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Original Article

Prevalence of Hyperuricemia in Smoker Population with Type 2 Diabetes Mellitus

Sooraj Kumar[1], Lata[2], Toseef Altaf Memon[3], Naveed[4]

ABSTRACT

Objective: To determine the prevalence of hyperuricemia in smoker population with type 2 diabetes mellitus.

Methodology: This descriptive cross-sectional study was carried out in the Department of Medicine, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, from June to December 2021. The study was conducted involving smoking populated individuals diagnosed with type 2 diabetes mellitus. The diagnosed cases who fulfilled the inclusion criteria were included in the study. The participants' blood samples were taken to assess the uric acid to confirm hyperuricemia. The data was analyzed in SPSS version 26.0.

Results: In this study, a total of 576 diabetic patients diagnosed with type II were enrolled. The mean age was 51.31±13.76 an age range of 18 and 85 years. Males were dominant i.e. 66.7% v/s 33.3% females. Hyperuricemia was prevalent in 28.125% of patients.

Conclusion: It is to be concluded that hyperuricemia is prevalent in type II diabetic smoker patients. Since the study was conducted on a limited sample size from a single hospital, the findings may not accurately represent the situation across the entire country, and in order to generalise the results of our research, it must be assessed further in a broader sample of patients at other hospitals throughout the nation.

Keywords: Hyperuricemia, Prevalence, Smokers, Type II diabetes mellitus

INTRODUCTION

Diabetes is causing a sharp rise in morbidity and mortality in Pakistan; its prevalence has reached 17.1%[1]. Type II diabetes mellitus has been found to have a substantial correlation with both blood uric acid levels and smokers[2]. Insulin resistance is closely linked to metabolic syndrome (MS) and diabetes mellitus. The main components of metabolic syndrome are hypertension, hyperglycemia, hyperinsulinemia, and hyperlipidemia[3]. This has been shown to have independent risk factors, to be a lethal component of coronary heart disease (CHD), and to synergistically accelerate type II diabetes mellitus and non-diabetic atherscoleropathy as well as MS-related atherscoleropathy[3,4]. Similarly, a study[5] found that four parameters—highly sensitive C-reactive protein, reactive oxygen species, hyperuricemia, and hyperhomocysteinemia are critical to the development of syndrome expansion.

Therefore, as a recommended screening strategy for type II diabetes mellitus, the population's greater risk of atherosclerosis needs to be determined[6]. Levels of serum uric acid and risk factors of cardiovascular disease have been shown to be strongly correlated[7]. Globally, there is rise in diabetes mellitus type II and its increasing comorbidities, which greatly raises morbidity and death rates[8]. Hyperuricemia is the state in which one's serum uric acid level is unusually increased. Purine metabolism and breakdown under normal metabolic circumstances produce uric acid as a byproduct[9]. Purine metabolism involves two final processes, which are catalyzed by xanthine oxidoreductase. First, xanthine is converted from hypoxanthine to uric acid[10]. Urate, the monoanion of uric acid, is eliminated by urination and is thought to have minimal physiological significance at physiological pH levels[11]. But purine metabolism can be disturbed for a variety of reasons, some of which may be hereditary and others of which may be acquired, leading to an aberrant elevation in blood uric acid level (hyperuricemia)[12]. There is a hypothesis that links the risk of type 2 diabetes to the amount of serum uric acid (SUA). Uric acid (UA) reduces the availability of nitric oxide, which is essential for insulin-stimulated glucose absorption. This reduction in availability leads to the physiologic worsening of insulin resistance in animal models[13].

Moreover, there has been little research on the occurrence of hyperuricemia and its related variables in emerging nations, particularly in Asian areas. As far as we know, there have been just a few research conducted on this subject in Pakistan. Hence, the objective of this research was to ascertain the frequency of hyperuricemia among individuals who smoke and have type 2 diabetes mellitus. The study's results are expected to provide valuable insights for both physicians and researchers. Moreover, they may be beneficial for implementing strategies to mitigate metabolic problems linked to hyperuricemia.

