



A Study on Serum Uric Acid Levels in Type 2 Diabetes Mellitus and Its Association with Cardiovascular Risk Factors.

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KEYWORDS

Serum uric acid levels, type 2 diabetes mellitus, cardiovascular risk factors.

ABSTRACT:

Background: The high incidence of noncommunicable diseases, particularly diabetes mellitus and coronary heart disease, in India leads to approximately 5.8 million deaths annually. Insulin resistance plays a significant role in the development of diabetes mellitus and metabolic syndrome (MS). MS consists of four components: hyperinsulinemia, hypertension, hyperlipidemia, and hyperglycemia, each of which is an independent risk factor for CHD and can work together to accelerate the progression of atherosclerosis and atheroscleropathy associated with MS and T2DM. **Materials & Methods:** This is hospital based cross sectional observational study which was conducted in the Department of general medicine of Meenakshi Medical college Hospital and Research Institute with study period of 1 year. The total sample size of the study was 100 patients. The collected data was entered in Microsoft Excel. Coding of the variables was done. Analysis was done using SPSS software (Version 27, IBM).

Results: The subjects had an average age of 58.56 years and a mean BMI of 25.63, with a standard deviation of 3.90. Additionally, the WHR ranged from 0.78 to 1.55, indicating variations in body fat distribution and potential health risks. Fasting Blood Sugar (FBS) levels varied from 101 to 208 mg/dL, while Postprandial Blood Sugar (PPBS) levels ranged from 165 to 307 mg/dL, reflecting the variability in glucose metabolism. Serum uric acid levels ranged from 3.1 to 8.4 mg/dL, which is important for evaluating metabolic health and potential gout risk. The prevalence of the condition was 43%, with a highly significant P value of 0.0001. **Conclusion:** Elevated serum uric acid levels was found to be prevalent in individuals with diabetes, with a significant positive correlation observed between serum uric acid and dyslipidemia, high triglycerides, hypertension, elevated BMI, and increased WHR. Additionally, it was observed that serum uric acid levels rose with the duration of diabetes.

INTRODUCTION

The surge in morbidity and mortality rates due to noncommunicable diseases, particularly diabetes mellitus and coronary heart disease, poses a significant challenge in India, leading to approximately 5.8 million

fatalities on an annual basis^{1,2}. Insulin resistance is a crucial factor in the development of diabetes mellitus and metabolic syndrome (MS). MS comprises four major components, namely hyperinsulinemia, hypertension, hyperlipidemia, and hyperglycemia, each of which serves as an independent risk factor for CHD and can



collaborate synergistically to expedite the progression of both non-diabetic atherosclerosis and atheroscleropathy associated with MS and T2DM^{3,4}.

Similarly, hyperuricemia, hyperhomocysteinemia, reactive oxygen species (ROS), and highly sensitive C-reactive protein (hsCRP) each play a crucial role in expanding the original Syndrome X described by Reaven in the atherosclerotic process⁵. Many previous studies have recommended regular screening of all type 2 diabetic subjects to identify individuals with a higher risk of subsequent atherosclerosis⁶. A strong association has also been demonstrated between uric acid levels and various other cardiovascular risk factors. Considering the scarcity of studies on this topic in India, an attempt has been made to examine the level of serum uric acid in type 2 diabetes mellitus and the correlation between elevated serum uric acid levels and cardiovascular risk factors such as obesity, hypertension, smoking, and dyslipidemia^{7,8}. The present study is aimed to identify the level of serum uric acid levels in type 2 diabetes mellitus and its association with cardiovascular risk factors. The objectives of the study is to assess the uric acid status in patients with diabetes mellitus and to find its association with cardiovascular risk factors such as age, gender, BMI, waist-hip ratio, smoking, dyslipidemia with increased triglycerides, and hypertension.

