

# Association of Hyperglycemia and Hyperuricemia in Diabetic Patients at Tertiary Care Hospitals of District Bannu, Khyber Pakhtunkhwa, Pakistan

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## Abstract

**Objective:** The aim and objective of the current study was to find the association between hyperglycemia and uric acid in the diabetic patient in district Bannu, Khyber Pakhtunkhwa, Pakistan

**Methods:** This cross-sectional descriptive was conducted in tertiary care hospitals of district Banu, Khyber Pakhtunkhwa Pakistan, from July 2020 to August 2021. Blood samples were collected from patients using gel tube, centrifuged, and then serum separate was subjected to Micolab-300 for the estimation of uric acid and glucose levels in subjects.

**Results:** In this study, total of 209 cases were analyzed, among them 114 were males and 95 were female. Frequencies of high Serum Uric Acid levels in diabetic patients were observed in the adults group and a significant association was observed between blood sugar levels and uric acid levels in these patients.

**Conclusion:** From the current study it has been concluded that a statistically significant association was found between hyperuricemia and hyperglycemia in diabetic patients and such association was most commonly observed in Adult patients s compared to other groups.

**Keywords:** Diabetic patients, Hyperuricemia, hyperglycemia

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## Introduction

Diabetes mellitus is a general term for heterogeneous disturbances of metabolism for which the main finding is chronic hyperglycemia. The cause is either impaired insulin secretion or impaired insulin action or both.<sup>1</sup> The term diabetes mellitus describes a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs. Diabetes mellitus may present with characteristic symptoms such as thirst, polyuria, blurring of vision, and weight loss.<sup>2</sup> Type 1 diabetes (cell destruction, usually leading to absolute insulin deficiency): This form of diabetes, accounts for only 5–10% of those with diabetes, previously encompassed by the terms insulin dependent diabetes, type I diabetes, or juvenile-onset diabetes, results

from cellular-mediated autoimmune destruction of the cells of the pancreas. In this form of diabetes, the rate of cell destruction is quite variable, being rapid in some individuals (mainly infants and children) and slows in others (mainly adults).<sup>3</sup> Type 2 diabetes, this form of diabetes, which accounts for 90–95% of those with diabetes, previously referred to as non-insulin dependent diabetes, type II diabetes, or adult-onset diabetes, encompasses individuals who have insulin resistance and usually have relative (rather than absolute) insulin deficiency At least initially, and often throughout their lifetime, these individuals do not need insulin treatment to survive.<sup>4</sup> The obese T2DM patients usually develop resistance to endogenous insulin due to alterations in cell receptors, and this is associated with distribution of abdominal fat.<sup>5</sup>

Uric acid in the human body is the final resultant product of purine metabolism Purine nucleotides decompose to hypoxanthine and guanine, some of which can be recycled and

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phosphorylated into hypoxanthine nucleotides, while the remaining part is metabolized by xanthine dehydrogenase/oxidase (XDH/XO) enzymatic reaction to the terminal product uric acid. In normal conditions, the serum levels of UA (SUA) are lesser than 6mg/dL in women and 7mg/dL in men,<sup>6</sup> High UA levels can cause gout, urolithiasis, and acute and chronic nephropathy, all of which are due to the deposit of urate crystals. There is also increasing evidence of relationships between Hyperuricemia with other important disorders, including hypertension, chronic renal disease, cardiovascular (CV) disease, and metabolic syndrome, although a causal relationship has not been clearly established. Low levels of UA are not a known cause of any disorder or disease.<sup>7</sup>

The positive association between uric acid concentration and diabetes may be explained by at least 3 potential mechanisms. First, metabolic syndrome, as a precursor of diabetes, induces high oxidative stress, which is worsened by the accompanying Hyperuricemia. Second, uric acid stimulates vascular smooth muscle proliferation and induces endothelial dysfunction. Third, uric acid is associated with increased renal glomerular pressure and increased renal sodium reabsorption.<sup>8</sup>

In this context, we aimed to assess the association between high blood glucose levels and serum uric acid levels in diabetic individuals in district Bannu.

## Materials and Methods

This cross-sectional descriptive study was conducted in adjacent areas, with patients attending and registered in tertiary care Hospitals District Bannu from July 2020 to August 2021. Sample size 209 was calculated through the WHO sample size calculator by taking the power of test 80% and level of significance 5%. Inclusion criteria consisted on all the patients of any age, gender and area were included from tertiary care hospitals of district Bannu, the presence of diabetes was confirmed based on the guidelines of World Health Organization and American Diabetes Association and subject's self-reported evidence whereas History of taking drugs like anti-Hyperuricemia, lactating mother, pregnant women and gout were excluded from the study and also further excluded subjects with self-reported kidney disorders, liver disorders and heart diseases were considered as exclusion criteria.

Informed consent was obtained from each diabetic patient before inclusion in this research study. All the methodologies were conducted in following with the standard guidelines and regulations. Blood samples were obtained from the patients by means of venipuncture. The samples were then placed into an ice-cooled box and transported immediately to the Clinical laboratory at the Department of Biochemistry, Samad Clinical Laboratory. After centrifugation of blood samples at 3000 rpm for 15 minutes, the serum was isolated and stored at -20°. The serum glucose concentration was measured within 2 hours after of blood collection. Serum Uric Acid was measured by

colorimeter method with a semi-automated biochemistry analyzer (Chem reader 300 plus). Commercially available diagnostic kits (Lab Tech, Barcelona Spain & Human Diagnostic, Germany) were used for the analysis of the above marker. All measurements were carried out in the clinical laboratory of the department according to the standard manufacturer's protocols and the accuracy of the measurement was maintained by regular method calibration with reference.

