

Hyperuricemia as a Predictor for the Development of Type 2 Diabetes Mellitus

Hyperuricemia as
a Predictor for
Type 2 Diabetes
Mellitus

Syed Saif ur Rehman¹, Yasir Mumtaz¹, Ayesha Aftab², Muhammad Wajad Munir¹ and Abida Mateen¹

ABSTRACT

Objective: Hyperuricemia as a predictor for the development of Type 2 Diabetes Mellitus.

Study Design: Prospective study

Place and Duration of Study: This study was conducted at the Department of Medicine of Al- Nafees Medical College & Hospital, Islamabad from September 2019 to March 2020.

Materials and Methods: The study was conducted after the approval from hospital ethical committee. All the patients were educated and an informed consent was taken. All male and female patients of specified age group presenting to OPD were evaluated. The correlation between hyperuricemia and oral glucose tolerance was based on uric acid level and oral glucose tolerance test from Al-Nafees Medical College and Hospital Laboratory.

Results: A total of 148 patients who fulfilled inclusion criteria were included in this study and divided into two groups of control (Group-1) and cases (Group-2). Group-1 involved 74 controls with a mean age of 51.7 years and Group-2 involved 74 cases with the mean age of 49.2 years. In Group-1 and Group-2 the mean uric acid came out to be 5.53 and 7.9 respectively. In Group-1 and Group-2 mean IGT came out to be 85.8 and 101.9 respectively.

Conclusion: Hyperuricemia is indirectly related to development of diabetes mellitus types 2 as an independent predictor. There should be frequent monitoring of hyperuricemia with oral glucose tolerance test which can help in establishing the undiagnosed cases.

Key Words: Impaired Glucose Tolerance (IGT), Type-2 diabetes mellitus (T2DM), Serum uric acid level (SUA)

Citation of article: Rehman SS, Mumtaz Y, Aftab A, Munir MW, Mateen A. Hyperuricemia as a Predictor for the Development of Type 2 Diabetes Mellitus. Med Forum 2022;33(10):88-91.

INTRODUCTION

The modern lifestyle with its characteristics like food consumption pattern, stress and lack of exercise has changed to a significant increase in chronic diseases like hypertension, diabetes, and other metabolic diseases.^{1,2}

Along with this hyperuricemia is also presumed to be associated with development of metabolic disorders like diabetes mellitus. Hyperuricemia is defined as serum uric acid concentrations of greater than 7.0 mg/dl in men, greater than 6.0 mg/dl in women and greater than 5.5 mg/dl in children.^{3,4}

A serum uric acid content >6.57 mg/dl increases the risk of all-cause mortality.

¹. Department of Medicine / Pharmacology², Al- Nafees Medical College & Hospital, Islamabad

Correspondence: Dr. Syed Saif Ur Rehman, Associate Professor of Medicine, Al- Nafees Medical College Hospital, Islamabad.

Contact No: 0300-5345671

Email: siafgillani786@gmail.com

Received: May, 2022

Accepted: July, 2022

Printed: October, 2022

In addition, serum uric acid levels are related to glucose intolerance, obesity, and diabetes.⁵

Hyperuricemia has multiple etiologies which can be divided into two categories: Firstly elevated uric acid production is mainly due to high levels of purine in the diet and increased purine metabolism, and secondly decreased uric acid excretion can be caused by kidney disease, certain drugs, and competition for excretion between uric acid and other molecules. Mixed causes include high levels of alcohol and starvation.^{3,6}

There are recognized observations that high levels of serum uric acid are predictive of development of diabetes mellitus, obesity and metabolic syndrome.⁷ Although literature showed the relationship of hyperuricemia with hypertension, and renal disease.^{6,7}

Serum uric acid (SUA) level has been linked with risk of type 2 diabetes mellitus. There is worsening of insulin resistance in animal models due to uric acid by inhibiting the bioavailability of nitric oxide, which is important for insulin-stimulated glucose uptake.⁷ Previous studies were conducted to estimate the prevalence of hyperuricemia in patients with type 2 diabetes mellitus (T2DM). The prevalence was 32.6% in Chinese patients with T2DM, ⁸ 33.6% in Indian patients ^{9,10} and 25.3% in Nigerian patients.¹¹

Previous studies have also determined the risk factors of elevated SUA, including female gender, intake of

certain medications such as antihypertensive drugs, diet, and family history of hyperuricemia, obesity and central obesity. High serum uric acid level was also associated with metabolic syndrome in both normal subjects and diabetic patients.¹²

In this study, we aim to establish that hyperuricemia may be a potential predictor for the development of type 2 diabetes mellitus in Asian population. If there, we can closely observe the population with hyperuricemia for development of type 2 diabetes mellitus, along with implementation of the life style modifications to reduce the risk of type 2 diabetes mellitus and other complications.

MATERIALS AND METHODS

This prospective study was conducted at outpatient department, Department of Medicine, Al- Nafees Medical College & Hospital Islamabad for six months from 10th September 2019 – 10th March 2020 after approval from hospital ethical committee. The sample size was calculated (n=148) with anticipated population proportion of 14.7%, significance level of 5% and with precision of 6%. Non probability purposive sampling technique was employed.