MATERIALS & METHODS

This is hospital based cross sectional observational study which was conducted in the Department of general medicine of Meenakshi Medical college Hospital and Research Institute with study period of 1 year. The total sample size of the study was 100 patients. **Inclusion criteria** – 1) Patients with type 2 diabetes mellitus (irrespective of their glycemic status and duration of diabetes). 2) Patient's age > 40 years. 3) Both sexes were included. **Exclusion criteria** – Patients with the following conditions were excluded from the study 1) Renal failure. 2) On long term diuretics and steroids. 3) Regularly consuming alcohol. 4) On antimetabolite and chemotherapy drugs. 5) Hepatic disorders. 6) Peripheral

vascular disease/ cerebrovascular disease/ pulmonary tuberculosis. 7) Renal transplant patients. 8) Pregnancy and lactating mothers. The study was approved by Institutional Ethics Committee of the private medical college. A written informed consent was obtained from all the patients. After informed written consent obtained, selected data will be elicited from the patients in structured proforma. **Data collection method:** The data will be collected on Socio-demographic parameters like age, gender. Clinical parameters like Duration of diabetes, Family history of diabetes, Smoking history. Physical examination will be done to record anthropometric data like Body weight, height, BMI, WHR. Blood pressure will be recorded. Blood will be collected and sent to the laboratory for assessment of Fasting and postprandial blood sugar levels estimated by using glucosoxidase peroxidase (GOD/POD) method, Serum lipid profile and uric acid levels.

Estimation of serum uric acid will be done by using phosphotungstic acid method.

Step 1: De proteinisation: In a test tube to 1 ml of distilled water, 0.2 ml of serum, 0.4 ml of 2/3 N H₂SO₄, 0.4 ml sodium turgitate (10%) are added and sample centrifuged for 5 minutes.

Step 2: To 1 ml of the filtrate add 0.75N NaOH, saturated picric acid 0.5 ml mix well & wait for 15 minutes. Reading is taken at 490 nm calorimetrically.

Hyperuricemia has been arbitrarily defined as >7.0 mg/dL in men and >6. mg/dL in women.

The collected data was entered in Microsoft Excel. Coding of the variables was done. Analysis was done using SPSS software (Version 27, IBM). Descriptive statistics was used. Association between categorical tests. The outcomes of the treatment groups were compared using a test to reach the hypothesis, a P value less than 0.5 was considered significant.

RESULT

Of the 100 patients, (64%) were males and (46%) were females. (**Chart 1**)



Chart 1: Gender distribution among the study participants

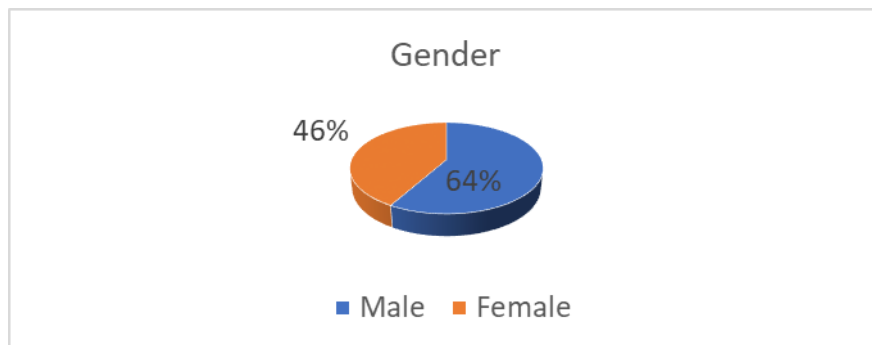


Table 1: Demographic details:

The average age is 58.56 years. The mean Body Mass Index (BMI) is 25.63, with a standard deviation of 3.90, indicating variations in body weight relative to height. The Waist-to-Hip Ratio (WHR) ranges from 0.78 to 1.55, which helps assess fat distribution and potential health

risks. Fasting Blood Sugar (FBS) levels span from 101 to 208 mg/dL, while Postprandial Blood Sugar (PPBS) levels range from 165 to 307 mg/dL, indicating variability in glucose metabolism. Serum uric acid levels vary between 3.1 and 8.4 mg/dL, which is crucial for evaluating metabolic health and potential gout risk.

Table - 2: Association of risk factors with Cardiovascular Risk Factors.

Variables		Percentage	P value
Family History CAD		68%	0.001
Smoking among males		77%	0.003
Hypertension	Yes	49%	0.04
	No	51%	

Family history of coronary artery disease (CAD) is reported in 68% of the individuals, with a highly significant P value of 0.001, indicating a strong association. Smoking is prevalent among 77% of males,

with a P value of 0.003, suggesting a significant link. Hypertension affects 49% of the population, with a P value of 0.04, indicating a noteworthy association.

