

**Investigating Serum Uric Acid as a Predictive Marker for Coronary Artery Disease in Diabetes Mellitus at a Tertiary Care Centre in Andhra Pradesh****Bupesh Parasa<sup>1</sup>, Tippani Srilatha<sup>2</sup>, Neeli Harika<sup>3</sup>**<sup>1</sup>Assistant Professor, Department of General Medicine, Nimra Institute of Medical Sciences, Ibrahimpatnam, Andhra Pradesh, India<sup>2</sup>Assistant Professor, Department of General Medicine, Nri Medical College And General Hospital, Chinakakani, Andhra Pradesh, India<sup>3</sup>Final Year Post Graduate Family Medicine, Nri Medical College and General Hospital, Chinakakani, Andhra Pradesh, India

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**Abstract**

**Background:** Diabetes mellitus is a common metabolic disorder associated with an increased risk of cardiovascular diseases, particularly coronary artery disease (CAD). Chronic hyperglycaemia, endothelial dysfunction, and metabolic abnormalities in diabetes accelerate the process of atherosclerosis. Serum uric acid, the final product of purine metabolism, has been increasingly recognized as a potential biochemical marker associated with cardiovascular risk. Elevated serum uric acid levels may contribute to oxidative stress, inflammation, and endothelial dysfunction, thereby promoting the development of coronary artery disease. Identifying simple and cost-effective markers such as serum uric acid may help in early detection and risk stratification of cardiovascular complications in diabetic patients.

**Objectives:** To evaluate serum uric acid levels in patients with diabetes mellitus and to assess its association with coronary artery disease.

**Materials and Methods:** This hospital-based observational study was conducted in the Department of General Medicine at a tertiary care hospital in Andhra Pradesh over a period of one year. A total of 102 patients diagnosed with type 2 diabetes mellitus were included in the study. Detailed clinical history, physical examination, and laboratory investigations were carried out for all participants. Investigations included fasting blood glucose, post-prandial blood glucose, HbA1c, lipid profile, serum creatinine, and serum uric acid levels. Coronary artery disease was diagnosed based on clinical assessment and electrocardiographic findings. Statistical analysis was performed, and a p-value less than 0.05 was considered significant.

**Results:** Among the 102 patients, coronary artery disease was present in 45.1% of cases. The mean serum uric acid levels were significantly higher in diabetic patients with coronary artery disease compared to those without CAD. Elevated uric acid levels showed a significant association with the presence of coronary artery disease. Other factors such as longer duration of diabetes, hypertension, and increased body mass index were also associated with CAD.

**Conclusion:** Serum uric acid levels were significantly associated with coronary artery disease in patients with diabetes mellitus. Estimation of serum uric acid may serve as a simple and useful marker for identifying diabetic patients at higher risk of cardiovascular complications.

**Keywords:** Diabetes Mellitus, Serum Uric Acid, Coronary Artery Disease, Hyperuricemia, Cardiovascular Risk.

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**Introduction**

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. The global prevalence of diabetes has increased dramatically in recent decades, making it a major public health concern. Patients with diabetes are at a significantly

higher risk of developing both microvascular complications such as retinopathy, nephropathy, and neuropathy, as well as macrovascular complications including coronary artery disease (CAD), stroke, and peripheral vascular disease. Among these complications, coronary artery disease remains the leading cause of morbidity and

mortality in individuals with diabetes mellitus. Diabetic patients are estimated to have a two- to four-fold increased risk of developing coronary artery disease compared with non-diabetic individuals. [1] Coronary artery disease is characterized by narrowing or obstruction of coronary arteries due to atherosclerotic plaque formation. The development of atherosclerosis is influenced by several well-known risk factors including hypertension, dyslipidemia, smoking, obesity, sedentary lifestyle, and diabetes mellitus. In diabetic patients, hyperglycaemia leads to endothelial dysfunction, oxidative stress, inflammation, and abnormal lipid metabolism, which collectively accelerate the process of atherosclerosis. [2]

Early identification of risk factors and biomarkers associated with coronary artery disease in diabetes is essential for prevention and timely management. Several biochemical markers have been investigated in this regard, including lipid profile, inflammatory markers, and metabolic parameters. Among these, serum uric acid has gained increasing attention as a potential marker associated with cardiovascular disease and metabolic disorders. [3]

Serum uric acid is the final product of purine metabolism in humans and is primarily produced in the liver through the action of the enzyme xanthine oxidase. Under normal physiological conditions, uric acid is excreted mainly by the kidneys and partially through the gastrointestinal tract. Elevated serum uric acid levels, known as hyperuricemia, occur due to either increased production or decreased excretion of uric acid. Traditionally, hyperuricemia has been associated with gout; however, recent studies have suggested that elevated uric acid levels may also play an important role in cardiovascular diseases, metabolic syndrome, and type 2 diabetes mellitus. [4]

Emerging evidence suggests that serum uric acid may contribute to the development of cardiovascular disease through several mechanisms.

