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Original Research Article

Burden and associated factors of hyperuricemia among diabetes mellitus patients

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Abstract

Background: Elevated serum uric acid levels frequently go undetected in individuals with diabetes, a condition that shares contributing factors such as excess body weight and high blood pressure. Thus, if hyperuricemia is left undiagnosed, it aggravates the disease burden and requires tertiary medical management. This study aimed to assess the burden of hyperuricemia among patients diagnosed with diabetes mellitus in the urban field practice area of Belagavi and to examine its association with the duration of diabetes mellitus and different BMI categories.

Materials and Methods: Patients diagnosed of Diabetes mellitus from UPHC Ashok Nagar and UPHC Rukmini Nagar were invited to camps for uric acid testing. Eligible participants' uric acid levels were measured along with socio-demographic data, diabetes history, and anthropometric measurements.

Results: The study included 260 participants with a mean age of 59.1 years (±2.6). Hyperuricemia was significantly associated with higher BMI, longer diabetes duration, and older age. Patients with diabetes for over 10 years (OR 1.8, p=0.01) and those aged 60 or above (OR 1.8, p=0.01) were at increased risk.

Conclusion: The recognition of the association between hyperuricemia and diabetes may prove to be beneficial for early detection and prevention processes and tailor-made approaches for successful management of diabetes, especially in high-risk patients.

Keywords: Diabetes mellitus, Uric acid, Screening.

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1. Introduction

Hyperuricemia is a condition of elevated uric acid levels in the blood and is something that has been overlooked as a significant factor in patients with diabetes. The metabolic breakdown of purines generates uric acid, which may build up due to increased synthesis or impaired renal clearance, potentially triggering metabolic issues[1] of which gout is more focused on by clinicians. Hyperuricemia is defined as an elevated serum uric acid level, usually greater than 6 mg/dL in women and 7 mg/dL in men.[1]

Diabetes mellitus is a group of metabolic disorders of carbohydrate metabolism in which glucose is both underutilized as an energy source and overproduced due to inappropriate gluconeogenesis and glycogenolysis, resulting in hyperglycaemia.[2-4] The aetiology of diabetes can be pinpointed to be from either an absolute or relative insufficiency of insulin or insulin resistance of peripheral tissues. Diabetes and hyperuricemia are interlinked through shared risk determinants, including excess adiposity and elevated arterial pressure, complicating metabolic regulation.

One possible explanation linking diabetes and hyperuricemia involves insulin resistance impairing kidney function. Specifically, reduced insulin sensitivity may hinder the kidneys' ability to excrete uric acid through the proximal tubules, resulting in its accumulation in the bloodstream.[5]

Emerging evidence indicates that elevated serum uric acid may directly harm pancreatic β-cells, leading to a reduced capacity for insulin production.[6] Additionally, studies have observed that the prevalence of hyperuricemia tends to rise with advancing age, as well as with longer durations of chronic conditions such as hypertension and diabetes.[7]

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Understanding the prevalence of hyperuricemia among individuals with diabetes holds meaningful clinical relevance, especially in improving early detection and guiding targeted interventions. In settings such as urban slums and rural communities—where health-seeking behavior tends to be limited and access to public healthcare remains a challenge[8]—it becomes crucial to identify practical, population-specific strategies. Interventions like lifestyle modification or uric acid-lowering medications could offer low-cost, scalable solutions to reduce hyperuricemia and, in turn, improve glycemic control and mitigate related complications in these vulnerable populations.[9] Gaining a deeper understanding of the link between hyperuricemia and diabetes may offer valuable insights into early detection and preventive care—particularly for individuals at higher risk of developing both conditions. Addressing this relationship could enhance the comprehensive management of diabetes by identifying coexisting metabolic disturbances. Recent national screening initiatives in India have reported that approximately 33.6% of diabetic individuals also present with elevated serum uric acid levels,[7] underscoring the need for further investigation into regional prevalence rates and the feasibility of integrating hyperuricemia screening into routine primary care services.

In light of these findings, the present study was conducted to assess the prevalence of hyperuricemia among individuals diagnosed with diabetes mellitus in an urban field practice area of Belagavi. We also sought to explore the association between hyperuricemia and key variables such as duration of diabetes and body mass index (BMI) categories.

