Relationship of Serum Uric Acid with Type II Diabetes Mellitus

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ABSTRACT *Introduction:* Diabetes mellitus is a group of metabolic disease characterized by high blood glucose levels that results from defects in insulin secretion or action or both. Some recent studies had shown that elevated level of uric acid is involved in the pathogenesis of type 2 diabetes, regardless of other characteristics of subjects. *Aims and Objectives:* Our aim was to investigate the correlation of serum uric acid concentration with Diabetes mellitus. *Materials & Methods:* One hundred and fifty type 2 diabetes mellitus subjects (male 80, female 70) and fifty non-diabetic subjects (25 male, 25 female) were included in the study over 1 year (June 2015 to May 2016). The study was conducted in the Department of Biochemistry, Kurnool Medical College, Kurnool. Uric acid was measured by enzymatic method. *Results:* The level of uric acid was higher in male and female diabetic subjects ($p<0.05$ and $p<0.001$) compared to non-diabetic subjects. *Conclusion:* Uric acid showed a positive association with fasting blood sugar (FBS), diastolic blood pressure, in case of diabetes subjects. These data strongly suggest that compared to non-diabetic subjects, diabetic subjects have significantly higher uric acid level.

Introduction:

Diabetes mellitus is a group of metabolic disease characterized by high blood glucose levels that results from defects in insulin secretion or action or both. Diabetes mellitus is commonly associated with hypertension and atherosclerotic cardiovascular disease. Cardiovascular disease is substantially increased in Diabetes with hyperglycemia. Identifying risk factors for the development of type 2 diabetes is essential for its early screening and prevention. It was shown in a prospective follow up study that high serum uric acid is associated with higher risk of type 2 diabetes independent of obesity, dyslipidemia and hypertension (1). Recent evidence suggests that uric acid plays a role in cytokine secretion and has been identified as a mediator of endothelial dysfunction and systemic inflammation (2). Chien et al (3) reported a positive association between plasma concentration of uric acid and the incidence of type 2 diabetes. The association was somewhat attenuated after adjustment for metabolic syndrome, suggesting that the association between hyperuricemia and diabetes was partly mediated through the metabolic syndrome in particular insulin resistance. Such result may not be contrary to the suggested protective effect of uric acid. Uric acid is the final oxidation product of urine catabolism in human. Serum uric acid has been shown to be associated with cardiovascular disease (CVD), hypertension and chronic kidney disease in previous studies (1, 4-7). In previous epidemiological studies, also elevated uric acid level is a risk factor for peripheral arterial disease (2), insulin resistance and components of metabolic syndrome. It is quite conceivable, in the context of the complex cellular environment of metabolic syndrome which is clearly associated with oxidative stress, antioxidant properties of uric acid might convert to a pre-oxidant state owing to reactive oxygen species (ROS) accumulation (8). This may also lead to adverse affects on endothelial function and a pro-inflammatory response, both of which are known to be associated with new onset of type 2 diabetes (9). Some studies reported that there is a positive association between high serum uric acid level and diabetes (3, 8-12) whereas other studies show no association (13) or inverse association (14, 15).

Materials and Methods:

150 type 2 diabetes subjects (male 80, female 70) and fifty non-diabetic subjects (25 male, 25 female) with age ≥40 years were included in study. Subjects were in fasting condition for at least eight hours and in subsequent morning venous blood was drawn at fasting and 2 hours after breakfast respectively. Blood samples were allowed to clot for thirty minutes and then centrifuged for 10 minutes at 3000 rpm and serum samples were collected for the estimation of fasting glucose, serum lipid profile (Total cholesterol, HDL-C, LDL-C, and TG), creatinine and uric acid. Blood pressure (BP) was measured by a sphygmomanometer. Hepatic complications like jaundice, hepatitis B and C virus positive or chronic liver failure and cirrhosis patient, patient with abnormal serum creatinine which means chronic renal failure were excluded from the study. Fasting blood glucose, glucose level 2 hrs after breakfast, serum total cholesterol, HDL-C and triglycerides was measured by enzymatic colorimetric method. The LDL-C level in serum was calculated by using Friedwalds formula (11). The estimation of serum creatinine was measured by alkaline picrate method; uric acid was measured by uricase-peroxidase method.

Statistical analysis was performed using SPSS software for Windows version 12. All the data were expressed as mean±SD and percentage as appropriate. To see the statistical significance, paired sample tests, Pearson correlation coefficient test were done. p value of <0.05

was considered statistically significant.

Results and Discussions:

Table 1 summarizes age, duration of diabetes, blood pressure, family history of diabetes of the diabetic subjects. Similarly table 2 summarizes age and biochemical characteristics of non-diabetic subjects.

There was no significant age and blood pressure difference between diabetic and non-diabetic subjects. Although compare to all non-diabetic subjects systolic and diastolic blood pressure were slightly higher in diabetic subjects. Fasting blood sugar is significantly higher in diabetic subjects as compared to non-diabetic subjects in both gender (p<0.001). Although the level of creatinine for both diabetes and non-diabetes subjects are in the normal range but the level was significantly higher in diabetic compared to non-diabetic subjects (p<0.01).