Hyperuricemia has been shown to induce endothelial dysfunction, increase oxidative stress, promote inflammation, and stimulate vascular smooth muscle cell proliferation.

These pathophysiological processes are important contributors to atherosclerosis and coronary artery disease. Additionally, uric acid has been associated with insulin resistance, which is a key feature of type 2 diabetes mellitus and metabolic syndrome. [5] Several clinical studies have reported a significant association between elevated serum uric acid levels and the presence or severity of coronary artery disease.

Elevated uric acid levels have been linked with traditional cardiovascular risk factors such as hypertension, obesity, dyslipidemia, and insulin resistance. Some studies have demonstrated that diabetic patients with coronary artery disease have significantly higher serum uric acid levels compared to diabetic patients without coronary artery disease. [6] In addition to its association with cardiovascular risk factors, serum uric acid has also been studied as a predictor of cardiovascular morbidity and mortality. Some epidemiological studies have shown that higher uric acid levels are associated with increased risk of cardiovascular events and adverse outcomes. Elevated uric acid may also contribute to the progression of atherosclerosis and vascular calcification, further increasing the risk of coronary artery disease. [7]

Despite growing evidence linking serum uric acid with cardiovascular disease, the exact role of uric acid as an independent risk factor or merely a marker of underlying metabolic abnormalities remains controversial. Some studies suggest that hyperuricemia may simply reflect the presence of other cardiovascular risk factors such as hypertension, renal dysfunction, and metabolic syndrome. However, other investigations have proposed that uric acid itself may directly contribute to vascular injury and atherosclerosis. [8]

In diabetic patients, the relationship between serum uric acid and coronary artery disease is particularly important because diabetes itself accelerates the process of atherosclerosis and increases the risk of cardiovascular complications. Identifying serum uric acid as a potential marker for coronary artery disease could help in early risk stratification and better management of diabetic patients. Moreover, serum uric acid estimation is inexpensive, widely available, and easily measurable in routine clinical practice, making it a practical biomarker for cardiovascular risk assessment. [6]

In developing countries like India, where the burden of diabetes and cardiovascular diseases is rapidly increasing, early detection of cardiovascular risk factors is essential to reduce morbidity and mortality. Studying the association between serum uric acid levels and coronary artery disease in diabetic patients may provide valuable insights into the role of hyperuricemia in cardiovascular risk and may help identify individuals at higher risk of developing coronary artery disease.

Therefore, the present study aims to evaluate serum uric acid levels in patients with diabetes mellitus and to assess its association with coronary artery disease in patients attending a tertiary care hospital in Andhra Pradesh.

Understanding this relationship may help in improving risk assessment and preventive

strategies for cardiovascular complications in diabetic individuals.

**Aim:** To study serum uric acid as a marker for coronary artery disease in patients with diabetes mellitus attending a tertiary care hospital in Andhra Pradesh.

### Objectives

1. To estimate serum uric acid levels in patients with diabetes mellitus.
2. To evaluate the association between serum uric acid levels and coronary artery disease in diabetic patients.
3. To compare serum uric acid levels in diabetic patients with and without coronary artery disease.
4. To assess the correlation between serum uric acid levels and other cardiovascular risk factors in diabetes mellitus.

### Materials and Methods

**Study Design:** Hospital-based observational cross-sectional study.

**Study Area:** The study was conducted in the Department of General Medicine in a tertiary care hospital in Andhra Pradesh.

**Study Duration:** 1 Year.

**Sample Size:** 102 patients diagnosed with diabetes mellitus attending the hospital during the study period.

**Study Population:** Patients diagnosed with Type 2 Diabetes Mellitus attending outpatient or inpatient departments of the hospital.

### Inclusion Criteria

1. Patients aged  $\geq 30$  years with diagnosed diabetes mellitus.
2. Patients willing to give informed consent.
3. Patients diagnosed with Type 2 Diabetes Mellitus with or without coronary artery disease.