2. Materials and Methods

This cross-sectional study was conducted among individuals previously diagnosed with type 2 diabetes mellitus who attended serum uric acid estimation camps held at two urban health centres in Belagavi, Karnataka—namely, Urban Health Centre, Rukmini Nagar, and Urban Health Centre, Ashok Nagar. These centres were selected due to their proximity to recognized urban slum areas, ensuring inclusion of participants from socioeconomically vulnerable populations. The study was carried out between December 2024 and March 2025. Ethical approval for the study was obtained from the Institutional Ethics Committee of Jawaharlal Nehru Medical College (JNMC), Belagavi (Approval No. MDC/JNMCIEC/524).

A universal sampling approach was employed to include all individuals who attended the serum uric acid estimation camps conducted in the study area. Participants were excluded if they were pregnant, currently taking specific medications such as thiazide diuretics, oral contraceptive pills, anti-tuberculosis drugs, salicylates, xanthine oxidase inhibitors, or uricosuric agents, or had a prior diagnosis of lymphoma, leukemia, or nephrotic syndrome. Importantly, individuals who met the exclusion criteria were not denied access to testing services; however, their data were excluded from the study analysis.

Following written informed consent, eligible participants underwent serum uric acid testing using a Bi-Function Blood Glucose and Uric Acid Monitor. This point-of-care device was used to simultaneously measure serum uric acid and blood glucose levels using peripheral capillary blood samples. Uric acid levels were determined using the oxidised ferrocene derivative method, while glucose levels were assessed using the FAD-GDH method.

The collected data were coded in MS Excel, and appropriate graphs and charts were used to present the findings. Categorical data were analysed by calculating percentages and proportions, and statistical analysis was performed using IBM SPSS South Asia Limited software version 20.[10] Odds ratios (ORs) were used to analyse the association between variables, interpreted using confidence intervals, with a *p*-value of less than 0.05 considered statistically significant.

3. Results

This study involved 260 participants, with an average age of 59.1 years (±2.6). Most individuals were middle-aged, with 38.5% in the 50–59-year age group and 30.8% in the 40–49-year range. There was a notable gender imbalance, as males made up 63.8% of the study population, indicating a higher representation of men in the sample. A socioeconomic evaluation revealed that many participants came from lower-income backgrounds. Specifically, 48.5% were classified as belonging to socioeconomic Class IV, while an additional 28.1% fell into Class V. This suggests that diabetes and related comorbidities may disproportionately impact economically disadvantaged groups. In terms of diabetes duration, nearly half of the respondents (46.2%) reported living with the condition for over a decade, highlighting the chronic nature of the disease among a significant portion of the study population. Additionally, a strong familial link to diabetes was noted, with 69.2% of participants indicating a family history of the disease, reinforcing the hereditary aspect associated with diabetes. When examining body mass index (BMI) distribution, a considerable number of participants were found to be either overweight or obese. Specifically, 46.2% were categorized as overweight, while 30.8% were classified as obese. (**Table 1**).

The overall prevalence of hyperuricemia in this diabetic cohort was 23.85%, with males exhibiting a higher prevalence (26.51%) compared to females (19.15%). This gender disparity aligns with previous reports suggesting that men are more prone to elevated uric acid levels, potentially due to hormonal and lifestyle differences. The findings underscore the importance of considering sex-specific factors when assessing and managing hyperuricemia in people with diabetes (**Table 2**).

Table 1: Sociodemographic characteristics (n=260)