All the data obtained were entered in Microsoft Excel 2016, Statistical data analyses were done using IBM SPSS version 25. Descriptive statistics were analyzed as mean, standard deviation, frequency, and percentage. P-value  $\leq 0.05$  was taken as statistically significant.

## Results

In this study, a total of 209 diabetic patients was processed and screened for Blood Glucose Levels and Serum Uric Acid levels. Out of 209 diabetic patients, 114 were male diabetic patients while 95 were female diabetic patients. Blood Sugar levels were checked to confirm the patients as a diabetic person and Serum uric acid levels were also measured in the blood samples of the above particular said diabetic patients to associate Hyperglycemia and Hyperuricemia in diabetic patients of Pakistani citizens at district Bannu, KPK, Pakistan.

Out of 209 diabetic patients, 42 (20.09%) cases were high Uric Acid levels. Furthermore, out of 114 males, 21 (18.42%) were with high Uric Acid levels while in females, out of 95 cases, 21 (22.10%) were with high Uric Acid levels. (Table I)

Out of 42/209 (20.09%) diabetic patients, 01 (12.50%) were of age from less than 20 years, 07 (13.02 %) were age 21--40

Gender	Diabetic	High Uric Acid Level	%
Male	114 (54%)	21 (10%)	18.42
Female	95 (46%)	21 (10%)	22.10
<b>Total</b>	<b>209</b>	<b>42</b>	<b>20.09</b>

years, 31 (25%) were age 41-60 years while 03 (12.5%) were age > 60 years. (Table II)

Age in years	Male	Female	Total Diabetic	High Uric Acid	%
Less < 20	4	4	08	01	12.50
21 to 40	30	23	53	07	13.02
41 to 60	63	61	124	31	25.00
More than 60	17	7	24	03	12.50
<b>Total patients</b>	<b>114</b>	<b>95</b>	<b>209</b>	<b>42</b>	<b>20.09</b>

Overall significant Negative Correlation ( $p = 0.015$ ) was observed between Serum Uric Acid level and Blood Sugar level in diabetic patients (Table III)

#### Paired Samples Statistics

Table III: Association of Uric Acid Level with Blood Sugar level				
	Mean	n	Std. Deviation	Sig.
Uric Acid	4.80	209	1.24	.086
Sugar Level	214.64	209	67.50	

#### Paired Samples Correlations

	n	Correlation	Sig.
Uric Acid & Sugar Level	209	-.168	.015

## Discussion

Diabetes mellitus and subsequent hyperglycemias has been found to be the most drastic disorders that are due to either insulin deficiency or insulin function loss, the most notable manifestations of hyperglycemia include diabetic nephropathy, diabetic neuropathy, diabetic retinopathy and sometime associated with increase uric acid level, which may lead to gout. The net increase in uric acid is due to loss of function of kidney that may be due to increase blood glucose.

Many epidemiological studies have identified a strong association between increased serum uric acid and cardiovascular risks such as hypertension or coronary artery disease in the general population.<sup>9</sup> Hyperuricemia is linked to a wide spectrum of metabolic and vascular conditions, including hypertension, renal disease, metabolic syndrome, and both coronary and cerebral vascular disease. It has also been well documented that uric acid levels correlate with traditional vascular risk factors such as older age, male sex, obesity, and dyslipidemia and insulin resistance.<sup>10</sup>

In the present study, it was observed that the overall frequency of high uric acid level in diabetic patients were 42 (22.09%) out of 209 cases. The previous study has also reported similar findings and reported (18.4%) rate of frequency of high uric acid in diabetic patients.<sup>8</sup> Baseline characteristics of this present study subjects revealed that Adult male participants often had a higher level of Serum Uric Acid level compared to female. This finding is in line with the previous research studies that conducted to estimate the impact of sex on uric acid concentrations<sup>11</sup> and in another research study that assessed the relationship between Serum uric acid levels and glycemic parameters among Indian adults<sup>12</sup> also supports the findings of the present study.

In the present study significant negative association were found between hyperglycemia and hyperuricemia in diabetic patients at district Bannu KPK Pakistan, in contrast to some previous studies, which reported positive association between serum uric acid level and blood sugar level<sup>13-15</sup> Similarly, in another study correlation was found between serum uric acid level and serum sugar level in diabetic individuals in India<sup>16</sup>, however, negative correlation in diabetic patients has been reported in Austrian men.<sup>17</sup> In another research study conducted on patients of the national health and nutrition survey reported that serum uric acid level were negative associated with diabetic patients<sup>18</sup> this is an agreement with our study.

## Conclusion

It is concluded from our study that frequency of high Serum uric acid level was commonly observed in adult diabetic patients, showing significant negative association between hyperglycemia and hyperuricemia in such diabetic patients at our set up at district Bannu KPK Pakistan.

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