

A Study of Serum Uric Acid Levels in Type 2 Diabetes Mellitus Subjects: A Cross Sectional Study

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ABSTRACT

Introduction: Diabetes mellitus is one of the major non-communicable diseases of which world is experiencing a serious epidemic these recent years. Uric acid serves as an early indicator of renal complications in diabetes mellitus patients.

Material and methods: This was an Observational, descriptive cross sectional study which was conducted during a period of 18 months (October 2016 and March 2018) This study was designed to check the levels of serum uric acid and its relation with creatinine, microalbuminuria, HbA1c, fasting and post prandial blood sugar levels in type 2 Diabetes subjects.

Results: Study included a total of 120 cases of type 2 Diabetes mellitus, out of which there were 69 males (57.5%) and 51 females (42.5%), with a mean age of 59.04 ±13.47 years. Mean FBS was 186.10 ±77.53 mg/dl, with majority of the subjects having elevated FBS. Mean PPBS of 274.94 ±108.66 mg/dl and of HbA1c 8.15 ± 1.7 was observed. The uric acid of majority number of our study participant males (65.22%) had level of ≥ 7.4, with a mean of 9.53 ± 4.38. Mean blood urea and serum creatinine levels were 46.91 ± 15.13 and 1.44 ± 0.29 respectively. There was significant association seen between uric acid levels and urine albumin, serum creatinine, twenty four hour urinary albumin, FBS and PPBS levels and HbA1c levels.

Conclusion: Present study had about two-third subjects with type 2 Diabetes mellitus with elevated uric acid levels had microalbuminuria and elevated serum creatinine levels.

Keywords: Type 2 Diabetes, Microalbuminuria, Serum Uric Acid levels.

INTRODUCTION

Diabetes Mellitus is a chronic disorder that is associated with cardiovascular complications, renal complications and various types of microangiopathies including metabolic syndrome. The International Federation of Diabetes, reported that around 415 million adults around all over the world are suffering from diabetes, and they estimated that the numbers are likely to reach around 642 million by 2040.¹

Recent studies have demonstrated that serum uric acid levels are higher in subjects with prediabetes and early type 2 diabetes than in healthy controls.^{2,3} Hyperuricemia has been also added to the set of metabolic abnormalities associated with insulin resistance or hyperinsulinemia in metabolic syndrome.⁴⁻⁶ This study was carried out to evaluate the level of serum uric acid in type 2 Diabetes mellitus patients and to correlate the parameters of diabetic nephropathy like microalbuminuria and serum creatinine levels with uric acid in type 2 Diabetes mellitus subjects.⁷

The current research aimed to study the levels of serum uric acid in type 2 Diabetes mellitus subjects and relation with microalbuminuria and serum creatinine levels.

MATERIAL AND METHODS

This was an Observational, descriptive cross sectional study. Present study included 120 subjects which were diagnosed type 2 Diabetes mellitus. This study was conducted at Krishna Hospital Medical Research Centre (KHMRC), Karad a tertiary care hospital and teaching institute, in the department of Medicine.

Study Period: This study was conducted over a period of 18 months (October 2016 and March 2018)

Inclusion criteria: Patients age more than 18 years with diagnosis of type 2 Diabetes mellitus

Exclusion criteria: Patients with renal failure and creatinine levels >1.5 mg/dl, renal stones, liver disease, drugs affecting renal function and uric acid level

STATISTICAL ANALYSIS

Data will be analysed for mean, percentage, standard deviation, chi square test, multiple correlation and multivariate analysis, by using SPSS-10 (Statistical Package for the Social Sciences) for Windows (SPSS, Chicago, Inc).

RESULTS

The mean for age in the study subjects was 59.04 (±13.47) years predominated by age group of 61 – 70 years (31.67%), followed by 51 – 60 years (30%). There were 71-80 years (13.33%), 41-50 years (11.67%) 31-40 years was (7.5%) and <30 years (3.33%). There were 69 males (57.5%) and 51 females (42.5%) in the study.

