

Original Research Article

Association between serum uric acid level and microalbuminuria among type 2 diabetic patients: a cross-sectional study

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ABSTRACT

Background: Diabetic nephropathy is common and its advancement is affected by different factors and one of them, serum uric acid has crucial role in the progression of kidney injury. The objective of this study is the determination of the association of serum uric acid level with the microalbuminuria among type 2 diabetic patients.

Methods: This cross-sectional study was performed in a tertiary care hospital of Rawalpindi, among 108 patients for 8 months from March 2021 to October 2021. Patients' recruitment was done by the inclusion and exclusion criteria and convenient sampling technique. Data was obtained via a self-designed proforma. Descriptive and inferential statistics were applied for data analysis. $P < 0.05$ was taken as statistically significant. Data analysis was performed by SPSS version 25.0.

Results: From total study population, 60 (55.55%) were females, whereas, 48 (44.45%) were males. The means of age for the study population and serum uric acid were 48.98 ± 15.67 years and 7.12 ± 0.91 respectively. The overall frequencies of hyperuricemia and microalbuminuria were 41 (37.96%) and 33 (30.55%) respectively. The frequency of hyperuricemia was higher among older age group, women, and patients with microalbuminuria. The associations of serum uric acid level with the age group, gender, and albuminuria were significant statistically.

Conclusions: Correlation between the serum uric acid levels and albuminuria is statistically significant. Serum uric acid levels have statistically significant relationship with age and gender as well. Serum uric acid level was higher among older age group, females, and patients with microalbuminuria.

Keywords: Association, Serum, Uric acid, Microalbuminuria, Type 2, Diabetic, Patients, Cross-sectional

INTRODUCTION

Diabetes mellitus (DM) is a prevalent endocrine disease in which insulin deficiency or insulin resistance in body cells leads to raised blood glucose level. According to international federation of diabetes more than 451 million people around the globe have been influenced by the DM and it is guessed that this number would go to 693 million by the end of 2045.¹ World health organization has reported that approximately 12.9 million population of

Pakistan have DM and hardly 9.4 million people, of whole diabetic population, have diagnosed with DM, whereas, almost 3.5 million people remained undiagnosed. Moreover, number of prediabetes population in Pakistan is nearly 38 million, and most of this population are females.^{2,3}

DM is linked with various microvascular and macrovascular complications. Microvascular complications included retinopathy, nephropathy, and

neuropathy. While macrovascular complications are myocardial infarction, cerebrovascular accident, and peripheral arterial diseases. As prevalence of DM is rising day by day, therefore, its linked complication frequencies are also raising. Almost 120,000 people in Pakistan, die every year due to DM related complications.^{3,4}

One of the most common microvascular complications of DM is diabetic nephropathy. Microalbuminuria is early indicator of renal involvement. Deranged level of albumin in urine occurs 30-40% of patients of DM2.⁵

Diabetic nephropathy is one of the leading causes of end-stage renal disease (ESRD). Several factors lead to progression of diabetic nephropathy to ESRD such as age, smoking, poor glycemic control, obesity, and hypertension.⁶ The basic mechanism linked with renal injury advancement is inflammation and endothelial damage. Recent studies have shown that raised serum uric acid causes inflammation and endothelial injury and causes further development in diabetic nephropathy.^{7,8}

Different research articles all over the world have noted that hyperuricemia is associated with microalbuminuria and thus with the progression of diabetic nephropathy.^{9,10} However, the research work on the association between the serum uric acid level and microalbuminuria in current research locality is little, therefore this study aims to determine the association of the serum uric acid level with the microalbuminuria among type 2 diabetic patients Rawalpindi, Pakistan.

METHODS

This cross-sectional study was carried out in the outdoor of Endocrinology department, of a tertiary care hospital of Rawalpindi, among one hundred and eight patients diagnosed with type 2 DM (According to WHO criteria for DM diagnosis a fasting plasma glucose concentration ≥ 7.0 mmol/L and 2 hours post-glucose load concentration ≥ 11.1), for eight months from March 2021 to October 2021. WHO calculator was used to calculate the study sample size. Non-probability convenient sampling and an established inclusion and exclusion criteria were applied for the recruitment of the study participants. Patients with older than 30 years and type 2 DM, and who had no cancer, no kidney disease due to other causes, no liver disease and no psychiatric diseases, were enrolled in the study. While, those who had an age below 30 years, cancer, kidney disease related to other