### Exclusion Criteria

1. Patients with chronic kidney disease.
2. Patients with gout or known hyperuricemia on treatment.
3. Patients taking drugs affecting uric acid levels (e.g., diuretics, uricosuric drugs).

4. Patients with acute infections or severe systemic illness.
5. Pregnant women.

**Data Collection:** Detailed clinical history will be obtained including age, gender, duration of diabetes, smoking history, hypertension, and family history of coronary artery disease. A thorough physical examination will be performed including measurement of blood pressure, body mass index (BMI), and other relevant parameters.

### Laboratory Investigations

The following investigations will be carried out:

- Fasting blood glucose
- Post-prandial blood glucose
- HbA1c
- Serum uric acid
- Lipid profile
- Serum creatinine
- Electrocardiogram (ECG)
- Echocardiography (if indicated)

Serum uric acid will be measured using standard enzymatic methods in the hospital laboratory.

**Diagnostic Criteria:** Coronary artery disease will be diagnosed based on clinical history, electrocardiographic findings, echocardiography, and relevant Cardiological evaluation.

**Statistical Analysis:** Data will be entered into Microsoft Excel and analyzed using SPSS software. Continuous variables will be expressed as mean  $\pm$  standard deviation and categorical variables as percentages.

Statistical tests such as Student's t-test and Chi-square test will be used to determine associations between variables. A p-value  $< 0.05$  will be considered statistically significant.

**Ethical Considerations:** The study will be conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent will be obtained from all participants before inclusion in the study.

### Results

A total of 102 patients with Type 2 Diabetes Mellitus were included in the study conducted over a period of 1 year in a tertiary care hospital in Andhra Pradesh.

**Table 1: Age Distribution of Study Participants**

Age Group (Years)	Number of Patients	Percentage (%)
30-40	12	11.8
41-50	28	27.5
51-60	34	33.3
61-70	20	19.6
>70	8	7.8
<b>Total</b>	<b>102</b>	<b>100</b>

Most patients belonged to the 51–60 years age group (33.3%), followed by 41–50 years (27.5%). This indicates that coronary artery disease in diabetic patients was more commonly observed in the middle-aged and elderly population.

**Table 2: Gender Distribution**

Gender	Number of Patients	Percentage (%)
Male	64	62.7
Female	38	37.3
<b>Total</b>	<b>102</b>	<b>100</b>

Among the study participants, males constituted 62.7% while females accounted for 37.3%. This suggests that male diabetic patients were more commonly affected or evaluated for coronary artery disease in this study.

**Table 3: Duration of Diabetes**

Duration (Years)	Number of Patients	Percentage (%)
<5 years	26	25.5
5–10 years	42	41.2
>10 years	34	33.3
<b>Total</b>	<b>102</b>	<b>100</b>

Most patients (41.2%) had diabetes for 5–10 years, followed by 33.3% with duration greater than 10 years. This suggests that longer duration of diabetes may contribute to increased cardiovascular complications.

**Table 4: Prevalence of Coronary Artery Disease among Study Participants**

CAD Status	Number of Patients	Percentage (%)
CAD Present	46	45.1
CAD Absent	56	54.9
<b>Total</b>	<b>102</b>	<b>100</b>

Out of 102 diabetic patients, 46 (45.1%) were diagnosed with coronary artery disease while 56 (54.9%) did not have CAD. This indicates a high prevalence of coronary artery disease among diabetic individuals.

**Table 5: Mean Serum Uric Acid Levels in Study Population**

Parameter	Mean $\pm$ SD (mg/dL)
Serum Uric Acid	6.8 $\pm$ 1.4

The mean serum uric acid level among all participants was 6.8  $\pm$  1.4 mg/dL. Elevated uric acid levels were observed in a significant proportion of diabetic patients.

**Table 6: Comparison of Serum Uric Acid Levels in CAD and Non-CAD Patients**

Group	Mean Uric Acid (mg/dL)	SD	p-value
CAD Present	7.6	1.2	
CAD Absent	6.1	1.1	<b>0.001</b>

The mean serum uric acid level was significantly higher in diabetic patients with coronary artery disease (7.6 mg/dL) compared to those without CAD (6.1 mg/dL). This difference was statistically significant ( $p = 0.001$ ) indicating a strong association between elevated uric acid and CAD.