Patients who fulfilled criteria were included with normal uric acid levels and BSR less than 200 were taken as controls. Two groups were made. In Group-1 patients attending the Medical OPD with raised uric acid levels and BSR less than 200 were taken as cases. In Group-2 patients were excluded who are known diabetic, alcoholics, having renal Insufficiency or taking drugs like Diuretics, Pyrazinamide, Ethambutol and Cyclosporine.

Detailed history regarding the illness was obtained from each patient. Complete clinical examination was performed by the trainee researcher. Informed consent was taken from the patients.

Fasting samples were taken in a fasting state to check sugar levels. 75 milligrams of glucose were given and blood samples were taken for random sugar levels at 2 hours durations. Serum uric acid and glucose level were performed on fully automated chemistry analyzer Selectra XL ensuring Internal and External quality Control procedures. Values obtained from both the groups were then compared with each other.

After collecting the data, it was entered in a specially designed performa. Data was analyzed by the Statistical Package for Social Sciences (SPSS) version 23. For quantitative variables like age, gender and impaired glucose tolerance mean and SD was calculated. Percentages and Frequencies were calculated for qualitative variables; Chi-square test was used to correlate the presence of uric acid as a potential indicator for diabetes in different genders.

P value of less than or equal to 0.05 was considered statistically significant. Effect modifiers like age and gender was controlled by stratification, Post stratification chi-square test for qualitative and t-test for quantitative variables was applied.

RESULTS

Total number of patients involved in the study was 148. They were divided into two groups of control (Group-1) and cases (Group-2). Group-1 involved 74 controls with a mean age of 51.7 years and Group-2 involved 74 cases with the mean age of 49.2 years (Table 1). In Group-1 and Group-2 the mean uric acid came out to be 5.53 and 6.9 respectively (Graph 1). In Group-1 and Group-2 mean IGT came out to be 85.8 and 101.9 respectively (Graph 1). In Group-1 and Group-2 positive IGT is found in 09 and 20 patients respectively (Table 2).

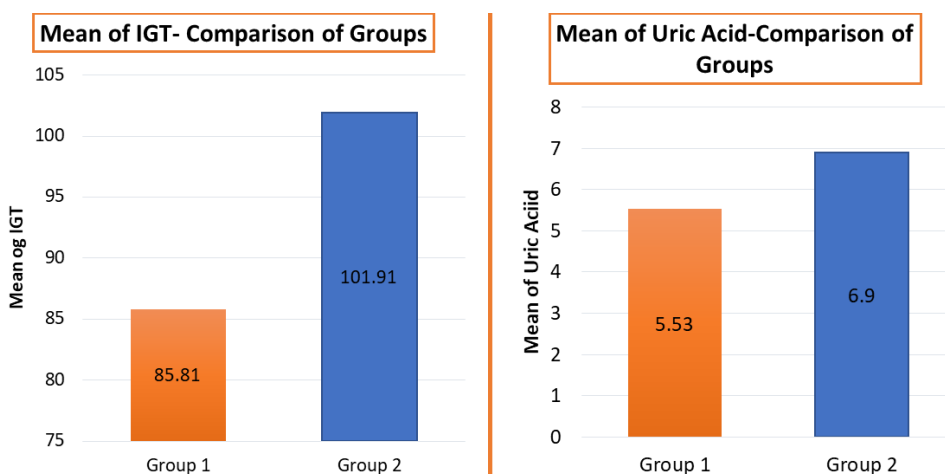


Figure No.1: Mean of IGT and Uric Acid the Time of Diagnosis (n=148)

Table No.1: Descriptive Analysis of Age in Groups (N=148)

	Mean	N	Standard deviation	Min.	Max.
Group-1	51.7	74	4.802	42	61
Group-2	49.2	74	4.706	38	59
Total		148			

Table No.2: Stratification of Uric Acid Levels with Respect to IGT (n=148)

Group	Uric acid levels	IGT (impaired)	Relative risk	P value
Group -1	74	9	4.21	0.020
Group -2	74	20	8.92	0.045

DISCUSSION

Hyperuricemia prevalence is increasing and is common metabolic syndrome pathology. Our study assessed hyperuricemia as a predictor in the development of type-2 diabetes and its prevalence in non-diabetic patients by assessing their glucose tolerance. It was found significant association between hyperuricemia and impaired glucose tolerance in a local population. Such patients may have increased chance of development of frank diabetes in the presence of hyperuricemia.

Pathologically, hyperuricemia leads to gout by formation of urate crystals. It is also related to high blood pressure, atherosclerosis and cardiovascular diseases. A study was conducted in 2019 in Lahore in which researchers determined serum uric acid level in subjects with impaired glucose tolerance and compared that with subjects with normal glucose tolerance. 300 subjects were included in this study. Raised serum uric acid levels were found in 56 % subjects with impaired glucose tolerance. That mean 86 out of 150 subject's demonstrated hyperuricemia¹³.

A study conducted in china also proved that raised uric acid levels are linked with an increased risk of developing T2DM. It also showed that insulin resistance and beta cell function are important factor that have a role in progression from normal glucose tolerance to impaired glucose tolerance and development in T2DM¹⁴.

