

Association of Microalbuminuria with Duration of Diabetes and Glycemic Status in Postmenopausal Women with Type 2 Diabetes Mellitus

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Abstract

Original Research Article

Background: Diabetes mellitus is a chronic disorder associated with serious complications, including cardiovascular and renal diseases, and microalbuminuria serves as an early marker of diabetic kidney disease and progressive nephropathy. Therefore, the purpose of the study is to assess the association between microalbuminuria, diabetes duration, and glycemic status in postmenopausal women with type 2 diabetes mellitus. **Aim of the study:** The aim of the study was to assess the association between microalbuminuria, diabetes duration, and glycemic status in postmenopausal women with type 2 diabetes mellitus. **Methods:** This cross-sectional study at the Department of Biochemistry, Dhaka Medical College, Dhaka, Bangladesh (July 2014–June 2015) included 100 postmenopausal women with type 2 diabetes. After ethical approval and consent, fasting plasma glucose, HbA1c, serum/urinary creatinine, serum albumin, microalbuminuria, and ACR were measured. Data were analyzed using SPSS 21 with t-tests and Pearson's correlation; $p < 0.05$ was significant. **Results:** Among 100 postmenopausal women with type 2 diabetes, 78% had microalbuminuria. All patients with diabetes > 5 years ($n = 65$) were positive, compared to 37.1% of those with < 5 years ($n = 35$) (mean duration 6.85 ± 1.85 vs 3.91 ± 0.87 years, $P = 0.001$). Microalbuminuria correlated positively with HbA1c ($r = +0.750$), FBS ($r = +0.717$), serum creatinine ($r = +0.694$), and ACR ($r = +0.997$), and negatively with serum albumin ($r = -0.750$) and urinary creatinine ($r = -0.762$), all $P = 0.001$. **Conclusion:** Microalbuminuria is highly prevalent and closely linked to diabetes duration and poor glycemic control, underscoring the need for early screening and management in postmenopausal women in Bangladesh.

Keywords: Microalbuminuria, Diabetes Duration, Glycemic Status.

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INTRODUCTION

Diabetes mellitus (DM) is a chronic, serious noncommunicable disorder that arises primarily due to either insufficient insulin production or resistance to its action [1]. Among its various forms, type 2 diabetes mellitus (T2DM) is the most prevalent, affecting over 462 million people worldwide. T2DM is associated with numerous complications, including cardiovascular diseases, neuropathy, and renal disorders [2]. In particular, cardiovascular complications remain the leading cause of morbidity and mortality, whereas renal complications are especially common among diabetic patients in Asian populations [3].

Microalbuminuria is defined as the urinary excretion of albumin ranging from 30 to 300 mg over 24 hours and is observed in over one-third of patients with T2DM. An increased urinary albumin level may reflect generalized vascular injury rather than isolated damage to renal parenchyma [4]. Detecting low levels of urinary albumin (microalbuminuria) serves as an early marker for diabetic kidney disease (DKD) and provides prognostic information regarding renal outcomes [5]. Diabetic nephropathy remains the primary cause of end-stage renal disease (ESRD) globally and is closely linked to elevated cardiovascular risk. The earliest clinical sign of nephropathy is often microalbuminuria, and stringent

control of blood glucose and blood pressure can help prevent its onset [6,7].

It is estimated that 20% to 40% of individuals with type 1 or type 2 diabetes will eventually develop DKD. Globally, diabetes mellitus is the leading cause of chronic kidney disease (CKD), and 20% to 30% of patients may exhibit microalbuminuria after an average diabetes duration of 15 years, although it can also be present at the time of T2DM diagnosis [8-10]. Albuminuria independently predicts adverse cardiovascular and renal outcomes in T2DM patients and is associated with increased cardiovascular morbidity and mortality in both types of diabetes [11,12]. Studies indicate that the incidence of microalbuminuria is lower in patients with intensive glycemic control (HbA1c 6.5%) compared to standard control (HbA1c 7.3%) [13-16]. In early diabetes, glomerular hyperperfusion and hypertrophy of the renal calyces occur, leading to an increased glomerular filtration rate (GFR) [17]. The presence of proteinuria increases mortality risk up to 40-fold in T2DM patients, highlighting its role as the most sensitive prognostic marker for early diabetic nephropathy and progressive renal disease [18].

