ORIGINAL ARTICLE

FREQUENCY OF HYPERURICEMIA IN TYPE 2 DIABETES MELLITUS PATIENTS WITH BMI >23 KG/M²- STUDY AT A TERTIARY CARE HOSPITAL

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ABSTRACT

OBJECTIVE: To determine the frequency of hyperuricemia in type 2 diabetes mellitus (T2DM) patients with BMI >23 kg/m²

Materials and Methods: This descriptive study was conducted from February 2020 to September 2021. All patients with Type 2 Diabetes Mellitus (T2DM)with body mass index (BMI) >23 kg/m² were assessed for hyperuricemia through Roche Cobas 6000 series C501 in MTI Hayatabad Medical Complex's laboratory.

RESULTS: Total number of patients was 300, out of which 60 % were males. The studied population has a mean age of 59 (SD =±7) years, mean systolic blood pressure was 151 (SD = ±17) mmHg, mean duration of T2DM was 13 (SD = ±4) years, mean HbA1c was 10.9 (SD = ±2.5) %, mean BMI was 28.8 (SD = ±3.1) kg/m² and mean serum uric acid was 5.7 (SD=±1.3) mg/dl. The overall prevalence of Hyperuricemia was 47% (36.7 % males and 62.5% females). Of those with hyperuricemia, 73 % were also found to have hypertension. Results showed that patients with hyperuricemia belonged to older age, and have higher Systolic blood pressure, raised BMI, and HbA1c. The mean differences were considered statistically significant with a p-value < 0.05 by using an independent sample t-test.

Conclusion: The current study demonstrated a higher prevalence of hyperuricemia in T2DM patients with BMI> 23 kg/m². Patients with hyperuricemia had a higher mean HbA1c, higher mean BMI, and raised systolic component of blood pressure.

keywords: BMI, Hyperuricemia, Hypertension, Type 2 diabetes mellitus, HbA1c

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INTRODUCTION

Diabetes mellitus (DM) is one of the major diseases globally with a rise in the estimated incidence, especially in developing countries[1]. According to the estimates, there were 537 million people with diabetes worldwide in 2021, and by the end of 2045; these figures are expected to increase to 783 million. According to the International Diabetic Federation (IDF), 33 million of the population of Pakistan has diabetes, and it is estimated to increase to 62 million by the year 2045. [2]

In Purine metabolism, Uric acid (UA) is the final oxidation product. As insulin levels are raised initially in DM due to insulin resistance, these higher levels of insulin interfere with uric acid clearance by the kidneys, this decrease in clearance leads to higher levels of uric acid, and patients with type 2 DM are thus more prone to uric acid injury[3]. Also, high serum UA has a major contribution to insulin resistance[4]. In the general population, hyperuricemia is being demonstrated as a risk for cardiovascular diseases by several studies. Some studies have also evaluated that hyperuricemia predicts the development of hypertension, metabolic syndrome, obesity, and T2DM[5]. Studies have also revealed that elevated levels of serum uric acid are associated with T2DM progression and play an important role in the development of coronary artery disease[6]. Some studies have also demonstrated the progression and worsening of renal disease with hyperuricemia in patients with T2DM. Moreover, it has also been found that complications of diabetes are more pronounced in those with elevated levels of serum uric acid compared to those with normal uric acid levels[7]. The high prevalence of hyperuricemia could be attributed to recent changes in lifestyle, diet, and increased life expectancy due to improved medical care[8].

A survey was done in 2007–2008 (National Health and Nutrition Examination Survey), showing a 21 % prevalence of hyperuricemia in American adults, approaching 26% in African Americans.[9] Woldeamlak et al's study

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showed hyperuricemia's prevalence of 31.5% in patients with T2DM. This study also revealed that elevated systolic blood pressure, increased waist circumference, and BMI ≥ 25 Kg/m2 were significantly associated with hyperuricemia.[10] Other studies conducted by Wang J et al. from China, Woyesa et al. from Ethiopia, and Shah P et al. from Egypt showed the prevalence of hyperuricemia to be 32.2%, 33.8%, and 32.0%, respectively.[11-13] A study by Shah et al. from Pakistan on hyperuricemia in type 2 DM patients revealed a prevalence of 25%, with a higher frequency of hyperuricemia and mean BMI in females compared to males.[14]

Serum uric acid is one of the most ignored investigations in patients with diabetes, though its prevalence is rising. The rationale for the index study was to determine the prevalence of hyperuricemia in diabetic patients who had a BMI> 23 kg/m² in our local population and to study the various clinical and biochemical parameters associated with hyperuricemia, keeping in view that very limited studies are available and its strong association with cardiovascular diseases.

