International Journal of Community Medicine and Public Health
Arshad H et al. Int J Community Med Public Health. 2024 Jan;11(1):75-78
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20234110

Original Research Article

Correlation of glycated hemoglobin with serum uric acid levels among type 2 diabetic patients: a cross-sectional study

Hamid Arshad[1], Ahad Munir[2], Sulaiman Tahir[2], Sumera Tariq[2], Atif Mehmood[3], Rimsha Qayyum[2], Qurat Ul Ain[1], Fahad Muneer[2], Aunia Tul Marva[2], Samia Samar Arooj[2], Nouman Rahim[4], Tayyab Mumtaz Khan[5]*, Jehanzeb Akram[2]

[1]Allama Iqbal Medical College, Lahore, Pakistan
[2]Rahbar Medical and Dental College, Lahore, Pakistan
[3]The University of Agriculture, Peshawar, Pakistan
[4]Central Park Medical College, Lahore, Pakistan
[5]Rawalpindi Medical University, Rawalpindi, Pakistan

Received: 11 May 2023
Revised: 12 December 2023
Accepted: 13 December 2023

***Correspondence:**
Dr. Tayyab Mumtaz Khan,
E-mail: tayyab.mkhan98@gmail.com

ABSTRACT

Background: Diabetes Mellitus Type 2 (DMT2) is one of the commonest disorders of endocrinology which is characterized by the raised blood glucose level due to insulin resistance in body cells. This study was aimed to determine the correlation between the glycated hemoglobin (HbA1c) and serum uric acid (SUA) in patients with DMT2.
Methods: This cross-sectional study was conducted in a tertiary care hospital of Lahore. 73 Patients' recruitment was made via convenient sampling technique and a developed inclusion and exclusion criteria. Self-structured proforma was used for data collection. Data analysis was done in SPSS version 25.0.
Results: From total patients, 40 (54.79%) were women while 33 (45.21%) were men. Means of different variables like age, HbA1c, and serum uric acid level were 54.98 years with standard deviation (SD) of ±11.67 years, 7.90 with SD of ±1.85%, and 7.51 with SD of ±0.81 respectively. 32 (43.83%) patients had good glycemic control whereas 41 (56.17%) patients had poor glycemic control. The frequencies of hyperuricemia and normal SUA in study population were 35 (47.94%) and 38 (52.06%) respectively. The means of the HbA1c across gender had statistically significant difference. Difference in the means of the SUA level, across gender and between patients with hyperuricemia and normal SUA level, was also statistically significant. Moreover, correlation between the HbA1c and SUA was positive and statistically significant.
Conclusions: In a nutshell, this study suggests that increase in SUA level, worsen the glycemic control by raising glycated hemoglobin level among patients with DMT2.

Keywords: Correlation, Diabetes mellitus, Glycated, Hemoglobin, Patients, Serum, Type 2, Uric acid

INTRODUCTION

Diabetes mellitus type 2 (DMT2) is commonest disorder of endocrinology and its incidence is still increasing day by day and putting human health to severe threat.[1] DMT2 is associated with the decrease life expectancy of the patients who get affected by it through its various microvascular (retinopathy, nephropathy, and peripheral neuropathy) and macrovascular (stroke, ischemic heart disease, and peripheral vascular disease) complications.[2]

Glycated hemoglobin (HbA1c) is formed when blood glucose gets attached with hemoglobin. It is very important measuring tool for the assessment of the diabetes mellitus type 2 as it reflects the average blood glucose level of the last three months. American Diabetes Association has recommended HbA1c as tool for the diagnosis of T2DM and for the determination of the patients who are the risk of development of T2DM.[3,4] HbA1c has been considered as an independent risk factor for the development of heart diseases and cerebrovascular accidents in both diabetic and non-diabetic population. It has been observed that with the reduction of 0.2% in HbA1c, the incidence of the development of cardiovascular diseases goes down by 10%.[5]

Serum uric acid is final product of purine metabolism. Elevated SUA levels are not only linked with cardiovascular diseases but also with metabolic disorders as studies have suggested that elevated serum uric acid impaired blood glucose level.[6-8] Findings regarding the association between the SUA level and development of diabetes mellitus are not consistent as according to some studies raised SUA levels lead to development of T2DM, while other studies result shows that no significant correlation exist between SUA and T2DM. Likewise, some other researchers reported low SUA level linked with the development of T2DM.[1,2,9]

In the presence of various studies that have highlighted the association between the serum uric acid level and blood glucose all over the world, this study aimed to assess the correlation between the HbA1c and SUA level in patients type 2 diabetes mellitus.