Despite extensive research on microalbuminuria and diabetic kidney disease, data on its prevalence and association with glycemic control and diabetes duration specifically in postmenopausal women with type 2 diabetes mellitus remain limited. Hormonal changes after menopause may influence glucose metabolism, vascular function, and renal susceptibility, yet studies focusing on this vulnerable population are scarce. Therefore, the purpose of the study is to assess the association between microalbuminuria, diabetes duration, and glycemic status in postmenopausal women with type 2 diabetes mellitus.

OBJECTIVE

- To assess the association between microalbuminuria, diabetes duration, and glycemic status in postmenopausal women with type 2 diabetes mellitus.

METHODOLOGY & MATERIALS

This cross-sectional study was conducted at the Department of Biochemistry, Dhaka Medical College,

Dhaka, Bangladesh, from July 2014 to June 2015. A total of 100 postmenopausal women with type 2 diabetes mellitus were enrolled using purposive sampling to assess the association of microalbuminuria with diabetes duration and glycemic status.

Inclusion Criteria:

- Postmenopausal women diagnosed with type 2 diabetes mellitus
- Age between 45 and 65 years

Exclusion Criteria:

- Pregnancy or lactation
- Hypertension
- History of total hysterectomy or unilateral/bilateral oophorectomy
- Acute or chronic debilitating diseases such as COPD, renal failure, or malignancy

Ethical clearance was obtained from the Ethical Review Committee of Dhaka Medical College, and written informed consent was obtained from all participants. Biochemical parameters measured included fasting plasma glucose, HbA1c, serum albumin, serum creatinine, urinary creatinine, microalbuminuria, and albumin-creatinine ratio (ACR). Post menopause was defined as the permanent cessation of menstruation for at least 12 months due to loss of ovarian follicular function. After overnight fasting, 10 mL of venous blood and 5 mL of morning urine were collected aseptically, processed, and either analyzed immediately or stored at -20°C until analysis. Laboratory investigations were performed according to standard reference ranges. Demographic and medical data were collected through clinical evaluation, history-taking, and review of diabetes records, and recorded in a pre-designed data sheet. Statistical analysis was conducted using SPSS version 21; continuous variables were expressed as mean $\pm$ SD, differences between microalbuminuria-positive and -negative groups were compared using the unpaired t-test, and correlations between variables were assessed with Pearson's correlation. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Prevalence of Microalbuminuria in the Study Population (n=100)

Microalbuminuria (MA)	Number of Patients	Percentage (%)
MA (+)	78	78.0
MA (-)	22	22.0
Total	100	100.0

Out of 100 postmenopausal women with type 2 diabetes mellitus included in the study, 78 patients

(78.0%) were positive for microalbuminuria, while 22 patients (22.0%) were negative.

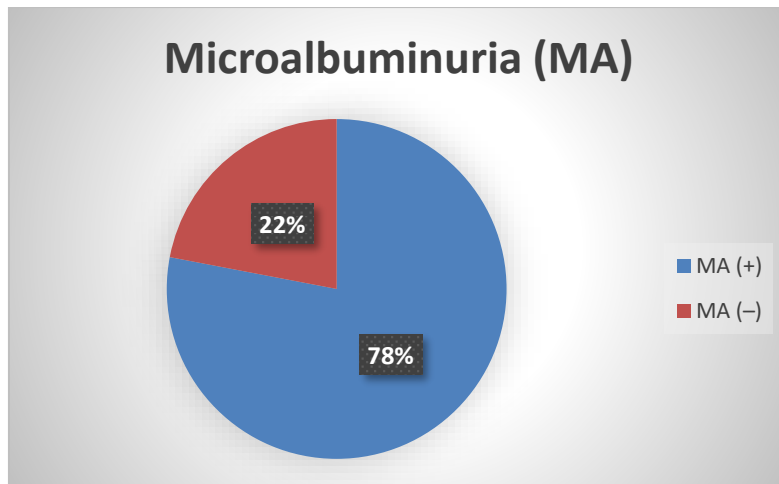


Figure 1: Distribution of Microalbuminuria in the Study Population (n=100)