The fasting blood sugars (FBS) of the subjects had mean of 186.10 ±77.53 mg/dl. Majority number of subjects

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Uric acid (mg/dl)	Serum creatinine (mg/dl)		Total	
	< 1.3	≥ 1.3		
<7.4	21	23	44	
≥7.4	14	62	76	
Total	35	85	120	
$\chi^2=11.58$; DF=1; 'p'<0.001				
Uric Acid (mg/dl)	HbA1c (%)		Total	
	< 6.5	≥ 6.5		
<7.4	18	26	44	
≥7.4	6	70	76	
Total	24	96	120	
$\chi^2=18.98$; DF=1; 'p'<0.001				
Uric Acid (mg/dl)	Twenty four hour urinary albumin			Total
	< 30	30 – 300	>300	
<7.4	11	22	10	43
≥7.4	9	58	10	77
Total	20	80	20	120
$\chi^2=7.357$; DF=2; 'p'=0.025				
Uric Acid (mg/dl)	Fasting blood sugar			Total
	<100	100-125	>125	
<7.4	6	8	28	42
≥7.4	10	3	65	78
Total	16	11	93	120
$\chi^2=11.03$; DF=2; 'p'=0.004				
Uric Acid (mg/dl)	Postprandial blood sugar			Total
	< 140	140-199	< 200	
<7.4	7	12	25	44
≥7.4	7	9	60	76
Total	14	21	85	120
$\chi^2=6.79$; DF=2; 'p'=0.033				

Table-1: Association between uric acid levels with Serum creatinine, HbA1c, FBSL and PPBSL

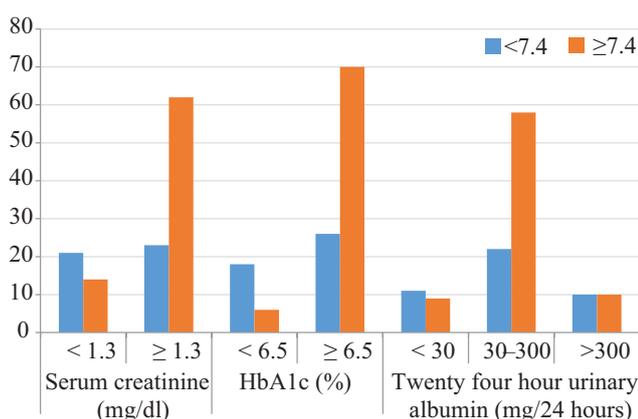


Figure-1: Association between uric acid levels with serum creatinine, HbA1c and twenty four hour urinary albumin

(77.50%) had elevated fasting blood sugar levels (>126), some (11.67%) had fasting blood sugar levels of less than 100 mg/dl while few (10.83%) had between 100-125 mg/dl range. The postprandial blood sugars (PPBS) of the subjects had mean of 274.94 ± 108.66 mg/dl. Significant number of subjects (70.83%) had raised PPBS (>200 mg/dl), some

(17.50%) had PPBS of 140–199 mg/dl while few (11.67%) had less than 140 mg/dl. The subjects in present study had mean HbA1c levels of 8.15 ± 1.7 majority number of subjects (51.67%) had levels of more than 8.1, some (20%) had controlled sugars with levels of less than 6.5, while others had levels of 7.1-7.5 (11.67%), 7.6 - 8 (9.16%) and 6.5 - 7 (7.50%).

The uric acid of majority number of present study participant males (65.22%) had level of ≥7.4, rest (34.78%) had levels of 3 – 7.4. The uric acid of maximum number of our study participant females (80.39%) had level of ≥6.3, rest (19.61%) had levels of 2.1– 6.3. Uric acid levels had a mean of 9.53 ± 4.38.

Mean blood urea and serum creatinine levels were 46.91 ± 15.13 and 1.44 ± 0.29 respectively. Blood urea of majority number of subjects (95.83%) had values of more than 26 mg/dl; few (4.17%) had values of 10–26 mg/dl. Maximum number of the study subjects (58.33%) had creatinine levels of 1.3 – 2, rest (41.67%) had levels of 0.6 – 1.3. Majority (81.67%) of the study participants had twenty four hour urinary albumin in the range of microalbuminuria (30-300 mg), some (10%) had macroalbuminuria (>300 mg) while few (8.33%) had levels of <30 mg. The mean twenty four hour urinary albumin in our participants was 129.26 ± 78.90 mg/dl. The significant number (41.67%) of our study subjects had urine albumin negative (nil / 0); 35% had 1+, 15.83% had 2+ and 7.50% had 3+ urine albumin.