**Table 7: Association between Serum Uric Acid Level Categories and CAD**

Uric Acid Level	CAD Present	CAD Absent	Total	p-value
Normal (<7 mg/dL)	14	38	52	
Elevated ( $\geq$ 7 mg/dL)	32	18	50	<b>0.002</b>
<b>Total</b>	<b>46</b>	<b>56</b>	<b>102</b>	

Among patients with elevated serum uric acid levels, 64% had coronary artery disease, compared to 26.9% with normal levels. The association between hyperuricemia and CAD was statistically significant ( $p = 0.002$ ).

**Table 8: Association between Hypertension and Coronary Artery Disease**

Hypertension	CAD Present	CAD Absent	Total	p-value
Present	30	20	50	
Absent	16	36	52	<b>0.004</b>
<b>Total</b>	<b>46</b>	<b>56</b>	<b>102</b>	

Hypertension was observed in 65.2% of diabetic patients with CAD compared to 35.7% among those without CAD. The association between hypertension and coronary artery disease was statistically significant ( $p = 0.004$ ).

**Table 9: Association between BMI and Coronary Artery Disease**

BMI Category	CAD Present	CAD Absent	Total	p-value
Normal (<25)	10	22	32	
Overweight (25–29.9)	20	24	44	
Obese (≥30)	16	10	26	<b>0.03</b>
<b>Total</b>	<b>46</b>	<b>56</b>	<b>102</b>	

A higher proportion of obese patients (61.5%) had coronary artery disease compared to those with normal BMI. The association between BMI and CAD was statistically significant ( $p = 0.03$ ).

### Discussion

Diabetes mellitus is a chronic metabolic disorder that significantly increases the risk of cardiovascular diseases, particularly coronary artery disease (CAD). The presence of diabetes accelerates the process of atherosclerosis through mechanisms such as endothelial dysfunction, oxidative stress, chronic inflammation, and abnormal lipid metabolism. Identifying biochemical markers that can predict the development of coronary artery disease in diabetic patients is essential for early diagnosis and prevention. Serum uric acid has recently gained attention as a potential marker associated with cardiovascular diseases, metabolic syndrome, and diabetes mellitus. The present study was conducted to evaluate the relationship between serum uric acid levels and coronary artery disease in patients with diabetes mellitus attending a tertiary care hospital in Andhra Pradesh.

In the present study, the majority of patients belonged to the age group of 51–60 years (33.3%), followed by the 41–50 years age group (27.5%). These findings are consistent with previous studies which reported that cardiovascular complications among diabetic patients are more common in middle-aged and elderly populations. A study by Shah et al. reported that the mean age of diabetic patients with coronary artery disease was around 55 years, indicating that the risk of CAD increases with advancing age in patients with diabetes mellitus.<sup>9</sup> Similarly, Kumar et al. observed that most diabetic patients with coronary artery disease were above the age of 50 years, supporting the observation that age is an important determinant of cardiovascular complications in diabetes. [10] Aging is associated with progressive endothelial dysfunction, increased arterial stiffness, and accumulation of atherosclerotic plaques, which contribute to the higher incidence of CAD in older individuals.

Gender distribution in the present study showed that males constituted 62.7% of the study population, while females accounted for 37.3%. This male predominance is consistent with findings from other studies evaluating cardiovascular risk in diabetic patients. Desai et al. reported that male

patients represented approximately 60% of their study population with coronary artery disease in diabetes. [11] Similarly, Patel et al. found that males were more commonly affected by coronary artery disease compared to females in diabetic populations. [12] The higher prevalence of CAD among males may be attributed to several factors including higher rates of smoking, alcohol consumption, sedentary lifestyle, and other metabolic risk factors. In addition, hormonal factors may provide a protective effect in premenopausal women, which may partly explain the lower incidence of CAD among females.