METHODS

This cross-sectional study was performed in the outdoor patient department (OPD) of a tertiary care hospital of Lahore, among seventy-three patients diagnosed with T2DM for almost 6 months from January 2023 to June 2023. For the enrollment of patients, non-probability convenient sampling and a developed inclusion and exclusion criteria was implemented. Patients with age from 40 years and diagnosed with type 2 diabetes mellitus, and who had no known diseases such as kidney disease, liver disease, or joint disease, were enrolled in the study. While, those who had an age below 40 years, any cancer, kidney disease related to other causes, liver disease, and any psychiatric diseases, were excluded. From the all participants before the data collection, informed consent was acquired. Data was obtained by applying a self-designed questionnaire. This questionnaire had two parts. First part was regarding the socio-demographic features of the study population like age in years and gender (female and male). Second part was linked to the biochemical parameters of study variables of HbA1C and serum Uric Acid (SUA). Patients whose HbA1C was 7% or above were labelled to have poor glycemic control while patients with HbA1C below 7% were labelled to have good glycemic control. SUA level ≥ 6.5 to >8.3 mg/dl is considered as hyperuricemia without consideration of gender. These biochemical parameters were measured in the laboratory of same hospital.

Statistical analysis

After data collection, data analysis was done via Statistical Package for the Social Sciences (SPSS) version 25 (Armonk, NY: IBM Corp.) by the action of the inferential and descriptive statistics. Qualitative variables' frequency and percentage were measured, while, quantitative variables' means were calculated. Independent t-test was applied to assess the difference in means of study variables. Pearson's correlation was used to estimate the correlation between HbA1C and SUA level. The p-value less than 0.05 was labelled as statistically significant.

RESULTS

Out of seventy-three patients, 40 (54.79%) were females, whereas, 33 (45.21%) were males. The means of age for the study population, HbA1c, and serum uric acid level were 54.98 years with standard deviation (SD) of ±11.67 years, 7.90 with SD of ±1.85%, and 7.51 with SD of ±0.81 respectively. 32 (43.83%) patients had good glycemic control while 41 (56.17%) patients had poor glycemic control. The frequency of hyperuricemia was 35 (47.94%) and while frequency of normal SUA level was 38 (52.06%).

Table 1: Comparison of means of HbA1c across the study variables and t-test analysis.

Variables		Means±SD of HbA1C	T-test P value
Gender	Female	7.25±0.40	0.037
	Male	8.40±1.45	

Table 1 shows the difference in means of the HbA1c, between the male and females, was statistically significant. Furthermore, it also manifests that HbA1c levels were higher among males.

Table 2: Comparison of means of SUA level across study variables along with t-test analysis.

Variables		Means±SD of SUA level	T-test P value
Gender	Female	7.09±0.31	0.030
	Male	8.11±0.58	
Glycemic control	Poorly-controlled	8.01±0.45	0.029
	Well-controlled	7.00±0.40	

Table 2 presents difference in means of the SUA level, between the men and women, and between patients with poorly-controlled and well-controlled diabetes mellitus type 2, was statistically significant. Likewise, it also

elaborates that SUA levels were higher among male and patients with the poorly-controlled DMT2.

Table 3 presents that with the increase in SUA level, HbA1c level also goes up and the correlation between the SUA level and HbA1c level was positive and statistically significant.

Table 3: Pearson correlation analysis between HbA1c level and SUA level.

Variable	Correlation Coefficient (r)	P value
SUA level	+0.36	0.032

DISCUSSION

This study has revealed valuable information regarding the correlation between glycated hemoglobin and serum uric acid level in patients with type 2 diabetes mellitus. It has also highlighted the frequency of patients who had poor glycemic control and hyperuricemia. Likewise, the difference in means of HbA1c and SUA levels in study population was also noted.

At the start of data analysis, it was noted that frequency of people with poor glycemic control was notably high in study population (56.17%). Then we found that the incidence of the hyperuricemia was also significantly high (47.94%).

Means of the HbA1c were compared across gender. Significant difference (p=0.037) was noted between men and women, with higher mean value of HbA1c in men which means glycemic control was poor among male patients as compared to female patients. Various studies also backed this finding of current study with higher means of glycated hemoglobin among males.[2,4,5] Whereas another study that was carried out in Korea showed poor control of T2DM among women with higher value of HbA1c in women.[10] The difference in current study results and Korean study results could be due to racial, genetics, and geographical variations between these two study populations.

Means of SUA levels were also compared between men and women, and between the patients with well-controlled DMT2 and patients with poorly-controlled DMT2. SUA mean was higher among men and difference of means across gender was statistically significant (p=0.030). This finding of current study was endorsed by several studies.[1,4,11] Whereas, a study that was done in Iraq presented conflicting finding with higher mean value of SUA level in women instead of men.[2] In the same way mean of SUA was higher among patients with poorly-controlled DMT2. Many studies reported higher mean of SUA in patients with higher HbA1c or poorly-controlled T2DM.[6,7,9] The difference in the means of SUA levels between patients with poorly controlled and well-controlled T2DM was significant (p=0.029).