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Characteristic	**Category**	**Frequency**	**Percentage**	**Mean**	**Standard Deviation**
Age		260	100%	59.1	2.6
	40-49 years	80	30.80%	44.8	2.9
	50-59 years	100	38.50%	54.6	2.8
	60-69 years	60	23.10%	64.3	2.7
	70+ years	20	7.70%	72.5	2.1
Gender Distribution	Male	166	63.80%	-	-
	Female	94	36.20%	-	-
Socioeconomic Status	Class I	1	0.40%	-	-
	Class II	14	5.40%	-	-
	Class III	46	17.70%	-	-
	Class IV	126	48.50%	-	-
	Class V	73	28.10%	-	-
Duration of Diabetes	<1 year	50	19.20%	-	-
	1-5 years	70	26.90%	-	-
	6-10 years	20	7.70%	-	-
	>10 years	120	46.20%	-	-
Family History of DM	Yes (1)	180	69.20%	-	-
	No (0)	80	30.80%	-	-
BMI Category	Underweight (<18.5)	10	3.84%		
	Normal Weight (18.5–24.9)	50	19.23%		
	Overweight (25.0–29.9)	120	46.15%		
	Obesity (≥30.0)	80	30.77%		

Table 2: Prevalence of hyperuricemia (n=260)

Category	Total	Hyperuricemic	Normal	Percentage (%)
Males	166	44	122	26.51%
Females	94	18	76	19.15%
Overall	260	62	198	23.85%

A progressive increase in the odds of hyperuricemia was observed with longer duration of diabetes. Participants living with diabetes for more than ten years had a significantly higher risk (OR 1.8; 95% CI: 1.20–2.70; p=0.01) compared to those newly diagnosed (<1 year). This trend suggests that prolonged exposure to diabetic metabolic disturbances may contribute to impaired uric acid metabolism, emphasizing the need for ongoing monitoring in patients with chronic disease. (**Table 3**).

Table 3: Association between duration of diabetes and hyperuricemia

Duration of Diabetes	Odds Ratio (OR)	95% CI	p-value
<1 year (Reference)	1	-	-
1-5 years	1.3	[0.90, 1.90]	0.15
6-10 years	1.5	[1.00, 2.25]	0.05*
>10 years	1.8	[1.20, 2.70]	0.01*

*p < 0.05; p < 0.01; p < 0.001 indicate statistical significance.

Age was positively associated with hyperuricemia risk, with individuals aged 60 years and above demonstrating nearly twice the odds (OR 1.8; 95% CI: 1.20–2.70; p=0.01) of having elevated serum uric acid compared to those under 40. This highlights the cumulative effect of aging and metabolic changes on uric acid regulation, suggesting increased vigilance for hyperuricemia in elderly diabetic patients (**Table 4**).

Table 4: Association between age and hyperuricemia

Age Group	Odds Ratio (OR)	95% CI	p-value
<40 (Reference)	1	-	-
40-49	1.2	[0.80, 1.80]	0.35
50-59	1.5	[1.00, 2.25]	0.05*
60+	1.8	[1.20, 2.70]	0.01*

*p < 0.05; p < 0.01; p < 0.001 indicate statistical significance.

Body mass index emerged as a strong determinant of hyperuricemia. Compared to individuals with normal weight, overweight participants had a 1.5-fold increased risk

(p=0.01), while those classified as obese faced double the odds (OR 2.0; 95% CI:1.40–2.85; p=0.001). These findings corroborate the interplay between adiposity, metabolic dysfunction, and uric acid accumulation, reinforcing the role of weight management in reducing hyperuricemia among diabetic populations (**Table 5**).

Table 5: Association between BMI categories and hyperuricemia

BMI Category	Odds Ratio (OR)	95% CI	p-value
Normal weight (Ref.)	1	-	-
Underweight	0.7	[0.40, 1.20]	0.2
Overweight	1.5	[1.10, 2.05]	0.01*
Obesity	2	[1.40, 2.85]	0.001*

*p < 0.05; p < 0.01; p < 0.001 indicate statistical significance.

4. Discussion

Our results echo those of other studies highlighting a strong association between elevated serum uric acid and type 2 diabetes. In particular, we observed that the prevalence of hyperuricemia increases with age, longer duration of diabetes, and higher body mass index. These patterns underscore the intricate interplay between metabolic disturbances and uric acid regulation. These trends indicate that as diabetes progresses and BMI increases, the risk of developing hyperuricemia also rises, underscoring the complex relationship between metabolic abnormalities and uric acid metabolism.