Table 3: Association with Duration of Diabetes and Hyperuricemia

Variables		Mean±SD
Age		58.56
BMI		25.63±3.90
WHR		0.78±1.55
FBS		101±208
PPBS		165±307
Serum uric acid		3.1±8.4
Duration of DM		4.67± 1.17
Variables	Percentage	P value
< 4 years	43%	0.0001*



>4 years	67%	
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For individuals with less than 4 years of the condition, the prevalence is 43%, with a highly significant P value of 0.0001. In contrast, those with more than 4 years of

the condition account for 67%. This indicates a significant increase in the prevalence of the condition with longer duration.

Table 4: Association diabetes mellitus with hyperuricemia

Variables	Percentage	P value
Negative	85%	0.000
Positive	15%	

The distribution and statistical significance of a certain variable within the studied population. A significant majority, 85%, tested negative for the variable, with a P value of 0.000, indicating a highly significant result. In contrast, only 15% tested positive. This stark contrast underscores the strong statistical difference between the negative and positive cases within the population.

DISCUSSION:

In their analysis, Katsiki et al⁹. identified a robust association between elevated serum uric acid levels and diabetes and its related complications. In contrast, Keenan et al¹⁰ reported that increased serum urate levels were not associated with type 2 diabetes (T2DM), coronary heart disease (CHD), ischemic stroke, or heart failure (HF). Unlike most previously published studies on this topic, the aforementioned study by Keenan et al¹⁰ inferred the absence of a causal relationship between uric acid and cardiovascular complications in individuals with diabetes.

The research performed by Choi H. K. et al¹¹. investigated the relationship between gout and the likelihood of developing type 2 diabetes in men with a high cardiovascular risk profile. The study revealed that men with gout and a high cardiovascular risk profile have a greater chance of developing type 2 diabetes, regardless of other known risk factors. These findings imply reverse causality and raise further questions about the nature of the association between diabetes, serum uric acid, and diabetes-related complications, particularly coronary artery disease. Du L. et al¹². also confirmed the increased risk of diabetes-related macrovascular complications, including CAD and cerebral infarction. After pooling

estimates from 23 studies, the authors concluded that higher serum uric acid levels may contribute to cerebral infarction in patients with type 2 diabetes.

The association between the duration of diabetes and serum uric acid levels proved to be statistically significant, as indicated by a study conducted by Gagliardi A. C et al⁸, as well as research carried out by Javorsky et al¹³ and Kramer C. K. et al¹⁴. These findings also revealed a comparable relationship, with a notable impact of serum uric acid on future cardiovascular events.

The dissimilarity was substantive and validated through investigations conducted by Li, Q. et al¹⁵ and Li, L. X., et al¹⁶. Furthermore, though the research performed by Li, L. X., et al¹⁶. unveiled a correlative nexus between hypertension and hyperuricemia, it concurrently conveyed that this association may not necessarily culminate in an escalated risk of cardiovascular ailments, as posited by a multitude of alternative studies.

The research conducted underscores the robust association between serum uric acid and other risk factors, such as hyperlipidemia. Studies by Lehto et al.¹⁷, Nagahama et al¹⁸., and Zoppini et al¹⁹. have also demonstrated a strong connection between hyperuricemia and components of metabolic syndrome. In summary, although there is substantial evidence indicating that elevated serum uric acid concentrations are strongly associated with increased cardiovascular risk and poor outcomes, prospective population studies are often complicated by the presence of co-existing risk factors. In the current study, serum uric acid displayed a positive correlation with the duration of diabetes and



cardiovascular risk factors such as obesity (as indicated by a high BMI and an abnormal waist-to-hip ratio), hypertension, and dyslipidemia, and the results were statistically significant.

CONCLUSION:

Serum uric acid levels were significantly elevated in diabetic population. Significant positive correlation between serum uric acid Elevated levels of serum uric acid were observed in individuals with dyslipidemia and high triglycerides, as well as those with hypertension and elevated Body Mass Index (BMI) and Waist Hip Ratio (WHR). Furthermore, it was observed that serum uric acid levels increased with the duration of diabetes.

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