MATERIALS AND METHODS

This study was conducted in the OPD of the Department of Diabetes, Endocrinology and Metabolic Diseases, MTI Hayatabad Medical Complex (HMC), Peshawar. The duration of this study was from February 2020 to September 2021. It was a descriptive cross-sectional study approved by the institutional research & ethical committee of MTI HMC. Written informed consent was obtained from all patients. All the relevant information, including demographics (Name, age, gender, BMI, duration of Diabetes, HBA1C & Serum Uric Acid), was obtained on pre-designed Pro-forma. Patients aged 30 - 75 years, either gender, diagnosed with T2DM, and BMI > 23 kg / m² were included in the study by non-probability consecutive sampling technique. The following patients were excluded; critically ill patients (sepsis/septicaemia, diabetic ketoacidosis, hyperosmolar hyperglycemic state, acute kidney injury, MI or stroke), those having chronic kidney disease, chronic liver disease, and those using uric acid lowering drugs. Blood specimen for uric acid, complete blood count, renal function tests, liver function tests, and random blood sugar and HBA1c was collected and sent to the hospital laboratory. Data were stored and analysed by the statistical program SPSS. All the quantitative variables were analysed for mean ± standard deviation. Frequencies and percentages were calculated for qualitative variables. Hyperuricemia was defined as a serum uric acid level of > 7 mg/dl in males and > 5.7 mg/dl in females.[15] Association of Hyperuricemia was tested with gender, hypertension, BMI, and duration of diabetes using the Chi square test and independent samples t-test was used to compare mean levels between two studied groups. P-values less than 0.05 were considered statistically significant.

RESULTS

The total number of patients was 300, out of which 60 % were males. Fifty-Six (56%) participants were hypertensive. The overall prevalence of hyperuricemia in the current study was 47%. Table -1 reports the baseline characteristics of the studied population.

Table-2 shows the mean and standard deviation of quantitative variables. The studied population has a mean age of 59 (SD =±7) years, mean systolic blood pressure was 151 (SD = ±17) mmHg, mean duration of T2DM was 13 (SD = ±4) years, mean HbA1c was 10.9 (SD = ±2.5) %, mean BMI was 28.8 (SD = ±3.1) kg/m² and mean serum uric acid was 5.7 (SD = ±1.3) mg/dl.

Table-3 describes the association of hyperuricemia with studied factors. Results showed that 36.7 % males and 62.5% females were having Hyperuricemia. Of those with hyperuricemia, 73 % were also found to have hypertension. Chi Square test give a significant association of outcomes with gender and hypertension with p value<0.05.

Table-4 demonstrates a mean comparison of quantitative characteristics between the two groups having normo-uricemia and hyper-uricemia. Results showed that patients with hyperuricemia belonged to older age, and have higher Systolic blood pressure, raised BMI, and HbA1c. The mean differences were considered statistically significant with a p-value < 0.05 by using an independent sample t-test, however, the duration of diabetes was found similar between normo-uricemia and hyperuricemia samples with p value=0.96, considered statistically insignificant.

Table 1: Baseline Qualitative Characteristics of Studied Samples (n= 300)

		%
Patient's gender	Male	60.0
	Female	40.0
Hypertension	Hypertensive	56.0
	Normotensive	44.0
Hyperuricemia	Normouricemia	53.0
	Hyperuricemia	47.0

Table 2: Baseline Quantitative Characteristics of Studied Samples (n= 300)

Characteristics	Mean	Standard Deviation
Patient's age (years)	59	7
Systolic BP (mmHg)	151	17
Duration of T2DM (years)	13	4
Patient's BMI (kg/m2)	28.8	3.1
HbA1c (%)	10.9	2.5
Serum Uric acid (mg/dl)	5.7	1.3

