

**RELATIONSHIP BETWEEN URIC ACID LEVEL AND BLOOD PRESSURE IN T2DM PATIENTS ATTENDING THE BIRDEM GENERAL HOSPITAL**S Ferdous<sup>1</sup>, K Begum<sup>2</sup>, MA Muttalib<sup>3</sup>

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## ABSTRACT

Hyperuricemia is associated with higher mortality in patients suffering from hypertension, coronary heart disease, cerebrovascular events, metabolic syndrome, insulin resistance, gout and renal stone formation and it is more in individuals with diabetes. The prevalence of hyperuricemia is high in T2DM. The aim of the present study was to assess the relationship between hyperuricemia and blood pressure in T2DM subjects and thus to help the clinician for early diagnosis, treatment and to prevent further complications. Total 350 study subjects were enrolled for this study; among them 203 were T2DM with normal level of serum uric acid level and 147 were T2DM with high serum uric acid level. It was observed that systolic blood pressure was significantly higher ( $134.5 \pm 9.6$  mm of Hg) in T2DM with hyperuricemia ( $p < 0.001$ ) than T2DM with normal serum uric acid level ( $123.3 \pm 10.9$  mm of Hg). On the other hand diastolic blood pressure was significantly higher ( $87.1 \pm 5.9$  mm of Hg) in T2DM with hyperuricemia ( $p < 0.001$ ) than T2DM with normal serum uric acid level ( $79.6 \pm 8.3$  mm of Hg). Age (years) showed no significant difference between T2DM with serum uric acid  $< 7$  mg/dl and T2DM with serum uric acid  $> 7$  mg/dl ( $p < 0.05$ ). In our study it was revealed that males were in greater risk of developing hyperuricemia. BMI was significantly ( $p < 0.001$ ) greater in T2DM subjects who had normal serum uric acid level ( $27.9 \pm 3.8$ ) than with those who had serum uric acid  $> 7$  mg/dl ( $24.4 \pm 3.83$ ). No significant differences were found in FBS, blood sugar 2 hours after breakfast, HbA<sub>1C</sub>, serum creatinine and blood urea between groups.

**Key Words:** Hyperuricemia, Type 2 DM, Blood Pressure, HbA<sub>1C</sub>

**Introduction**

Hyperuricemia is becoming an increasing problem all over the world with a steady increase in prevalence<sup>4</sup>. Many factors contribute to hyperuricemia eg: genetics, insulin resistance, hypertension, renal insufficiency, obesity, diet, use of diuretics, and consumption of alcoholic beverages<sup>3</sup>. Some experimental and clinical studies suggest that uric acid has a contributory role in the pathogenesis of elevated blood pressure by several mechanisms such as inflammation, vascular smooth muscle cell proliferation in renal microcirculation, and activation of renin-angiotensin-aldosterone system<sup>7</sup>. Another study showed high arterial

tension in gout due to higher level of uric acid in the blood increases tone of arterioles causing hypertension<sup>8</sup>. Several recent small clinical trials have demonstrated that serum uric acid lowering agents such as allopurinol and probenecid can reduce blood pressure (BP) in adolescents<sup>9</sup>. Some studies also showed that the subjects with higher levels of serum uric acid are more at risk of developing type 2 diabetes and it was also found that one-quarter of diabetic cases can be attributed to a high serum uric acid level<sup>10</sup>. Recent studies have introduced serum uric acid as a potential risk factor for hypertension, stroke and cardiovascular diseases<sup>11-13</sup>. A study showed the prevalence of hyperuricemia to be 33% of

total population and 49.5% people with hyperuricemia also had hypertension<sup>14</sup>. The importance of this finding is even clearer when it was observed that lowering serum uric acid in subjects in the highest quartile may decrease the incidence of diabetes by 24%<sup>15</sup>. The number of adults with hypertension is predicted to increase by 60% to a total of 1.56 billion by 2025. Hypertension affects approximately 70% of patients with diabetes and is approximately twice as common in persons with diabetes as in those without DM<sup>16</sup>. Our aim of study is to find out the relationship between serum uric acid and BP among T2DM patients attending in the BIRDEM General Hospital.