It was observed that the correlation between HbA1c and SUA levels was statistically significant (p=0.032) and it was positive which means that with the increase SUA level the value of glycated hemoglobin also goes up. Some studies have supported this main finding of the current study.[2,7] While other studies suggested inverse association between the HbA1c and SUA level.[1,11] Few studies in literature, showed that no correlations is present between HbA1c and SUA.[9] These differences in finding could be due to multiple factors, but as current study showed positive correlation between HbA1c and SUA level, so, current study supports this statement that serum uric acid level has an important role in the development and progression of T2DM.

The limitation of the study included small sample size and single centered oriented study. Because of these limitations current study results could be controversial. However, this study has suggested correlation exist between glycated hemoglobin and serum uric acid level in patients with type 2 diabetes mellitus.

CONCLUSION

This study results shows that glycemic control was poor among males and they had higher mean value of HbA1c. While mean of SUA level was higher among the men and patients with higher value of HbA1c. Furthermore, it also manifested that the correlation between HbA1c and SUA was positive and statistically significant, which means that with the rise in SUA level, the glycemic control among patients with DMT2 got deteriorate. Therefore, for the better glycemic control among diabetic population, we should monitor serum uric acid as well. Then by controlling serum uric acid level, we could prevent progression of diabetes mellitus. In healthy people, monitoring of serum uric acid could prevent development of diabetes mellitus.

ACKNOWLEDGEMENTS

We would like to thank all patients who gave their precious time to this research project.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Cui Y, Bu H, Ma X, Zhao S, Li X, Lu S. The relation between serum uric acid and HbA1c is dependent upon hyperinsulinemia in patients with newly diagnosed type 2 diabetes mellitus. J Diab Res. 2016;2016.
2. Fadhel AA, Yousif AK. Correlation of glycated hemoglobin (Hba1c) and serum uric acid in type-2 diabetic patients. Ind J Publ Heal. 2019;10(5):105.

3. Wei F, Chang B, Yang X, Wang Y, Chen L, Li WD. Serum uric acid levels were dynamically coupled with hemoglobin A1c in the development of type 2 diabetes. Scient Rep. 2016;6(1):28549.
4. Bai XU, Tan JB, Feng NI, Sun JP, Zhang KY, Li LI, et al. Association between serum uric acid and prevalence of type 2 diabetes diagnosed using HbA1c criteria among Chinese adults in Qingdao, China. Biomed Environm Sci. 2015;28(12):884-93.
5. Ghari Arab A, Zahedi M, Kazemi Nejad V, Sanagoo A, Azimi M. Correlation between hemoglobin a1c and serum lipid profile in type 2 diabetic patients referred to the diabetes clinic in gorgan, Iran. J Clin Basic Res. 2018;2(1):26-31.
6. Neupane S, Dubey RK, Gautam N, Agrawal KK, Jayan A, Shrestha S, et al. Association between serum uric acid, urinary albumin excretion, and glycated hemoglobin in Type 2 diabetic patient. J Nig Med Associa. 2016;57(2):119.
7. Duman TT, Kocak MZ, Atak BM, Erkus E. Serum Uric acid is correlated with HbA1c levels in type 2 diabetes mellitus. Experim Biomed Res. 2018;1(1):6-9.
8. Qiu Q, Gong Y, Liu X, Dou L, Wang Y, Wang B, Liang J. Serum uric acid and impaired glucose tolerance: The Cardiometabolic Risk in Chinese (CRC) Study. Cell Biochem Biophy. 2015;73:155-62.
9. Babikr WG, Elhussein AB, Abdelraheem A, Magzoub A, Mohamed H, Alasmary M. The correlation of uric acid levels with glycemic control in type II diabetic patients. Biomed Pharmacol J. 2016;9(3):1005-8.
10. Bae JC, Suh S, Jin SM, Kim SW, Hur KY, Kim JH, et al. Hemoglobin A1c values are affected by hemoglobin level and gender in non-anemic Koreans. J Diab Investigat. 2014;5(1):60-5.
11. Latief M, Shafi O, Hassan Z, Farooq S, Abbas F. Uric acid level and its correlation with glycemic control in diabetics with normal renal function. Medical Journal of Dr. DY Patil University. 2022;15(4):507.

Cite this article as: Arshad H, Munir A, Tahir S, Tariq S, Mehmood A, Qayyum R. Correlation of glycated hemoglobin with serum uric acid levels among type 2 diabetic patients: a cross-sectional study. Int J Community Med Public Health 2024;11:75-8.