



## ASSOCIATION OF HYPERGLYCEMIA AND HYPERURICEMIA IN DIABETIC PATIENTS AT TERTIARY CARE HOSPITALS

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### ABSTRACT

**Background:** Uric acid is created by the external breakdown through the metabolism of purines that come from dietary intake, as well as by endogenous decomposition of those cells that are dead. Approximately 90% of filtrated serum uric acid (SUA) gets absorbed again, demonstrating its vital role in the human body

**Objective:** The objective of the study was to find out the possible association between hyperglycemia and hyperuricemia among diabetes mellitus patients in tertiary care hospitals.

**Methodology:** The current analytical cross-sectional was conducted at the department of Biochemistry Mohtarma Benazir Bhutto Shaheed medical college Mirpur for a period of six months from July 2023 to December 2023 after approval from the ethical review board of the hospital. All the participants were selected through a convenient sampling technique. The total sample size was 217, though the WHO calculator with a 95 % confidence interval and a 5 % margin of error. Proper informed consent was obtained from all the participants after ensuring confidentiality and anonymity. Descriptive statistics were assessed using mean, standard deviation, frequency, and percentages. Statistical significance was defined as a P-value of <0.05.

**Results:** A total of 217 patients were included in the study, consequently, they all were screened for the purpose of their glucose level as well as serum uric acid level. Out of the total 119 were male and 98 were female patients. . 46 (21.19 %) of the total patients have high uric acid levels of which 27 (12.44 %) were male and female patients account for 19 (8.75 %). From 36-45 and 46-60 years of age, 20.31 % and 23.17 % have high uric acid levels, additionally, above 60 years of age 37.05 % have above-normal uric acid levels. There was a negative relationship between hyperglycemia and hyperuricemia with a p-value of 0.78.

**Conclusion:** This concluded that there was a negative relationship between high serum uric acid and hyperglycemia, however, the level of uric acid was found higher in later age, those with above 40 years of age participants.

**Keywords:** Serum uric Acid, hyperglycemia, Diabetes Mellitus, Metabolic Syndrome

## INTRODUCTION

Uric acid is created by the external breakdown through the metabolism of purines that come from dietary intake, as well as by endogenous decomposition of those cells that are dead. Approximately 90% of filtrated serum uric acid (SUA) gets absorbed again, demonstrating its vital role in the human body (1). Uric acid has a significant physiological significance as an effective oxidizing agent, a potent free radical generator and peroxynitrite scavenging, and a prominent plasma antioxidant. Nevertheless, there is some debate over uric acid's antioxidants and prooxidative characteristics. Uric acid is a marker indicating excessive levels of harmful oxidative stress. Furthermore, hyperuricemia causes insulin resistance, whereas hyperinsulinemia produced by the resistance to insulin raises SUA levels by decreasing renal uric acid release along with concentrating precursors for uric acid synthesis (2). Type 1 diabetes, also known as insulin-dependent diabetes, or diabetes juvenile onset is caused by autoimmune conditions destruction of pancreatic cells, resulting in a complete insulin deficiency. It represents the only 5-10% of diabetes cases. This type of diabetes causes cell loss at varying rates, with children and youngsters experiencing rapid damage and adults experiencing slower destruction (3). Type 2 diabetes, also known as diabetes without insulin dependence, diabetes type 2, or diabetes with adult-onset, affects 90-95% of diabetics. It is characterized by increased resistance to insulin and a relative insulin deficiency. These patients typically do not require insulin treatment for survival, both initially and over time (4). Because of changes in cell receptors, obese T2DM patients typically acquire resistance to endogenous insulin, which is linked to the distribution of their fat around the abdomen (5). The final outcome of purine metabolism in the body of humans is uric acid. Purine nucleotides break down into guanine as well as hypoxanthine, a few of which can be retrieved again phosphorylated into hypoxanthine nucleotides. The remainder is broken down by the enzymatic process of xanthine dehydrogenase/oxidase (XDH/XO) to produce uric acid as the end product. Under typical circumstances, UA (SUA) serum levels are less than 6 mg/dL in women as well as 7 mg/dL in men. Due to the deposition of urate crystals, elevated UA levels can result in gout, urolithiasis, and both acute and chronic nephropathy. Although a direct link between hyperuricemia and other significant conditions, such as hypertension, chronic renal illness, cardiovascular (CV) illnesses, and metabolic syndrome (MS), has not been convincingly demonstrated, there is growing evidence of these connections. There is no documented link between low UA levels and any illness or condition (6,7). Three possible processes could account for the positive correlation between uric acid levels and diabetes. Firstly, excessive oxidative stress is brought on by metabolic syndrome, a prelude to diabetes, and is exacerbated by hyperuricemia. Secondly, uric acid causes endothelial dysfunction and promotes the growth of vascular smooth muscles. Thirdly, elevated renal sodium reabsorption and elevated renal glomerular pressure are linked to uric acid (8). Due to increased diabetic incidence at the current time, moreover, patients having diabetes also face multiple complications such as retinopathy, recurrent urinary tract infections, nephropathy, and cardiac problems as well because of high sugar levels. Therefore, the current study aimed to investigate the possible relationship between hyperglycemia and hyperuricemia in patients having diabetes mellitus.

**Objective:** The objective of the study was to find out the possible association between hyperglycemia and hyperuricemia among diabetes mellitus patients in tertiary care hospitals.