### Materials and Methods

This cross sectional study was carried out during the period of July 2015 to June 2016 in the Biochemistry Department of BIRDEM General Hospital. The study was approved by Ethical Review Committee of Diabetic Association of Bangladesh. A total of 350 patients attending the out-patient department of BIRDEM General Hospital were enrolled and all patients gave informed written consent prior to entry in the study. Subjects having any acute and chronic diseases or on any antihypertensive medication, insulin and uric acid lowering medication were excluded from the study. Study subjects were divided into two groups, Group-I: T2DM with serum uric acid level <7 mg/dl and Group-II: T2DM with serum uric acid level >7 mg/dl. Among 350 study subjects, 203 were T2DM with normal level of serum uric acid and 147 were T2DM with high serum uric acid level. The detail history about age, sex, occupation, educational history, marital status, family history and drug history were taken from the subjects. Height (in cm), weight (in kg) were measured and BMI ( $\text{kg}/\text{m}^2$ ) was calculated. Blood pressure was measured on the right arm by sphygmomanometer after taking 10 minutes rest in a sitting position. Average of the two measurements at 10 minutes interval was taken. Participants were called

hypertensive who had systolic blood pressure  $\geq 140$  mm of Hg and diastolic blood pressure  $\geq 90$  mm of Hg<sup>17</sup>. Biochemical parameters including fasting blood glucose (FBS), glucose 2 hours after breakfast (2HABF), HbA<sub>1C</sub>, serum uric acid (S.UA), serum creatinine (S.Cr) and blood urea were estimated. Plasma glucose level were estimated by means of glucose hexokinase method and HbA<sub>1C</sub> by high performance liquid chromatography (HPLC) method, blood urea by enzymatic method, serum creatinine by Jaffe's reaction and serum uric acid were estimated by enzymatic method. At first blood sample was collected from study subjects after an overnight fasting of 10 hours to estimate fasting blood glucose, HbA<sub>1C</sub>, serum creatinine, serum uric acid and blood urea. A second sample was taken 2 hours after breakfast. The serum was separated after centrifugation at 3000 rpm for 5 minutes and was collected in eppendorf tube, labeled properly and stored in refrigerator at 2-8°C. All biochemical measurements were carried out on the same day at the Biochemistry laboratory of BIRDEM General Hospital.

### Results

Table-I showed the comparison of clinical characteristics of the subjects between groups. In this table we observed that age (years) showed no significant difference between T2DM with serum uric acid <7 mg/dl and T2DM with serum uric acid >7 mg/dl ( $p=0.005$ ). This table also showed that mean  $\pm$ SD of BMI was  $27.9 \pm 3.8$  in group-I and  $24.4 \pm 3.83$  in group-II. BMI was significantly greater in T2DM subjects who had normal serum uric acid level. Table I also showed that systolic blood pressure ( $p < 0.001$ ) and diastolic blood pressure ( $p < 0.001$ ) were significantly greater in T2DM with hyperuricemia. Table II showed no significant differences in FBS, 2HABFS, HbA<sub>1C</sub>, serum creatinine and blood urea between groups.

Fig 1 and Fig 2 showed the correlation between SBP and DBP with serum uric level which was significantly positive in both.

**Table-I:** Comparison of clinical characteristics of the subjects between groups.

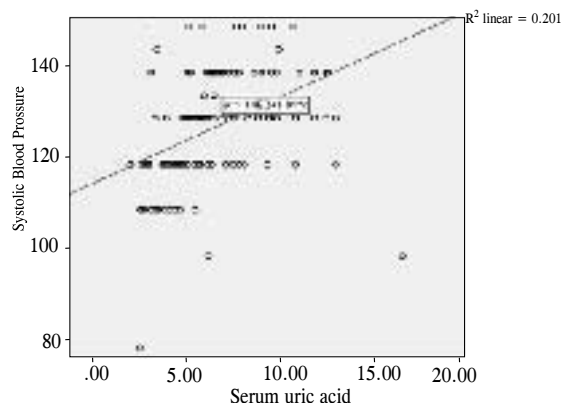
Variables	DM (Group-I) Uric acid <7.0 mg/dl (n=203) Mean±SD	DM (Group-II) Uric acid >7 mg/dl (n=147) Mean±SD	P value
Serum uric acid (mg/dl)	5.3±1.2	9.8±2.1	<0.001
Systolic Blood Pressure (mm of Hg)	123.3±10.9	134.5±9.6	<0.001
Diastolic Blood Pressure (mm of Hg)	79.6±8.3	87.1±5.9	<0.001
BMI (kg/m <sup>2</sup> )	27.9±3.8	24.4±3.83	<0.001
Age (years)	52.8±7.82	50.3±9.68	<0.05

Student's 't' test was done to measure the level of significance.  $p < 0.05$  was considered as significant

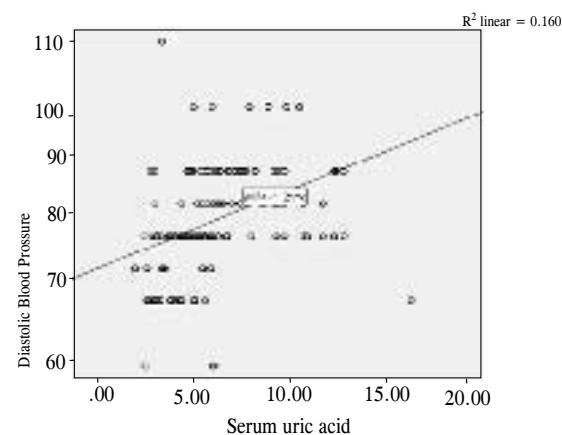
**Table-II:** Comparison of biochemical parameters between groups.