METHODOLOGY

This descriptive cross-sectional study was conducted at the Department of Medicine at Liaquat University of Medical and Health Science (LUMHS) Jamshoro, from June 2021 to December 2021. A total of 576 participants were recruited using a non-probability consecutive sampling method. The study included patients of either gender, aged 20 to 70 years, who had been diagnosed with type II diabetes mellitus for more than 5 years. Participants who were smokers and presented with complaints related to type II diabetes mellitus were included in the study.

Exclusion criteria comprised individuals with major comorbidities, recent urological surgeries, immunodeficiency, or a history of alcohol consumption. Additionally, individuals with a history of chronic liver diseases, chronic renal failure, histologically diagnosed malignancies, cardiovascular diseases, or hypertension were also excluded from the study.

Approval for the study was granted by the institutional ethical review committee. All participants provided written informed

Corresponding Author
Sooraj Kumar[1]
Email: suraj_mankani@yahoo.com

Affiliations:
Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro[1,2,3]

Indus Hospital Karachi[4]

Postgraduate Resident [1,2,4]

Doctor of Medicine (MD)[3]

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consent, and confidentiality was maintained throughout the study. Demographic data were collected using a preset proforma after obtaining informed consent. Sociodemographic information such as age, sex, family history of diabetes mellitus, duration of diabetes, and smoking history was gathered. A physical examination was conducted, and quantitative characteristics, including weight, height, waist-to-hip ratio (WHR), and body mass index (BMI), were recorded. Clinical measurements such as systolic blood pressure, diastolic blood pressure, and heart rate were also documented.

A 10 ml blood sample was collected from each participant for laboratory analysis. Postprandial blood sugar levels were estimated using the glucosoxidase-peroxidase method. Lipid profiles and blood urea levels were determined using the diacetyl monoxime method, while serum creatinine levels were measured using the alkaline picrate methodology.

Continuous data were reported as the number of cases with corresponding percentages and were compared using the Chi-square test. The Chi-square test was also used to compare categorical variables, with significance set at a p-value of less than 0.05. Statistical analysis was performed using SPSS version 26.0.

RESULTS

Table I presents the demographic characteristics of type II diabetes smoker patients (n=576). Most of the patients were male (66.7%), having a mean age of 51.31 ± 13.76 years. Age distribution showed that 50.5% were between 18-50 years, and 49.5% were above 60 years old. BMI mean was 30.99 ± 5.20 kg/m^2, with 9.2% categorized as normal, 38.0% as overweight, and 52.8% as obese. Mean DM duration was 6.53 ± 6.18 years, 58.9% having diabetes for 0-5 years and 41.1% for more than 5 years. Distribution of marital status was 29.2% were unmarried, 61.8% married and 9.0% separated, widowed, or divorced. Educational status distribution included 33.5% with primary education, 53.3% with secondary education, and 13.2% with higher education. In terms of residential status, 76.0% lived in urban areas, while 24.0% resided in rural areas. Occupational status indicated that 73.1% were employed, and 26.9% were unemployed.

Table II outlines the clinical characteristics of Type II diabetes smoker patients with or without hyperuricemia (n=576). The comparison with hyperuricemia revealed no significant differences in fasting blood glucose (p=0.637), random blood glucose (p=0.988), total cholesterol (p=0.229), triglyceride levels (p=0.997), HDL (p=0.114), LDL (p=0.482), SBP (p=0.871), and DBP (p=0.355). However, a significant difference was noted in uric acid levels, with those with hyperuricemia having a higher mean of 8.85 ± 0.66 compared to 6.03 ± 1.07 in the non-hyperuricemia group (p=0.000).

Table III presents factors associated with or without hyperuricemia among Type II diabetes smoker patients (n=576). The analysis includes age group, gender, BMI, hypertension, dyslipidemia, smoking status, waist circumference, total cholesterol, triglyceride, family history of hyperuricemia, HDL, and LDL. Among these factors, the odds ratios (OR) with 95% confidence intervals (C.I.) and p-values are provided. Notable findings include a significant association between hyperuricemia and smoking status (OR=1.6, p=0.672). Additionally, there is a trend toward association with hypertension (OR=1.42, p=0.058) and HDL levels (OR=1.88, p=0.132). No other variables showed significant correlations with hyperuricemia.