## METHODOLOGY

The current analytical cross-sectional was conducted at the department of Biochemistry Mohtarma Benazir Bhutto Shaheed medical college Mirpur for a period of six months from July 2023 to December 2023 after approval from the ethical review board of the hospital. All the participants were selected through a convenient sampling technique. The total sample size was 217, though the WHO calculator with a 95 % confidence interval and a 5 % margin of error. Proper informed consent was obtained from all the participants after ensuring confidentiality and anonymity. Those individuals who have diabetes according to the guidelines of WHO and the American diabetes association were included in the study. Those individuals having autoimmune disorders such as kidney and liver, pregnant females along with lactating mothers, moreover, those who already taking medicines for

gout disease were excluded from the study. Every methodology was carried out in accordance with the accepted standards and rules. Via venipuncture, blood samples were taken from the patients. After that, the samples were put in an ice-cooled box and delivered right away to the clinical laboratory, which is part of the Department of Biochemistry. The serum was separated and kept at -20° after blood samples were centrifuged for 15 minutes at 3000 rpm. Within two hours after blood collection, the serum level of glucose was determined. Measurements of serum uric acid were made by colorimeter technique using a Chem Reader 300+ semi-automated biochemistry analyzer. The aforementioned marker was analyzed using commercially accessible testing equipment (Lab Tech, Barcelona, Spain as well as Human Diagnostic, Germany). All measurements were performed in the department's clinical laboratory in accordance with established manufacturer's protocols, and routine technique calibration with reference was used to preserve measurement accuracy. All the collected data was analyzed properly by using SPSS version 24, moreover, Descriptive statistics were assessed using mean, standard deviation, frequency, and percentages. Statistical significance was defined as a P-value of <0.05.

## RESULTS

A total of 217 patients were included in the study, consequently, they all were screened for the purpose of their glucose level as well as serum uric acid level. Out of the total 119 were male and 98 were female patients. Diabetic patients in tertiary care hospitals had blood sugar levels tested and serum uric acid levels measured to identify hyperglycemia and hyperuricemia. 46 (21.19 %) of the total patients have high uric acid levels of which 27 (12.44 %) were male and female patients account for 19 (8.75 %) as shown in Table 1.

**Table 1: Gender-related traits of individuals with diabetes**

Gender	Diabetics	Level of high uric acid	Percentage
Male	119 (54.83 %)	27 (12.44 %)	22.68 %
Female	98 (45.16 %)	19 (08.75 %)	19.38 %
<b>Total</b>	<b>217</b>	<b>46</b>	<b>21.19 %</b>

Table 2 highlights, the age-related features of patients with diabetes, it can be seen from the tables below that the frequency of high uric acid was higher among the later-age patients. From 36-45 and 46-60 years of age, 20.31 % and 23.17 % have high uric acid levels, additionally, above 60 years of age 37.05 % have above-normal uric acid levels.

It can be below from Table 3 that there was a negative relationship between hyperglycemia and hyperuricemia with a p-value of 0.78.

**Table 2: Age-Related Features of Patients with Diabetes**

Age (years)	Male	Female	Total diabetic	High uric acid	Percentage
< 25	10	4	14	01	07.14 %
26-35	21	19	40	05	12.5 %
36-45	37	27	64	13	20.31 %
46-60	43	39	82	19	23.17 %
Above 60	08	09	17	08	37.05 %
<b>Total</b>	<b>119</b>	<b>98</b>	<b>217</b>	<b>46</b>	

**Table 3: Statistics based on paired samples**

	Mean	Number	St. Deviation	p-value
Uric acid	5.38	209	1.81	0.78
Sugar level	221.16	209	36.71	

**Table 4: Correlation between paired samples**

Uric acid & sugar level	Number	Correlation	p-value
	217	-.178	0.13

## DISCUSSION

Complications from diabetes are becoming more commonplace globally. The relationship involving levels of uric acid as well as complications associated with diabetes mellitus (DM) has drawn a lot of attention, as has the impact of uric acid levels upon the emergence of blood vessel problems in people with DM. With a prevalence of 60% to 90%, diabetic peripheral neuropathy (DPN) has become a chronic condition associated with diabetes mellitus. There is a considerable frequency of impairment and mortality linked to this illness, and about half of patients show no symptoms (9,10). DPN is a disorder that causes irreversible nerve injury, which causes sensory function to gradually deteriorate, beginning in the lower limbs. DPN is further differentiated by the presence of pain and substantial morbidity (11,12). Elevated serum uric acid has been strongly linked in multiple epidemiological investigations to cardiovascular risks in the general public, including hypertension as well as coronary artery disease. Numerous metabolic and vascular disorders, such as elevated blood pressure, kidney disorders, diabetes, metabolic syndrome, and both coronary artery and cerebrovascular disease are associated with hyperuricemia. The correlation between uric acid levels and conventional vascular risk factors, including male sex, obesity, dyslipidemia, and insulin resistance, has also been extensively studied (13,14). In the present study, 46 (21.19 %) of the total patients have high uric acid levels of which 27 (12.44 %) were male and female patients account for 19 (8.75 %), similarly, another study conducted by Haque T, Rahman S, Islam S, Molla NH, Ali N, 2019 had also reported 18.40 % frequency of high serum uric acid level among diabetic patients (8), in addition, another carried out by Ullah A, Haq MU, Khan MS, Ullah, 2021 study concluded that 22.09 % frequency of SUA in those diabetic patients and a negative relationship between high uric acid and hyperglycemia (p=0.15) (15). Moreover, In the current study, there is a negative relationship between hyperglycemia and hyperuricemia with a p-value of 0.78, in addition, the level of high uric acid was observed among male patients as compared to females, which is aligned with the single-center study by Barbieri L et al, 2015 (16). However, some previous have found a positive correlation which is in contrast with our study (17,18). But A study conducted by Bandaru P., and Shankar A., 2011 had similar results of an inverse relationship between SUA and hyperglycemia among US adults.

## CONCLUSION

This concluded that there was a negative relationship between high serum uric acid and hyperglycemia, however, the level of uric acid was found higher in later age, those with above 40 years of age participants.

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