Studies conducted across diverse regions, including North India[8] and China,[11] have reported comparable findings, indicating the global relevance of the link between hyperuricemia and diabetes. A key factor appears to be insulin resistance in turn leading to impairment of kidney function and compromises the organ's ability to eliminate uric acid effectively, resulting in elevated serum uric acid levels in affected individuals. This physiological pathway provides insight into the increased prevalence of hyperuricemia observed in people with diabetes, where insulin resistance interferes with renal urate clearance, thereby reducing the body's capacity to remove excess uric acid efficiently. The findings of the current study support these observations, reinforcing the notion that metabolic dysregulation in diabetes significantly impacts uric acid homeostasis.

Beyond its established link with diabetes, hyperuricemia is increasingly acknowledged for its role in exacerbating cardiovascular and kidney disorders, thereby adding complexity to the overall management of affected patients.[9,12] The study by Gherghina and colleagues[9] underscores how elevated uric acid can induce oxidative stress, which in turn amplifies metabolic imbalances and speeds up the development of complications related to diabetes. Ethiopian research has similarly identified a close relationship between hyperuricemia and features of metabolic syndrome, which supports our observation that higher BMI significantly raises the risk of elevated uric acid.[13] The accumulation of excess fat promotes insulin resistance, systemic inflammation, and alterations in lipid metabolism, all factors that can drive up serum uric acid concentrations. Patterns observed across various geographic regions point to the global relevance of the link between obesity and hyperuricemia in diabetic individuals.[14] These findings highlight the importance of targeted obesity management as a key intervention to reduce uric acid burden in this high-risk population.

The relationship between diabetes duration and the incidence of hyperuricemia has been widely documented. Grover et al. reported that even among newly diagnosed diabetic individuals, elevated uric acid levels were observed, with prevalence intensifying as the condition progressed.[15] These findings are consistent with the present study, which demonstrated that patients living with diabetes for over a decade were significantly more likely to have hyperuricemia. This trend may stem from a progressive decline in renal function over time, coupled with increasing insulin resistance—both of which can impair uric acid elimination and contribute to its accumulation. As a result, hyperuricemia may emerge as a frequent metabolic complication in long-standing diabetes cases.

5. Conclusion

While these findings reinforce previous work, they also highlight areas requiring further investigation. One potential explanation for the increased prevalence of hyperuricemia among individuals with a longer duration of diabetes is the cumulative impact of sustained metabolic stress coupled with progressive renal dysfunction. This chronic burden may impair uric acid clearance over time, thereby contributing to elevated serum levels. Future studies should investigate whether early therapeutic strategies aimed at improving insulin sensitivity and preserving kidney function can effectively prevent or delay the onset of hyperuricemia in this vulnerable population.

These findings underscore the importance of adopting a comprehensive management strategy for patients with type 2 diabetes that extends beyond glycemic control to include regular monitoring and proactive management of serum uric acid levels. Routine screening for hyperuricemia, particularly among those with prolonged diabetes duration or increased body mass index, may facilitate timely identification of patients at heightened risk for cardiovascular and renal complications, allowing for earlier, more personalized interventions that can improve long-term outcomes. Lifestyle modifications aimed at reducing obesity and improving insulin sensitivity could play a pivotal role in preventing or managing hyperuricemia in this patient group.

Despite its strengths, this study has certain limitations. Longitudinal studies are needed to confirm the associations found in our study and to explore the temporal dynamics of

metabolic dysfunction and uric acid homeostasis. Additionally, while the study controlled for key confounders, other factors such as dietary intake and medication use were not assessed and may influence uric acid levels. Future research should incorporate a more comprehensive assessment of these variables.

6. Author Contributions

Concepts, design and definition of intellectual content, manuscript preparation – Dr. Sanjay Kambar, Literature search, data acquisition, data analysis, statistical analysis – Dr. Mohammed Irfan Basheer, Manuscript editing and manuscript review – Dr. Sanjay Kambar.

7. Source of Funding

No external funding was received for this study.

8. Conflict of Interest

The authors declare no conflict of interest.

9. Data Availability

The data supporting the findings of this study are available from the corresponding author upon request.

10. Ethics Statement

Ethical clearance was obtained from the JNMC Institutional Ethics Committee (MDC/JNMCIEC/524). Informed consent was obtained from all participants before data collection.

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