Table I: Profile of Type II Diabetic Smokers (n=576)

Demographic Profile	Frequency (%)
Gender	
Male	384 (66.7)
Female	192 (33.3)
Age, Mean ± SD= 51.31 ± 13.76 Years	
18-50 Years	291 (50.5)
>60 Years	285 (49.5)
Body Mass Index, Mean ± SD= 30.99 ± 5.20 kg/m^2	
Normal	53 (9.2)
Overweight	219 (38.0)
Obese	304 (52.8)
Duration of Diabetes, Mean ± SD= 6.53 ± 6.18 Years	
0-5 Years	339 (58.9)
>5 Years	237 (41.1)
Marital Status	
Unmarried	168 (29.2)
Married	356 (61.8)
Separated/Widowed/Divorced	52 (9.0)
Educational Status	
Primary	193 (33.5)
Secondary	307 (53.3)
Higher	76 (13.2)
Residential Status	
Urban	438 (76.0)
Rural	138 (24.0)
Occupational Status	
Employed	421 (73.1)
Unemployed	155 (26.9)

Table II: Clinical Characteristics of Type II Diabetes Smoker Patients with or without Hyperuricemia (n=576)

Clinical & Biochemical Parameters	Hyperuricemia		P-Value
	Yes (n=162)	No (n=414)	
Fasting Blood Glucose	128.91 ± 24.75	129.96 ± 23.52	0.637
Random Blood Glucose	162.95 ± 55.49	163.02 ± 51.65	0.988
Total Cholesterol	175.81 ± 42.80	180.70 ± 44.10	0229
Triglyceride	185.45 ± 136.25	185.40 ± 141.31	0.997
High-Density Lipoprotein (HDL)	44.54 ± 14.34	42.55 ± 13.30	0.114
Low-Density Lipoprotein (LDL)	110.63 ± 38.30	113.26 ± 41.19	0.482
Systolic Blood Pressure (SBP)	136.07 ± 17.63	135.80 ± 18.12	0.871
Diastolic Blood Pressure (DBP)	84.46 ± 9.61	83.51 ± 11.57	0.355
Uric Acid	8.85 ± 0.66	6.03 ± 1.07	0.000

Table III: Factors Associated with Hyperuricemia in Type II Diabetic Smokers (n=576)

Factors		Hyperuricemia		Odd Ratio (95% C.I.)	P-Value
		Yes (n=162)	No (n=414)		
Age Group	18 – 50 Years	74 (25.4%)	217 (74.6%)	0.76 (0.53 ---- 1.09)	0.146
	>50 Years	88 (30.9%)	197 (69.1%)		
Gender	Male	104 (27.1%)	280 (72.9%)	0.85 (0.58 ---- 1.25)	0.432
	Female	58 (30.2%)	134 (69.8%)		
Body Mass Index	Normal	11 (20.8%)	42 (79.2%)	1.07 (0.81 ---- 1.41)	0.071
	Overweight	73 (33.3%)	146 (66.7%)		
	Obese	78 (25.7%)	226 (74.3%)		
Hypertension	Yes	79 (24.9%)	238 (75.1%)	0.70 (0.48 ---- 1.01)	0.058
	No	83 (32.0%)	176 (68.0%)		
Dyslipidemia	Yes	31 (28.2%)	79 (71.8%)	1.00 (0.63 ---- 1.59)	0.988
	No	131(28.1%)	335(71.9%)		
Smoking Status	Yes	33 (26.6%)	91 (73.4%)	0.90 (0.58 ---- 1.42)	0.672
	No	129 (28.5%)	323 (71.5%)		
Waist Circumference	Yes	35 (31.5%)	76 (68.5%)	1.22 (0.78 ---- 1.92)	0.374
	No	127 (27.3%)	338 (72.7%)		
Total Cholesterol (TC)	Normal	115 (27.8%)	298 (72.2%)	0.95 (0.63 ---- 1.42)	0.812
	High	47 (28.8%)	116 (71.2%)		