In contrary to our findings, a study conducted in United Kingdom analyzing 310 Blood samples for fasting blood sugar, serum uric acid and lipid levels. It was found out that SUA levels were high in healthy individuals but declined in pre-diabetic and diabetics with rising fasting blood sugar concentrations¹⁵.

Previous studies and researches suggested contrary data about association of Hyperuricemia with diabetes mellitus, recent studies conducted finally showed direct

linkage of raised serum uric acid levels with IGT, but it is still unclear whether uric acid is just a risk marker or an independent risk factor. The study shows that high uric acid levels are related with high risk of diabetes, independent of other known risk factors.¹⁶

The study in Vietnamese population showed that there was a significant association of hyperuricemia with IFG, IGT, and diabetes mellitus, and the predominant association was found in females than in males.¹⁷

In summary, hyperuricemia is significantly correlated with impaired glucose tolerance and in asymptomatic patients. Such patients are at risk of developing type-2 diabetes mellitus in near future.

CONCLUSION

Hyperuricemia is indirectly related to development of Type 2 diabetes mellitus as an independent predictor. There should be frequent monitoring of hyperuricemia with oral glucose tolerance test which can help in establishing the undiagnosed cases.

Author's Contribution:

Concept & Design of Study: Yasir Mumtaz
 Drafting: Syed Saif Ur Rehman, Abida Mateen
 Data Analysis: Ayesha Aftab
 Revisiting Critically: Muhammad Wajad Munir
 Final Approval of version: Syed Saif Ur Rehman

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Alqahtani S. The effect of gender and altitude on vitamin d status among Saudi population: A cross sectional study. *Curr Topic Nutr Res* 2022;20:1–6.
2. Alqahtani SAM. Prevalence and characteristics of thyroid abnormalities and its association with anemia in Asir region of Saudi Arabia. A cross-Sectional Study 2021;11:494–504.
3. Woyesa SB, Hirigo AT, Wube TB. Hyperuricemia and metabolic syndrome in type 2 diabetes mellitus patients at Hawassa university comprehensive specialized hospital, South West Ethiopia. *BMC Endocr Disord* 2017;17:76.
4. Maiuolo J, Oppedisano F, Gratteri S, Muscoli C, Mollace V. Regulation of uric acid metabolism and excretion. *Int J Cardiol* 2016; 213:8–14.
5. Martínez-Sánchez FD, Vargas-Abonce VP, Guerrero-Castillo AP, Santos-Villavicencio ML, Ezeiza-Acevedo J, Meza-Arana CE, et al. Serum Uric Acid concentration is associated with insulin resistance and impaired insulin secretion in adults at risk for Type 2 Diabetes. *Prim Care Diabetes* 2021;15:293–9.

6. Ruoff G, Edwards NL. Overview of serum uric acid treatment targets in gout: why less than 6 mg/dL? *Postgrad Med* 2016;128:706–715.
7. Robinson PC. Gout-An update of aetiology, genetics, co-morbidities and management. *Maturitas* 2018;118:67–73.
8. Wang J, Chen RP, Lei L, et al. Prevalence and determinants of hyperuricemia in type 2 diabetes mellitus patients with central obesity in Guangdong Province in China. *Asia Pac J Clin Nutr* 2013; 22:590–598.
9. Billa G, Dargad R, Mehta A. Prevalence of hyperuricemia in Indian subjects attending hyperuricemia screening programs-a retrospective study. *J Assoc Physicians Ind* 2018; 66:43–46.
10. Mundhe S, Mhasde D. The study of prevalence of hyperuricemia and metabolic syndrome in type 2 diabetes mellitus. *Int J Adv Med* 2016;3:241–249.
11. Ogbera AO, Azenabor AO. Hyperuricaemia and the metabolic syndrome in type 2 DM. *Diabetol Metab Syndr* 2010;2:24.
12. Haque T, Rahman S, Islam S, Molla NH, Ali N. Assessment of the relationship between serum uric acid and glucose levels in healthy, prediabetic and diabetic individuals. *Diabetol Metab Syndr* 2019; 11:49.
13. Zubair M, Farooq M, Butt MR, Farooq M, et al. Serum Uric Acid levels in patients with IGT as compared to subjects with normal glucose tolerance. *PAFMJ* 2019;69(5).
14. Peng Yu, Li Huang, Wang Z, Meng Z. Journals, diabetes, metabolic syndrome and obesity: targets and therapy 2021;14:2673-2682.
15. Haque T, Rehman S. Dibeology and metabolic syndrome 2019;11:49.
16. Wu WC, Lai YW, Chou YC, Liao YC, You SL, et al. Serum Uric Acid Level as a Harbinger of Type 2 Diabetes: A Prospective Observation in Taiwan. *Int J Environ Res Public Health* 2020; 17(7):2277.
17. Binh TQ, Phuong PT, Chung NT, Nhung BT, Tung D, et al, First Report on Association of Hyperuricemia with Type 2 Diabetes in a Vietnamese Population, *Int J Endocrinol* 2019;7.