, & Komatsu Y. (2014). The total urine protein-to-creatinine ratio can predict the presence of microalbuminuria. *PLoS one*, 9(3), e91067.

10. Astor BC, Matsushita K, Gansevoort RT, van der Velde M, Woodward M, et al. Lower estimated glomerular filtration rate and higher albuminuria are associated with mortality and end-stage renal disease. A collaborative meta-analysis of kidney disease population cohorts. *Kidney Int* 2011;79: 1331-1340.
11. Abdulqawi Ali Al-Shammakh, Abdullatif Daifallah Ali, Hussein Al Jermozy. Prevalence of Proteinuria among Type 2 Diabetic Patients in Dhamar Governorate, Yemen. *Al-Shammakh et al Int J Diabetes Clin Res*. 2019;6(2):1-7.
12. Al-Maskari F, El-Sadig M, Obineche E Prevalence and determinants of microalbuminuria among diabetic patients in the United Arab Emirates. *BMC Nephrol* 2008;9: 1.
13. Manan Jhavar, Venkatachalam Jayaseelan, Ramya Selvaraj. Burden of Proteinuria and Risk Factors of Chronic Kidney Disease among Adult Population in Urban Puducherry, India. *Journal of Clinical and Diagnostic Research*. 2017;11(8):14-6.
14. Jayaseelan V, Murugan N, Abraham SB, Singh Z, Purty AJ, Sathya GR, et al. Prevalence of risk factors for chronic kidney disease in a coastal area of Tamil Nadu, South India. *Journal of Medical and Dental Sciences*. 2012;2(4):29-33.
15. Yang CW, Park KT, Kim YS, Kim YL, Lee YS. Prevalence of diabetic nephropathy in primary care type 2 diabetic patients with hypertension: data from the Korean Epidemiology Study on Hypertension III (KEY III study). *Nephrol Dial Transplant* 2011;26: 3249-3255.
16. Viswanathan V, Tilak P, Kumpatla S Risk factors associated with the development of overt nephropathy in type 2 diabetes patients: A 12 years observational study. *Indian J Med Res* 2012;136: 46-53.
17. Singh NP, Ingle GK, Saini VK, Jami A, Beniwal P, Lal M, et al. Prevalence of low glomerular filtration rate, proteinuria, and associated risk factors in North India using Cockcroft-Gault and modification of diet in renal disease equation: an observational, cross-sectional study. *BMC Nephrol*. 2009;10(1):4.
18. Modesti PA, Bamoshmoosh M, Rapi S, Massetti L, Bianchi S, Al-Hidabi D, et al Relationship between hypertension, diabetes, and proteinuria in rural and urban households in Yemen. *Journal of Human Hypertension*. 2013; 27:572-79.
19. Ishigami T, Yamamoto R, Nagasawa Y, Isaka Y, Rakugi H, Iseki K, et al. An association between serum γ -glutamyltransferase and proteinuria in drinkers and non-drinkers: a Japanese nationwide cross-sectional survey. *Clin Exp Nephrol*. 2014;18(6):899-910.
20. Bamashmoos MA, Ganem Y Diabetic nephropathy and its risk factors in type 2-diabetic patients in Sana'a City, Yemen. *World Journal of Medical Sciences* (2013) 9: 147-152.
21. Al-Shaikh A Prevalence of microalbuminuria in type 2- DM at diabetic clinic King Abdulaziz University Hospital. *Pak Med Sci* 2007;23: 223-226.
22. Rahamtalla FA, Elagib AA, Mahdi A, Ahmed SM Prevalence of microalbuminuria among Sudanese type 2 diabetic patients at Elmusbah center at Ombadda- Omdurman. *IOSR J Pharm* 2012;2: 51-55.
23. Shebl M, Atteia M High prevalence of microalbuminuria (MA) in type 2 diabetic patients. *Health Care* 2008;21: 221-232.
24. Farahat TM, Elsaed GK, Gazareen SS, Elsayed TI Prevalence of proteinuria among type 2 diabetic patients in Menoufia governorate, Egypt. *Menoufia Med J* 2014;27: 363-371.