

Original Research Article

Serum Uric Acid Levels in Type 2 Diabetes Mellitus

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Abstract:

Introduction: The previous studies done to see the serum uric acid level in type 2 diabetic patients have shown the conflicting results and most of them have shown low serum uric acid level in the diabetic patient. This study was done to see the uric acid level in diabetic patient and to give the insight behind the mechanism of the result found in the study.

Material and methods: 50 type 2 Diabetic patients without nephropathy were taken as cases and 50 age and sex matched normal healthy individual were taken as controls. FBS, PP₂BS, serum Uric acid, serum creatinine and urea were estimated in both. 24-Hour Urinary uric acid and creatinine were estimated in cases and controls.

Result: Serum creatinine and urea, and urinary creatinine were identical in cases and controls. There is significant decrease in the serum uric acid concentration in cases compare to controls. There is also significant increase in the urinary uric acid in cases compare with controls. There is no correlation between FBS and serum uric acid. There is significant positive correlation of FBS and PP₂BS with urinary uric acid. There is also significant correlation of PP₂BS with serum uric acid and serum uric acid with urinary uric acid.

Conclusion: The uricosuric effect of blood sugar on kidney is affecting the reabsorption of uric acid resulting increase excretion of uric acid in the urine, which shown by our result as decrease serum uric acid in diabetic patients.

Key words: Serum Uric acid, urinary Uric acid, type 2 Diabetes Mellitus.

Introduction:

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia with disturbances in the carbohydrate, fat and protein metabolism due to absolute or relative deficiency of insulin secretion or its action.^{1,2} The prevalence of diabetes mellitus is rising at alarming rate. The status of diabetes mellitus has changed from mild disorder of elders to one of the major cause of morbidity and mortality affecting youths and middle age. Total burden of diabetes mellitus will rise from 285 million in 2010 to 438 million by 2030.^{3,4} The final oxidation product of the purine metabolism is uric acid. The level of uric acid is determined by the balance of its production, reabsorption and secretion.^{5,6} In previous studies it has been shown that hyperuricemia is associated with hypertension, cardiovascular disease and renal diseases and insulin resistance.⁷ The association of uric acid and blood glucose was first described in 1923, but the association between serum uric acid and diabetes mellitus is still not clear.⁸

Many researchers have begun to consider serum uric acid as the indicator of glycometabolic disorder but changes in the serum uric acid does not correlate with the changes in the blood glucose concentration.^{9,10} It has been shown in the various studies that positive correlation is present between serum uric acid and blood glucose

concentration in normal and prediabetic individual. While the serum uric acid level tends to decline in relation to blood glucose concentration in type 2 diabetes mellites. While some studies suggest a positive association between serum uric acid and diabetes mellitus or blood glucose concentration.^{11,12}

The aim of our study is see the levels of serum uric acid and its relationship with blood glucose in diabetic and non-diabetic individuals.

Materials and methods:

The study was conducted in the Pacific Medical College and Hospital, Udaipur, Rajasthan from March 2017 to February 2018. Institutional ethics committee clearance was taken before starting the study. Written consent was also taken from the study subjects.

50 type 2 Diabetes mellitus patients without any complications were enrolled as cases and 50 age and sex matched healthy individuals were enrolled as controls.

Subjects with history of chronic illness, smoking, alcohol intake, hypertension, hyperlipidemia, any complication of diabetes mellitus, any illness which causes increase uric acid and known case of hyperuricemia were excluded.

5 ml of venous blood was withdrawn from the patients after overnight fasting and kept in the plain and EDTA vacutainer. Plasma and serum was separated and kept in the freeze till the estimation was done.

Fasting blood sugar by GOD-POD method, serum uric acid by Uricase method, serum creatinine by modified Jaffe's method and serum urea by berthelot method were done in cobas c311 fully automated analyzer by commercially available kit.

All patients provided 24 Hour urinary samples. The following parameters were estimated in 24-hour urine sample: Uric acid by uricase method, Creatinine by modified jaffes method.

Statistical Analysis:

The results are expressed as Mean ± S.D. Significance of difference between cases and control groups are assessed by using the unpaired student 't' test. The 'p' values are expressed along with mean values and S.D. The 'p' value < 0.05 was considered statistically significant. Pearson correlation 'r' was used to assess the correlation between different parameters in the groups analysed.