Table 2: Distribution of Microalbuminuria According to Duration of Diabetes Mellitus in the Study Population (n=100)

Duration of DM	N	MA Positive, n (%)	MA Negative, n (%)	P value
>5 years	65	65 (100.0%)	0 (0.0%)	
<5 years	35	13 (37.1%)	22 (62.9%)	
Total	100	78	22	
Mean $\pm$ SD		6.85 $\pm$ 1.85	3.91 $\pm$ 0.87	0.001

Among the study participants, 65 patients had diabetes for more than 5 years, and all of them (100.0%) were positive for microalbuminuria. In contrast, among the 35 patients with diabetes duration less than 5 years, 13 (37.1%) were microalbuminuria positive, and 22

(62.9%) were negative. The mean duration of diabetes was significantly higher in microalbuminuria positive patients (6.85 $\pm$ 1.85 years) compared to negative patients (3.91 $\pm$ 0.87 years, P=0.001).

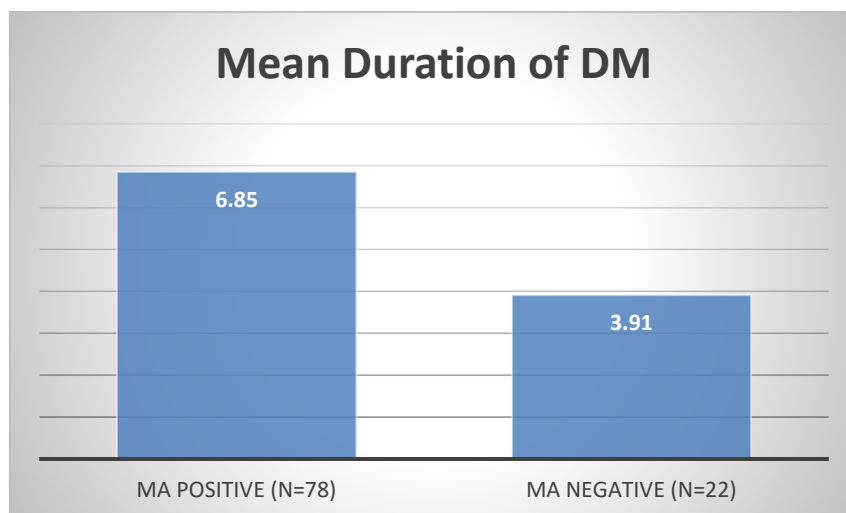


Figure 2: Mean Duration of Diabetes Mellitus in Microalbuminuria Positive and Negative Patients.

Table 3: Pearson Correlation Between Microalbuminuria and Selected Glycemic and Renal Parameters in the Study Population

Parameter		Pearson correlation (r)	P value
Microalbuminuria ($\mu\text{g}/\text{min}$)	S. albumin	-0.750**	0.001
	U. creatinine	-0.762**	0.001
	ACR	+0.997**	0.001
	HbA1c	+0.750**	0.001
	FBS	+0.717**	0.001
	S. creatinine	+0.694**	0.001

Microalbuminuria showed significant correlations with all studied parameters. Strong positive correlations were observed with albumin-creatinine ratio ($r = +0.997$, $P=0.001$), HbA1c ($r = +0.750$, $P=0.001$),

fasting blood sugar ($r = +0.717$, $P=0.001$), and serum creatinine ($r = +0.694$, $P=0.001$). Strong negative correlations were found with serum albumin ($r = -0.750$, $P=0.001$) and urinary creatinine ($r = -0.762$, $P=0.001$).