Variables	DM (Group-I) Uric acid <7.0 mg/dl (n=203) Mean±SD	DM (Group-II) Uric acid >7 mg/dl (n=147) Mean±SD	P value
Fasting blood glucose (mmol/L)	8.82±3.2	8.8±3.9	0.958
2-Hours after breakfast blood glucose (mmol/L)	12.3±4.1	11.9±5.4	0.431
HbA <sub>1C</sub> (%)	7.0±1.8	6.9±1.5	0.583
Serum Creatinine (mg/dl)	0.83±0.30	0.84±0.28	0.752
Blood Urea (mg/dl)	19.7±3.9	19.6±3.7	0.809

Student's 't' test was done to measure the level of significance.  $p < 0.05$  was considered as significant



**Fig-1:** Correlation between SBP and serum uric acid



**Fig-2:** Correlation between DBP and serum uric acid

### Discussion

Our study shows that mean ( $\pm$ SD) of age was  $50.3 \pm 9.6$  years in T2DM with hyperuricemia which was comparatively older in our study population. It was revealed in our study that male subjects were 57.1% and females were 48% who had T2DM with hyperuricemia and it explains that T2DM males are comparatively at higher risk for developing hyperuricemia than female subjects. It is in line with Li-Ying Chen<sup>4</sup>, Feig *et al*<sup>8</sup>, AU Haq<sup>5</sup>, Masanari Kuwabara<sup>2</sup>. Our study shows that mean $\pm$ SD of BMI was  $27.9 \pm 3.8$  in T2DM with normal serum uric acid level and  $24.4 \pm 3.83$  in T2DM hyperuricemic subjects. A previous study by Roozbech *et al*.<sup>18</sup>

showed no association between uric acid and BMI. The present study shows that 83.4% subjects were urban staying and it was comparatively higher in our study population. It was revealed that urban people develop T2DM more. The present study shows that Systolic Blood Pressure ( $r=+0.449$ ,  $p<0.001$ ) is positively correlated with hyperuricemia which is in line with Srivastav *et al*<sup>19</sup>, Kuwabara *et al*<sup>2</sup> and Kashem *et al*<sup>20</sup>. A previous study showed that Diastolic Blood Pressure was significantly ( $p<0.001$ ) associated with hyperuricemia<sup>21</sup>. Another previous study showed that DBP was significantly higher in T2DM with hyperuricemia<sup>2</sup>. Osaka Health Survey<sup>22</sup> showed that the 95% CI of developing hypertension in hyperuricemic subjects was (1.56-2.60). A previous study showed correlation of S.UA and BP to be positive ( $p<0.05$ )<sup>14</sup>. Our study showed  $r$  for Diastolic blood pressure (DBP)+0.660, with  $p<0.001$  which was positively correlated with hyperuricemia. The above mentioned studies are in agreement with our study. It was revealed in our study that fasting blood glucose showed no significant difference between groups. Another study of Wei *et al.*<sup>23</sup> showed that S.UA and FBS are inversely correlated, ( $r=-0.131$ ,  $p=0.009$ ) in T2DM which was in agreement with our study. In present study it was demonstrated that 2HABF ( $p=0.431$ ) was not significantly different between groups. Our study showed that HbA<sub>1</sub>C was ( $p=0.583$ ) not associated with serum uric acid level. The study of Yuliang Cui *et al*<sup>24</sup> showed that HbA<sub>1</sub>C is inversely correlated with serum uric acid ( $r=0.224$ ,  $p=0.00$ ) which is in agreement with our study. Our study showed that T2DM subjects who had hyperuricemia was 42%. Another study shows 33% population with hypertension had high serum uric acid level<sup>21</sup>. A study of our country observed 25.4% of study populations had hyperuricemia with hypertension<sup>20</sup>. In the present study it was revealed that serum creatinine was ( $p=0.752$ )

not associated with serum uric acid level and did not agree with Nishida<sup>6</sup>. But our study revealed that Blood urea was ( $p=0.809$ ) not associated with serum uric acid which did not agree with the study done by A Haq<sup>5</sup>.

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