Result:

Table No. 1. Shows the statistical difference of age and sex between cases and controls

	Cases	Controls	'p value'
Age (Years)	45 ± 6.27	44 ± 5.76	> 0.05
Sex (Male/Female)	35/15	37/13	

As shown in Table No. 1, there is no statistical difference between cases and controls with respect to age and sex.

Table No. 2. Shows the Mean \pm SD values of serum parameters in cases and controls

Parameter	Cases	Controls	'p' value
FBS (mg/dl)	164.37 \pm 39.74	101.81 \pm 9.66	< 0.05
PP ₂ BS (mg/dl)	210.85 \pm 48.25	124.57 \pm 13.29	< 0.05
Uric acid (mg/dl)	4.2 \pm 1.73	6.2 \pm 1.35	< 0.05
Creatinine (mg/dl)	0.93 \pm 0.36	0.89 \pm 0.26	> 0.05
Urea (mg/dl)	28.91 \pm 5.94	27 \pm 7.14	> 0.05

As shown in Table No.2, there is statistically significant difference in cases and controls with respect to FBS, PP₂BS, serum Uric acid. There is no statistically significant difference between cases and controls with respect to serum creatinine and serum Urea.

Table No. 3. Shows the Mean \pm SD values of parameters in 24 Hour Urine sample

Parameter	Cases	Controls	'p' value
Uric acid (mg/day)	967.61 \pm 48.47	639 \pm 68.59	< 0.05
Creatinine (mg/day)	1237.34 \pm 74.95	1201.89 \pm 97.31	> 0.05

As shown in Table No. 3, there is statistically significant difference between cases and controls with respect to 24-hour urinary uric acid. There is no statistically significant difference between cases and controls with respect to Creatinine.

Table No. 4. Shows the Pearson's correlation coefficient between various parameters

Correlation	Cases (r value)
FBS with Serum Uric acid	- 0.43
PP ₂ BS with Serum Uric acid	- 0.73
FBS with Urinary Uric acid	+ 0.58
PP ₂ BS with Urinary Uric acid	+ 0.85
Serum Uric acid with Urinary Uric acid	- 0.77

As shown in Table No. 4, there is no significant correlation of FBS with Serum Uric acid, but there is significant negative correlation of PP₂BS with Serum Uric acid in cases. There is also significant positive correlation

of FBS and PP₂BS with Urinary Uric acid. There is also significant negative correlation of Serum Uric acid with Urinary Uric acid.

Discussion:

In our study patients with type 2 Diabetes Mellitus there is significant decrease in the serum uric acid concentration compare to non-diabetic healthy controls as shown in table no. 2. As show in table no. 3 there is significant increase in the excretion of uric acid in the urine compared to controls. Our findings are consistent with the studies done by Sudhindra Rao M. et al.², Yunyang Wang et al¹³, Pavani Bandaru et al.⁷ and Bindu Pavani et al.¹⁴.

The net serum uric acid concentration is dependent on the synthesis, secretion and reabsorption of uric acid in the body.^{5,6} The low serum uric acid level may be the result of uricosuric effect of glucose on uric acid. This may result into increase excretion and decrease reabsorption of uric acid from kidney.¹⁴

70 % of the total uric acid excretion is done by the kidney.¹⁵ The exact mechanism is not known but the proposed mechanism is that the 100 % uric acid is filtered in the glomerulus to the renal tubules with 90% filtered load reabsorbed.¹⁶ Most of uric acid is reabsorbed by proximal tubules by urate/anion exchanger and a voltage sensitive urate channels.^{17,18} The blood glucose is also filtered and most of it reabsorbed in the proximal renal tubules. Both glucose and uric acid are reabsorbed at the same location in the kidney, so the blood glucose may affect the reabsorption of uric acid.^{19,20} GLUT9 transporter transports uric acid from lumen to proximal convoluted tubules. This reabsorption of uric acid by transporters is affected by several factors like organic and inorganic anions and glucose which results in decrease reabsorption and increase excretion of uric acid.²¹

In our study also as the blood glucose concentration is increasing there is increase in the excretion of the uric acid in the urine, suggestive of above mechanism, especially with PP₂BS where the concentration of the blood glucose is above 180 mg/dl.

Conclusion:

The decrease in the uric acid concentration of the type 2 Diabetes Mellitus without any complication may be due to uricosuric effect of glucose on uric acid, which is shown by the increase concentration of 24-hour urinary uric acid in the type 2 Diabetes mellitus.

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