causes, liver disease, and any psychiatric diseases, were excluded. From the all participants before the data collection, informed consent was taken. Data was collected by applying a self-structured questionnaire. This questionnaire had two components. First component was regarding the socio-demographic features of the study population like age group (Between 30 years to 50 years, above 50 years) and gender (female and male). Second component was related to the biochemical values of study variables such as albuminuria and serum uric acid level. Microalbuminuria is defined as having a urine spot for albumin to creatinine ratio (UACR) from 2.5 to 30 mg/mmol in men and from 3.5 mg/mmol to 30 mg/mmol in women, whereas normo-albuminuria was defined as having urine spot for albumin to creatinine ratio less than 2.5 mg/mmol and 3.5 mg/mmol in men and women respectively. Hyperuricemia is defined as serum uric acid levels >6 mg/dl (360 $\mu\text{mol/l}$) and >7 mg/dl (416 $\mu\text{mol/l}$) in females and males respectively, while serum uric acid level ≥ 6.5 mg/dl (387 $\mu\text{mol/l}$) to >8.3 mg/dl (494 $\mu\text{mol/l}$) is considered as hyperuricemia without regard to gender. We took urine samples from morning and midstream for the determination of the UACR. Patients' serum samples were obtained for the determination of the uric acid status of them. After data collection, data analysis was conducted in Statistical Package for the Social Sciences (SPSS) version 25 (Armonk, NY: IBM Corp.) by the implementation of the inferential and descriptive statistics. The frequency and percentage of qualitative variables were measured, whereas, means of quantitative variables were calculated. Chi-square test was applied to assess the association between the uric acid and other study variables. $P < 0.05$ was taken as statistically significant.

RESULTS

Out of one hundred and eight patients, 60 (55.55%) were females, whereas, 48 (44.45%) were males. The means of age for the study population and serum uric acid were 48.98 years with standard deviation (SD) of ± 15.67 years and 7.12 with SD of ± 0.91 respectively. The overall frequencies of hyperuricemia and microalbuminuria were 41 (37.96%) and 33 (30.55%) respectively.

Table 1 shows that frequency of hyperuricemia was higher among older age group and women. Furthermore, it is also shown in the associations between the age group and serum uric acid level, and between the gender and serum uric acid level were statistically significant.

Table 1: Comparison of frequencies and percentages of serum uric acid level across the age group and gender.

Variables		Serum uric acid level		Chi-square test
		Normal uric acid	Hyperuricemia	P value
Age group (in years)	Between 30 to 50	47 (43.51%)	15 (13.89%)	0.028
	Above 50	20 (18.51%)	26 (24.07%)	
Gender	Male	34 (31.48%)	14 (12.96%)	0.026
	Female	33 (30.55%)	27 (25.0%)	

Table 2: Comparison of frequencies and percentages of serum uric acid level across the albuminuria status.

Variables		Serum uric acid level status		Chi-square test
		Normal uric acid	Hyperuricemia	P value
Albuminuria status	Normoalbuminuria	59 (54.63%)	16 (14.82%)	0.012
	Microalbuminuria	08 (7.41%)	25 (23.15%)	

Table 2 presents that frequency of hyperuricemia was higher among patients with microalbuminuria in contrast to the patients with normo-albuminuria. It also explains that the association between the serum uric acid level and albuminuria level was statistically significant.

DISCUSSION

Current study has provided valuable information about the association of serum uric acid level and microalbuminuria among type 2 diabetic patients in Rawalpindi, Pakistan. Moreover, it has also highlighted the difference in the frequency hyperuricemia based on the age and gender.

First of all, we found that the incidence of the hyperuricemia was 37.96% in current study population. Almost similar incidence of hyperuricemia was presented in a that was also conducted in Pakistan.¹¹ The incidence of microalbuminuria was 30.55% in present study population, another Pakistani study showed consist finding about the incidence of the microalbuminuria (31.78%).¹²

After the assessment of incidences of the hyperuricemia and microalbuminuria among the study population, we evaluated the difference in the frequency of hyperuricemia based on the age, and we noted that the hyperuricemia frequency was higher among the older study population as compared to the younger study population. Likewise, it was also discovered that relationship between the age and serum uric acid level is statistically significant ($p=0.028$). Similar finding was noted by different research articles.^{13,14}

Then we also observed the difference in the frequency of hyperuricemia in the study population based on gender, and we noticed higher frequency of hyperuricemia among females. Moreover, current study has also suggested that correlation between the serum uric level and gender is statistically significant ($p=0.026$). This finding of current study was supported by several studies that were performed in various parts of the globe.^{11,13}

Regarding the association of serum uric acid level and microalbuminuria, we found that hyperuricemia was more common among the diabetic patients with the microalbuminuria in contrast to the diabetic patients with normo-albuminuria, and the association between the serum uric acid level and microalbuminuria was statistically significant with the $p=0.012$. These results of the current study were also endorsed by different studies in literature.^{1,14}

This study has suggested that as microalbuminuria is considered as screening tool in for the diabetic nephropathy, while serum uric acid can used as monitoring tool for the assessment of the progression of the diabetic nephropathy to end stage renal disease (ESRD). Besides, presenting such crucial details about serum uric acid and microalbuminuria, this study also has some limitations as this research could not explain how serum uric acid leads to advancement of renal injury in diabetic patients. Therefore, further research work is needed to assess that how uric acid level causes deterioration in the diabetic nephropathy.

CONCLUSION

In short, current study we noted that level of serum uric acid and microalbuminuria are positively and significantly correlated. Serum uric acid could be used for the monitoring of advancement of diabetic nephropathy among type 2 diabetic patients. Furthermore, this study has also showed that serum uric levels are significantly related with gender and age. Serum uric levels were higher among the female gender and older study population.

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

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