In present study, significant association was seen between the serum creatinine and uric acid levels (p<0.001), we observed that with elevated serum creatinine levels of the subjects, there was also increase in uric acid levels (fig-1). Significant association was seen between twenty four hour urinary albumin and uric acid levels (p = 0.025), with increase in uric acid levels, we observed that microalbuminuria was significant. Similarly, highly significant association was seen between HbA1c and uric acid levels in present study (p < 0.001). There was significant association seen between fasting blood sugar levels and uric acid levels in the study (p=0.004). High uric acid levels were seen more in subjects with raised fasting blood sugar level and similarly it was significant between PPBS levels and uric acid levels in present study. (p=0.033) (table-1).

DISCUSSION

Current study observed effects of uric acid levels in type 2 Diabetes mellitus and its correlation with creatinine and microalbuminuria. The age group wise distribution in the study observed mean age 59.04 years ± 13.47 years. Majority subjects were from age group of 61–70 years (31.67%). The study by Saeed et al observed mean age similar to the current study (57 ± 8.3 years). There were (57.50%) males and (42.50%) females in present study. Prabhswamy et al, Prashant et al quoted there were predominant males in their study similar to present study.⁸⁻¹⁰

Mean of fasting blood glucose was found to be 186.10 ± 77.53 mg/dl. Majority number of subjects (77.50%) had high fasting blood sugar levels. The study by Talwar et al had

mean FBS to be 222 ± 14.82 which is higher than the current study.¹¹ The post prandial blood sugars of the subjects had mean of 274.94 ± 108.66 mg/dl. The study by Talwar et al¹² had mean of 273.91 ± 32.59 similar to the current study. The uric acid of majority number of present study participant females (80.39%) had level of ≥ 6.3 , rest (19.61%) had levels of 2.1–6.3. Mean uric acid levels in a study by Talwar et al¹² was seen to be 3.93 which is lower than the current study among females.

Blood urea of majority number of subjects (95.83%) had values of more than 26 mg/dl, few (4.17%) had values of 10 – 26 mg/dl. The study by Prabhuswamy et al had mean urea level of 22.28 which is lower than the current study. Majority of the study subjects (58.33%) had creatinine levels of 1.3 – 2, rest (41.67%) had levels of 0.6 – 1.3. The study by Prabhuswamy et al had mean creatinine level of 0.805 which is lower than the current study. Majority (41.67%) number of our study patients had urine albumin negative (nil / 0). Some (35%) had urine albumin level of 1, rest had levels of 2 (15.83%) and 3 (7.50%).¹⁴

In current study twenty four hour urinary albumin levels were maximum in the range of 30-300 mg/dl levels (81.67%), (10%) had levels of >300 mg, while few (8.33%) had levels of <30 mg. The study by Suryawanshi et al saw increased microalbuminuria in diabetics as seen in the current study.¹² The study by Wen CP et al had lower levels of microalbuminuria in contrast to the current study.¹³

There was highly significant association seen between Urine albumin and Uric acid levels of the study participants ($p < 0.001$), with increasing levels of urine albumin along with increased uric acid levels. Similar findings were seen in a study by Prabhuswamy et al and Barkha Goyal et al.^{14,15} Significant association was seen between twenty four hour urinary albumin and Uric Acid levels ($p = 0.032$), with increasing uric acid levels of the subjects, increase in 24 Hr urinary albumin was observed. The study by Prabhuswamy et al findings were similar to the current study where they found correlation between the two.¹¹ Microalbuminuria is a good predictor of diabetic nephropathy, the earlier it is detected better the chances of preventing further renal damage.¹⁶

In present study, significant association was seen between the serum creatinine and uric acid levels ($p = 0.001$), we observed that with increasing serum creatinine levels of the subjects, there was also increase in Uric Acid levels. Many studies saw association with poor glycemic control and creatinine like study by Naveen et al and by Barkha Goyal et al. Uric acid levels also serve as an indicator of cardiac risk, which when raised in the cases of type 2 DM, further adds the cardiac risk which is already there due to diabetes.^{17,18}

The current study saw highly significant association between HbA1c and Uric acid levels ($p < 0.001$). With increasing levels of uric acid observed in subjects with HbA1c levels of ≥ 6.5 .