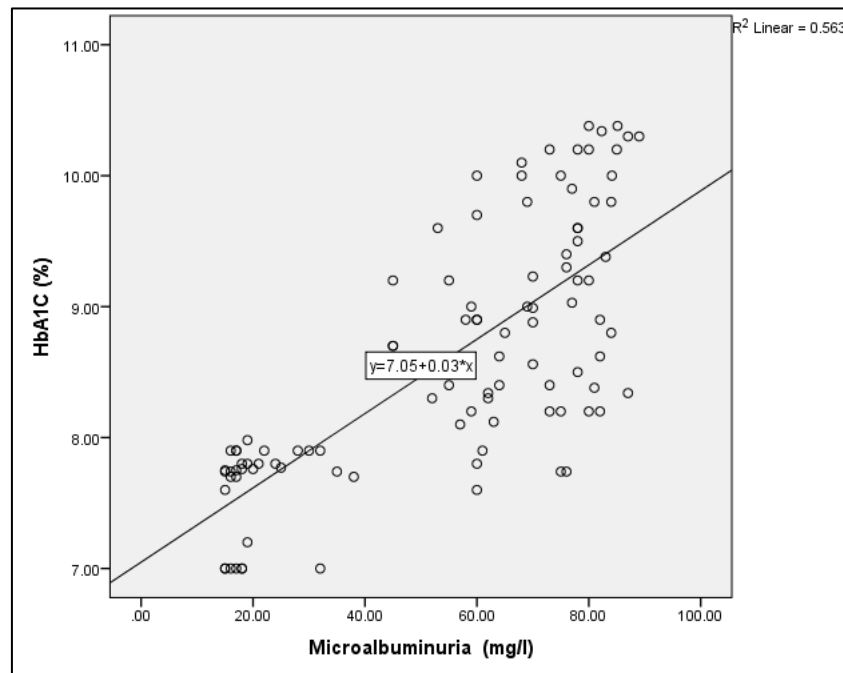


Figure 3: Scatter Diagram Showing the Correlation Between Microalbuminuria and HbA1c

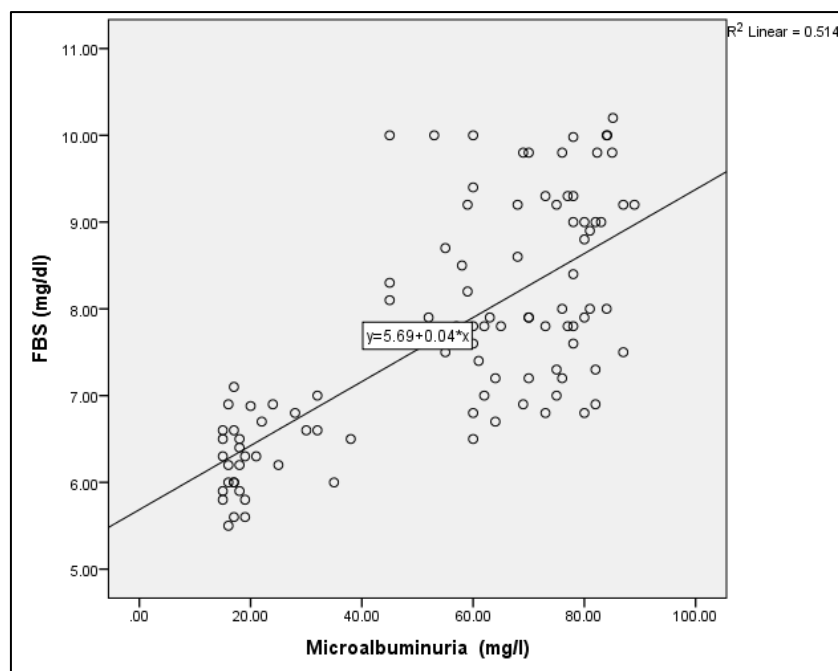


Figure 4: Scatter Diagram Showing the Correlation Between Microalbuminuria and Fasting Blood Sugar

DISCUSSION

The prevalence and correlates of microalbuminuria among postmenopausal women with type 2 diabetes mellitus at a tertiary care hospital in Bangladesh were evaluated in this study. Microalbuminuria, an early marker of diabetic kidney disease, poses significant risks for renal and

cardiovascular complications if not detected and managed timely. The findings highlight the multifactorial influences on microalbuminuria, including prolonged diabetes duration and poor glycemic control. The high prevalence and strong associations with glycemic and renal parameters emphasize the importance of early screening and targeted interventions to prevent

progression to overt nephropathy and reduce associated morbidity in this vulnerable population.