Table 3: Association of Hyperuricemia with Studied Factors

Factors		Outcomes				p-value
		Normouricemia (n=159)		Hyperuricemia (n=141)		
		n	%	n	%	
Patient's gender	Male	114	63.3	66	36.7	0.01*
	Female	45	37.5	75	62.5	
Hypertension	Hypertensive	45	26.8	123	73.2	<0.01*
	Normotensive	114	86.4	18	13.6	
Duration of Type 2 DM	≤ 5 years	6	66.7	3	33.3	0.07
	5 to 10 years	66	68.7	30	31.2	
	≥ 10 years	87	44.6	108	55.3	
BMI Categories	23 to 27.4	129	97.7	3	2.3	<0.001
	(Overweight)	30	17.8	138	82.1	
HbA1c (%) Categories	≤ 7	3	100	0	0	0.017
	7 to 9.9	81	69.2	36	30.8	
	≥ 10	75	41.7	105	58.3	

*p<0.05 was considered significant using Chi Square test

Table 4: Mean Comparison of Studied Parameters with Hyperuricemia

Parameters	Normouricemia (n=159)		Hyperuricemia (n=141)		p-value
	Mean	SD	Mean	SD	
Patient's age (years)	57.4	5.3	60.5	7.5	0.017*
Systolic BP (mmHg)	131.2	13.3	151.5	13.6	<0.01*
Duration of T2DM (years)	12.6	4.6	12.6	3.3	0.96
Patient's BMI (kg/m2)	26.6	1.9	31.4	1.7	<0.01*
HbA1c (%)	9.9	1.8	12.0	2.7	<0.01*
Serum Uric acid (mg/dl)	4.6	0.9	6.8	0.6	<0.01*

*p<0.05 was considered significant using Chi Square test

DISCUSSION

In the current study, we identified that 47 % of patients with T2DM and BMI >23kg/m² were found to have hyperuricemia, of whom 62.5% were females. Among those having hyperuricemia, 73.2% of them were hypertensive as well with a mean systolic blood pressure of 151.5 mmHg. This prevalence of hyperuricemia in the current study is higher as compared to two studies conducted one in China and the other in South West Ethiopia which showed a prevalence of 32.2 % and 33.8 % respectively. [11,12] Another study conducted by Fennoun H et al showed a prevalence of 26.5% which was much lower compared to the observed frequency in our study, However, the study showed a higher prevalence of hyperuricemia amongst female patients which is matching with findings in the current study.[16] kumar et al study showed a higher prevalence of hyperuricemia of 66.67 % in patients with T2DM.[17] Another study conducted by Mundhe SA et al showed the prevalence of hyperuricemia to be 25.3% which was much lower compared to our study. [18]

These differences in the prevalence among different studies might be explained by differences in the participant's profiles such as dietary factors, genetic factors, geographical location, sample size, study design and methodology, and the use of different cut-off values for hyperuricemia. Moreover, our study included only those patients with T2DM who had BMI >23 kg/m².

Our study also demonstrated that patients with hyperuricemia had a higher mean systolic BP (151.5 vs 131.2 mmHg), higher mean HbA1c (12 vs 9.9 %), and higher mean BMI (31.4 vs 26.6 kg/m²) compared to the group of patients having normal uric acid levels. These differences in the mean between the two groups were statistically and clinically significant (p-value < 0.05). Similar findings were observed by Yoo et al. who showed that serum uric acid concentration was found to be independently correlated with hypertension.[19] A study conducted by Arsera et al. revealed that hyperuricemia was associated with obesity.[20] Similarly, another study also demonstrated an association of hyperuricemia with a higher BMI.[21] These findings were

comparable to our study. This may be due to the increased insulin resistance in patients with obesity.

The limitation of this study is that it was a cross-sectional study, where correlations between different factors are difficult to obtain. Only a prospective study could definitively confirm the associations and correlations between different patient characteristics and the serum uric acid levels. Further large-scale studies are required to study other parameters like hypertriglyceridemia, low HDL cholesterol, and alcohol consumption in association with hyperuricemia in order to have a better insight into understanding the underlying pathophysiology. This will help us in prevention and in time management as studies have already identified increased levels of uric acid as a risk factor for renal and cardiovascular diseases.

CONCLUSION

The current study demonstrated a higher prevalence of hyperuricemia in T2DM patients with BMI> 23 kg/m^2. Patients with hyperuricemia had a higher mean HbA1c, higher mean BMI, and raised systolic component of blood pressure.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Noor A: Main Idea, Research proposal

Kanwal S: Data Collection and writing

Malik SE: Review and proofreading

Ullah Z: Literature review, data Collection

Ghaffar T: Idea, Concept, Statistical analysis

Usman K : Bibliography, Literature review

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.