Triglyceride (TG)	Normal	76 (28.1%)	194 (71.9%)	1.00 (0.69 ---- 1.44)	0.991
	High	86 (28.1%)	220 (71.9%)		
Family History of Hyperuricemia	Yes	10 (22.7%)	34 (77.3%)	0.73 (0.35 ---- 1.52)	0.407
	No	152 (28.6%)	380 (71.4%)		
High-Density Lipoprotein (HDL)	Yes	152 (27.5%)	400 (72.5%)	0.53 (0.23 ---- 1.22)	0.132
	No	10 (41.7%)	14 (58.3%)		
Low-Density Lipoprotein (LDL)	Yes	111 (28.5%)	279 (71.5%)	1.05 (0.71 ---- 1.55)	0.795
	No	51 (27.4%)	135 (72.6%)		

DISCUSSION

Diabetes mellitus (DM), also known as "sugar", is a chronic noncommunicable disease (NCD) that has emerged as a major global health concern. The condition is attributed to pancreatic insufficiency in insulin production, leading to elevated blood sugar levels known as hyperglycemia. Type 2 diabetes mellitus is associated with insulin resistance and inadequate compensatory insulin secretion[14].

Both young and elderly suffer from type 2 diabetes, which is closely linked to high rates of morbidity and death as well as significant medical expenses for affected individuals, their families, and nations[15].

According to the International Diabetes Federation (IDF), there are 352 million persons worldwide who have impaired glucose tolerance, which raises their chances of developing diabetes by 2045. The burden of diabetes is rising, but there is a lack of epidemiological data and inadequate therapies[16].

The incidence of hyperuricemia has been increasing quickly in recent years among people worldwide[15]. Recent data indicates that hyperuricemia is becoming more common not only in wealthy nations, but also frequently occurring in low- and middle-income nations. Obesity, a diet high in purines, and alcohol intake have all been shown as separate risk factors for the development of hyperuricemia[17].

Hyperuricemia is very common in people with metabolic syndrome and has been linked to incident insulin resistance. Hyperuricemia is well recognised as a causative factor in the progression of diabetes, hypertension, atherosclerosis, cardiovascular disease, and chronic renal disease.

As per our study findings, hyperuricemia was prevalent in 28.125% of patients. Several investigations were undertaken to determine the frequency of hyperuricemia in individuals with type 2 diabetes mellitus (T2DM). The proportion of hyperuricemia between the cases of diabetes was 12.13% in Pakistan[14], the incidence of Chinese cases was 32.6% with Type II diabetes mellitus[15], prevalence rates of 33.6% and 25.3% have been seen in Indian individuals[16,17,] Ethiopian cases 33.8% [18], and Nigerian cases 25.3%[19]. In terms of clinical practice, clinicians are becoming increasingly concerned about the prevalence of hyperuricemia with metabolic syndrome (MS). Moreover, hyperuricemia may not show symptoms until much later and may only be discovered in conjunction with other problems like uremia[20].

Most people agree that smoking cigarettes increases the chance of developing several well-known chronic illnesses including diabetes, cardiovascular disease, and cancer. Additionally, some chronic musculoskeletal conditions such degenerative disc disease, rheumatoid arthritis, and low back pain are thought to be linked to it.

Hyperuricemia has lately gained attention due to research indicating its association with cardiovascular risk factors and its considerable contribution to the development of metabolic diseases.

The non-probability consecutive sampling limits the generalizability of the findings to the broader diabetic smoker population. The cross-sectional design prevents causal inferences between hyperuricemia and type 2 diabetes in smokers. Potential reporting biases may affect data accuracy, and the single-center setting restricts the applicability of the results to other populations or settings. Additionally, the sample may not fully represent the broader diabetic population with complex health conditions.

CONCLUSION

It is to be concluded that hyperuricemia is prevalent in type II diabetic smoker patients. Since the study was conducted on a limited sample size from a single hospital, the findings may not accurately represent the situation across the entire country, and in order to generalize the results of our research, it must be assessed further in a broader sample of patients at other hospitals throughout the nation.

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Authors' Contributions: **Kumar S:** Led the study and was responsible for its overall design. **Lata;** Managed study logistics and assisted in data collection. **Memon T:** Handled data analysis and interpretation of results. **Naveed:** Conducted the literature review, contributed to manuscript writing, and provided a critical review. Each author played a crucial role in the successful completion of the research.

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