In the present study, microalbuminuria was detected in 78% of postmenopausal women with type 2 diabetes mellitus, indicating a high prevalence of early renal involvement in this population. This finding aligns with the observations of Sana *et al.*, [19], who also reported a significant prevalence of microalbuminuria among patients with T2DM and emphasized its strong association with poor glycemic control. Similarly, Weir *et al.*, [20] found microalbuminuria in 28.2% of diabetic patients, along with 7.6% showing clinical proteinuria, underscoring the progressive nature of diabetic nephropathy. The higher prevalence observed in the present study may be attributed to the older, postmenopausal cohort and longer diabetes duration, both of which are known contributors to endothelial dysfunction and increased renal microvascular permeability. Collectively, these findings highlight the importance of early screening for microalbuminuria in postmenopausal diabetic women to facilitate timely intervention and prevent progression to overt nephropathy.

A significant association was also observed between the duration of diabetes and the presence of microalbuminuria. All patients with diabetes duration greater than five years were microalbuminuria positive, while only 37.1% of those with a duration less than five years showed positivity, indicating a strong temporal relationship between prolonged hyperglycemia and renal microvascular damage. This finding concurs with Indriani *et al.*, [21], who reported that longer diabetes duration was significantly associated with microalbuminuria (mean duration 9.37 ± 5.96 years; $\beta = 0.367$; $p < 0.001$). Similarly, Naskar *et al.*, [22] found that patients with diabetes for more than five years were 1.48 times more likely to develop microalbuminuria compared to those with shorter disease duration ($p = 0.016$). The consistent trend across studies underscores that the risk of microalbuminuria increases with the chronicity of diabetes, reflecting cumulative glycemic burden and endothelial dysfunction. These findings emphasize the importance of early and sustained glycemic control in delaying the onset of diabetic nephropathy among postmenopausal women.

Furthermore, microalbuminuria in the present study demonstrated strong positive correlations with HbA1c, fasting blood sugar (FBS), serum creatinine, and albumin-creatinine ratio (ACR), along with significant negative correlations with serum albumin and urinary creatinine. This indicates that poor glycemic control and renal dysfunction are closely interlinked in the early stages of diabetic nephropathy. These results are consistent with Na *et al.*, [23], who reported a significant positive correlation between urinary albumin-creatinine ratio and HbA1c ($r = 0.565$, $P < 0.01$) in postmenopausal diabetic women, highlighting the contribution of chronic

hyperglycemia to microvascular injury. Similarly, Bae *et al.*, [24] observed that HbA1c showed the strongest association with microalbuminuria among female patients, emphasizing the gender-specific impact of glycemic control on renal outcomes. Gnanasegaran *et al.*, [25] also found that microalbuminuria was significantly associated with fasting and postprandial blood glucose levels and duration of diabetes ($P < 0.001$), supporting the relationship between glycemic dysregulation and early renal impairment. Together, these findings reinforce that poor glycemic control and longer diabetes duration are key determinants of microalbuminuria in postmenopausal women, underscoring the need for regular metabolic and renal monitoring to prevent diabetic nephropathy.

Limitations of the study

This study had a few limitations:

- Urinary albumin was measured on a single occasion, which may not reflect fluctuations over time.
- The study was conducted in a single hospital, limiting the generalizability of the findings to the wider community.
- The sample size was relatively small due to time and cost constraints, which may affect representativeness; a larger sample could have yielded more robust and generalizable results.

CONCLUSION

Microalbuminuria is highly prevalent among postmenopausal women with type 2 diabetes mellitus and is closely associated with longer disease duration and poor glycemic control. The study also demonstrated significant correlations between microalbuminuria and key renal and metabolic parameters, highlighting early renal involvement in this population. These findings emphasize the importance of regular screening and optimal glycemic management to prevent diabetic nephropathy in postmenopausal women in Bangladesh.

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