CONCLUSIONS

The present study is predominated by male gender and age

group of more than 60 years. Uric acid levels were observed elevated in subjects with high blood sugar levels, as seen on glycemic index. The serum creatinine levels were elevated in subjects who were type 2 Diabetes mellitus with high uric acid levels. About two-third subjects with type 2 Diabetes mellitus with elevated uric acid levels had microalbuminuria. There was positive correlation of uric acid levels with HbA1c. The study population had an elevated uric acid levels with microalbuminuria in type 2 Diabetes mellitus. Hence it is sensible to check uric acid and urine albumin levels in subjects with type 2 Diabetes mellitus to prevent renal complications.

REFERENCES

1. Akhtar SN, Dhillon P. Prevalence of diagnosed diabetes and associated risk factors: Evidence from the large-scale surveys in India. *Journal of Social Health and Diabetes* 2017;1;5:28.
2. Alberti KG, Zimmet P, Shaw J. Metabolic syndrome—a new world-wide definition. A consensus statement from the international diabetes federation. *Diabetic medicine* 2006; 23:469-80.
3. Poulsen P, Kyvik KO, Vaag A. Heritability of type 2 (non-insulin dependent) diabetes mellitus and abnormal glucose tolerance—a population-based twin study. *Diabetologia* 1999;42:125–127.
4. Rich SS. Mapping genes in diabetes: genetic epidemiological perspective. *Diabetes* 1990;39:1315–1319.
5. Cook JT, Shields DC, Page RC, et al. Segregation analysis of NIDDM in Caucasian families, *Diabetologia* 1994; 37:1231–1240.
6. Perley MJ, Kipnis DM. Plasma insulin responses to oral and intravenous glucose: studies in normal and diabetic subjects. *J Clin Invest* 1967; 46:1954– 1962.
7. Harris H. The familial distribution of diabetes: a study of the relatives of 1241 diabetic proposition. *Ann Eugenet* 1950;15:95–119.
8. Behradmanesh S, Horestani MK, Baradaran A, Nasri H. Association of serum uric acid with proteinuria in type 2 diabetic patients. *Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences*. 2013;18:44.
9. Prabhuswamy KM, Virgin Joena M. A cross sectional study of correlation between serum uric acid level and micro-albuminuria in type 2 Diabetes Mellitus patients 2013,13;189-223.
10. Prashanthkumar G, Nagendra S, Kashinath RT. Plasma Uric Acid Levels in Relation to Plasma Cholesterol Levels in Type-2 Diabetes Mellitus. *Global Journal of Medical Research*. 2015,14;123-201.
11. T.Talwar, L.Tanwar, M.Gupta. Study of serum uric acid levels in type-2 diabetes mellitus patients. *Journal of Dental and Medical Sciences*. 2017,32: 83-89.
12. Suryawanshi KS, Jagtap PE, Belwalkar GJ, Dhonde SP, Nagane NS, Joshi VS. To study serum uric acid and urine microalbumin in type-2 diabetes mellitus. *Int J Med Sci*. 2015;2:24-9.
13. Wen CP, Cheng TY, Chan HT, Tsai MK, Chung WS, Tsai SP et al, Examination of its independent effect in a large cohort with low cardiovascular risk. *American*

- journal of kidney diseases. 2010.1;56:273-88.
14. Goyal B, Goyal J, Sinha M, Fiza B, Sharma P, Bandhari S, Sharma P. Association of glycosylated hemoglobin with microalbuminuria in patients with type 2 diabetes mellitus. *International Journal of Biotechnology and Biochemistry*. 2017;13:311-23.
 15. Brunzell JD, Robertson RP, Lerner RL. Relationships between fasting plasma glucose levels and insulin secretion during intravenous glucose tolerance tests. *J Clin Endocrinol Metab* 1976;42:222-229.
 16. Avula NR, Shenoy D. Evaluation of association of hyperuricaemia with metabolic syndrome and insulin resistance. *Journal of clinical and diagnostic research: JCDR*. 2016;10:32-53.
 17. Mogensen CE. Microalbuminuria as a predictor of clinical diabetic nephropathy. *Kidney international*. 1987;31:673-89.
 18. Feig DI, Kang DH, Johnson RJ. Uric acid and cardiovascular risk. *New England Journal of Medicine*. 2008;359:1811-21.

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