The duration of diabetes is another important factor associated with the development of cardiovascular complications. In the present study, 41.2% of patients had diabetes for 5–10 years, while 33.3% had diabetes for more than 10 years. These findings are comparable with the observations made by Singh et al., who reported that patients with longer duration of diabetes had a significantly higher risk of coronary artery disease. [13]

Chronic hyperglycemia over a prolonged period leads to glycation of proteins, endothelial dysfunction, oxidative stress, and vascular inflammation, all of which contribute to the development and progression of atherosclerosis. Similarly, Gupta et al. reported that the prevalence of coronary artery disease increased significantly in patients with diabetes duration exceeding 10 years. [14] In the present study, 45.1% of diabetic patients were found to have coronary artery disease, indicating a high burden of cardiovascular complications among individuals with diabetes mellitus. This finding is consistent with earlier studies that reported an increased prevalence of CAD in diabetic populations. Reddy et al. reported that nearly 40–50% of diabetic patients evaluated in their study had evidence of coronary artery disease. [15] Diabetes mellitus is known to accelerate atherosclerosis through multiple mechanisms including dyslipidemia, insulin resistance, increased platelet aggregation, and endothelial dysfunction. These metabolic abnormalities collectively contribute to the development of coronary artery disease in diabetic individuals.

One of the major findings of the present study was the significant association between serum uric acid levels and coronary artery disease in patients with diabetes mellitus. The mean serum uric acid level

among diabetic patients with CAD was significantly higher compared to those without CAD. These findings are comparable to those reported by Shah et al., who demonstrated that serum uric acid levels were significantly elevated in diabetic patients with coronary artery disease compared to those without CAD.<sup>9</sup> Similarly, Cheng et al. reported that higher serum uric acid levels were associated with an increased risk of cardiovascular disease and adverse cardiovascular outcomes. [16]

The association between serum uric acid and coronary artery disease may be explained by several biological mechanisms. Elevated uric acid levels can lead to endothelial dysfunction by reducing nitric oxide availability and increasing oxidative stress. Uric acid also stimulates inflammatory pathways and promotes proliferation of vascular smooth muscle cells, which contribute to the development of atherosclerotic plaques. Kanellis and Kang demonstrated that hyperuricemia can induce vascular inflammation and endothelial dysfunction, thereby contributing to the progression of atherosclerosis. [17]

These mechanisms suggest that uric acid may play an active role in the pathogenesis of cardiovascular disease rather than merely acting as a marker of metabolic abnormalities.

In the present study, patients with elevated serum uric acid levels ( $\geq 7$  mg/dL) showed a significantly higher prevalence of coronary artery disease compared to those with normal uric acid levels. This association was statistically significant. Similar observations were made by Fang and Alderman, who reported that elevated serum uric acid levels were associated with increased cardiovascular mortality. [18] Likewise, Rodrigues et al. demonstrated that higher uric acid levels were associated with the progression of coronary atherosclerosis and increased risk of cardiovascular events. [19] Hypertension was another important risk factor evaluated in the present study. It was observed that hypertension was more common among diabetic patients with coronary artery disease compared to those without CAD. These findings are consistent with previous studies that reported a strong relationship between hypertension and coronary artery disease. Patel et al. also observed that hypertension was significantly associated with the presence of CAD among diabetic patients. [12] Hyperuricemia has been shown to contribute to the development of hypertension by stimulating renin-angiotensin system activation and reducing endothelial nitric oxide production, which may further increase cardiovascular risk.

Body mass index (BMI) was also found to be associated with coronary artery disease in the

present study, with a higher proportion of obese patients developing CAD. These findings are in agreement with the study conducted by Gupta et al., who reported that obesity and increased BMI were important risk factors for cardiovascular disease in diabetic populations. [14] Obesity is associated with insulin resistance, systemic inflammation, and dyslipidemia, all of which contribute to the development of atherosclerosis.

Overall, the findings of the present study are consistent with several previous studies that demonstrated a significant association between serum uric acid levels and coronary artery disease in patients with diabetes mellitus. Since serum uric acid estimation is inexpensive, widely available, and easy to perform, it may serve as a useful biomarker for identifying diabetic patients at higher risk of developing coronary artery disease. However, further prospective studies with larger sample sizes are required to determine whether serum uric acid is an independent predictor of coronary artery disease or simply reflects the presence of other metabolic risk factors.

### Conclusion

The present study evaluated the association between serum uric acid levels and coronary artery disease in patients with diabetes mellitus attending a tertiary care hospital in Andhra Pradesh. The findings demonstrated that serum uric acid levels were significantly higher among diabetic patients with coronary artery disease compared to those without CAD. This indicates that hyperuricemia may be associated with an increased risk of cardiovascular complications in diabetes. In addition, other risk factors such as age, duration of diabetes, hypertension, and obesity were also found to influence the occurrence of CAD. Therefore, serum uric acid estimation may serve as a simple and useful marker for early identification of diabetic patients at higher cardiovascular risk.

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