Serum HDL-cholesterol was found to be significantly higher in non-diabetic subjects as compared to diabetic subjects (p<0.01). Male diabetic and non-diabetic subjects had significantly lower serum LDL-cholesterol levels than female diabetic and non-diabetic subjects respectively. Diabetic male had significantly higher serum triglyceride levels than diabetic female (p<0.01).

The level of uric acid was also significantly higher (p<0.05 and p<0.01) in diabetic as compared to non-diabetic subjects in both male and female (Fig. 2).

**Table 1: Clinical and biochemical characteristics of the diabetic subjects.**

Variables	Male(n=80)	Female(n=70)	Male&Female (n=150)
Age (years)	57.8±10.2)	55.6±11.9)	56.7±10.9
Duration of Diabetes	8.9±7.7	7.1±4.8	8.3±5.1
DBP(mm of Hg)	75.9±11.6	76.5±9.0	76.1±8.4
SBP (mm of Hg)	125.7±12.8	126.8±11.7	126.1±12.2
Family H/O DM	60(75.6)	58 (83.1)	118(76.1)
FBS (mmol/l)	7.8±3.1	7.6±2.8	7.7±3.1
ABF(mmol/l)	13.1±2.9	12.8±3.1	12.1±2.6
Serum Uric acid (mg/dl)	6.1±2.1	6.9±2.7	6.5±2.3
Serum Creatinine (mg/dl)	1.0±0.5	0.8±0.5	0.9±0.5
Triglycerides (mg/dl)	155.8±27.7	145.1±29.7	150.4±28.6
Serum Cholesterol (mg/dl)	171.4±27.8	176.8±26.7	173.7±27.5
HDL – Cholesterol (mg/dl)	33.1±3.6	33.4±4.9	33.2±4.3
LDL- Cholesterol (mg/dl)	113.4±23.4	116.1±23.1	114.3±23.2

Values are mean±SD for continuous variables and number (percentage) for categorical variables.

Table 2: Clinical and biochemical characteristics of the non-diabetic subjects.

Variables	Male (n=25)	Female (n=25)	All (n=50)
Age (years)	54.2± 12.6	50.5 ± 9.4	52.4 ± 11.1
Fasting blood sugar (mmol/l)	5.0± 0.5	4.9 ± 0.6	5.0 ± 0.6
Triglyceride (mg/dl)	14521± 22.46	144.3 ± 19.5	144.8 ± 42.2
Uric acid (mg/dl)	4.6± 1.2	4.3 ± 1.3	4.5 ± 1.3
Creatinine (mg/dl)	0.9± 0.2	1.0 ± 0.2	1.0 ± 0.2
Cholesterol (mg/dl)	163.2 ± 25.2	170.4± 24.3	165.4± 24.8
HDL-cholesterol (mg/dl)	38.6 ± 5.2	36.1 ± 5.0	35.8 ± 5.1
LDL-cholesterol (mg/dl)	109.5 ± 25.2	112.3± 20.2	107.9± 22.8

Values are mean±SD.
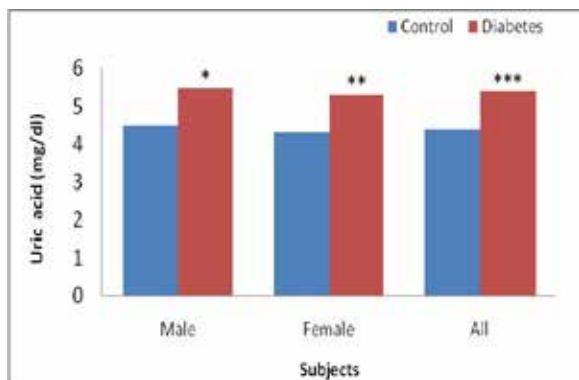
Fig 1: Uric acid level of the study subjects. Values are mean±SD. *p<0.05, **p<0.01, ***p<0.01 versus control subjects.

In case of Pearson correlation among diabetic subjects, uric acid shows correlation with FBS (p<0.001), ABF (p<0.001) and diastolic blood pressure (p<0.01) but with only age (p<0.001) in non-diabetic subjects.

Some recent studies had shown that serum uric acid level is positively associated with type 2 diabetes regardless of other various characters (1, 3, 5). It has also been reported that uric acid may be a useful predictor of type 2 diabetes in older adults with impaired fasting glucose (16). Our study also shows similar results. Level of uric acid was significantly higher in diabetic subjects as compared to non-diabetic subjects in both genders. Chien et al (3) reported that insulin resistance, which is closely related to metabolic syndrome and inflammation, may mediate the association between uric acid and diabetes risk.

Conclusion:

In conclusion, the results of the present study suggest that compared to non-diabetic subjects, diabetic subjects have significantly higher level of uric acid and positively associ-

ated with type 2 diabetes. Further research should attempt to determine whether it is effective to utilize serum uric acid levels as a predictor of type 2 diabetes for its primary prevention.

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