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Relationship between HbA1c and uric acid levels in type 2 diabetes- A case series study

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Article

Keywords: Uric acid, HbA1c, Blood glucose, Diabetes mellitus: Prediabetes

Posted Date: November 23rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10617828/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Serum uric acid and glycosylated hemoglobin were closely related to the body’s metabolism. Therefore, the current study was conducted to determine the relationship between HbA1c and uric acid levels in patients with type 2 diabetes.

Methods

Participants in this study were to be between the ages of 35 and 45, regardless of gender. Three groups were formed out of them. Group 1 consisted of fifty healthy, normal people who had no family history of diabetes. Fifty patients with prediabetes were in group 2. 50 individuals with diabetes from the same population were part of Group 3. Participants in all three groups were asked to fast peripheral venous blood samples, which were then examined for serum uric acid, fasting blood sugar, and HbA1c levels.

Results

Serum uric acid levels did not significantly alter in response to rising blood glucose or HbA1c levels in either normal or prediabetic subjects. In contrast, the uric acid levels in the diabetic group tend to drop considerably when compared to the normal healthy control and prediabetic groups.

Conclusion

The study's findings suggest that those with elevated HbA1c levels may be less susceptible to gout and hyperuricemia.

Introduction

Diabetes mellitus has become a prevalent health issue globally, with estimates indicating that by 2030, there would be 300 million individuals with impaired glucose tolerance and 552 million patients with diabetes [1]. Numerous atherosclerotic consequences, such as cardiovascular and cerebrovascular disorders, are linked to diabetes mellitus and significantly increase morbidity and mortality [2].

The pancreatic islets of Langerhans' β-cells release the hormone insulin which controls how the body uses glucose (blood sugar). A malfunctioning pancreas may generate insufficient amounts of insulin or no insulin at all which can result in Type 1 diabetes mellitus [3]. Type 2 diabetes mellitus is a diverse condition marked by elevated glucose production, decreased insulin secretion, and varying degrees of insulin resistance. When cells lose their sensitivity to insulin's effects, insulin resistance develops [4].

Hemoglobin A1C (Hba1c), which is used to track blood glucose control in patients with DM is a measurement of glycosylated hemoglobin over a 3-month period since erythrocytes typically have a lifespan of 120 days [4].

In fact, a number of extensive studies offer proof of the effectiveness of HbA1c in glycemic control evaluation, diabetes mellitus diagnosis, and risk assessment for complications associated with the disease.

The final byproduct of human purine metabolism is uric acid [5–7]. A higher risk of hypertension, cardiovascular disease, chronic renal disease, and metabolic syndrome is linked to elevated serum uric acid levels [7–10]. Because uric acid and glucose metabolism are related, some research indicates that uric acid may be linked to glycometabolic diseases [7]. Blood glucose levels and uric acid, however, are inversely correlated in diabetic patients. As a result, our goal was to ascertain if HbA1c and uric acid levels among normal, healthy, prediabetic, and diabetic individuals are related.

Materials and Methods

In order to ascertain the relationship between uric acid and HbA1c levels in individuals with type 2 diabetes, a case control study was conducted on participants who visited the Saveetha Medical College & Hospital's outpatient department between June 2022 and October 2022. The Institutional Review Board of Saveetha Medical College & Hospital in Chennai, 602015, gave its approval to this study. Number of Approval: SMC/IEC/2022/09/032. Every person who agreed to take part in the study gave their informed consent. The study excluded patients who were using diuretics, had cancer, or had chronic liver or renal disease. Participants in this study were of either sex and aged between 35 and 45. They were split up into three groups, which were as follows

Group 1 consisted of 50 healthy, normal people without a family history of diabetes mellitus whose HbA1C values ranged from 4.2 to 5.6%.

Fifty individuals in Group 2 had been diagnosed with prediabetes, and their HbA1C levels ranged from 5.7 to 6.4%.

Group 3 comprised 50 individuals with Type 2 Non-Insulin Dependent Diabetes Mellitus (NIDDM) with HbA1C values between 10.2 and 18.5%.

Every patient provided a thorough history, and a comprehensive clinical examination was performed. The Department of Biochemistry at Saveetha Medical College & Hospital obtained fasting blood samples in two test tubes with and without anticoagulants. The samples were then analyzed for blood sugar (GOD-POD method) and serum uric acid (enzymatic method) using Ortho-Clinical Diagnostic kits by Vitros 5600 fully automated analyzer, and HbA1c was calculated using ion exchange HPLC with a glycosylated hemoglobin analyzer system (Bio-Rad).

Statistical analysis

. All the grouped data were statistically evaluated with SPSS\17.0 software. Hypothesis testing methods included one-way analysis of variance (ANOVA) followed by least significant difference (LSD) test; All the results were expressed as Mean ± STD for 50 subject in each group P-value of less than 0.05 was considered to indicate statistical significance. All the results were expressed as the mean ± SD for 50 subjects in each group. Pearson's correlation coefficient was estimated to assess the correlation between HbA1c and uric acid levels. A p value is less than 0.05 was considered to indicate statistical significance

Results

Table 1 displays the mean and standard deviation with LSD of the three groups' fasting blood glucose, uric acid, and HbA1c levels (normal healthy control, prediabetic, and diabetic group). Table 2 compares the different parameters that were examined by Post Hoc analysis of correlation among the three study groups. According to the statistical analysis, all test subjects' blood glucose levels and HbA1c had a linear relationship. Blood glucose levels rose when HbA1c levels rose in each of the three groups, but there was no linear relationship between HbA1c and uric acid levels. The normal healthy control and prediabetic groups showed no significant increase in uric acid levels as blood glucose and HbA1c levels rose up to 4.2–6.4%, while the diabetic group showed a tendency for uric acid levels to decrease as blood glucose and HbA1c levels increased up to 10.2–18%.

Table 1
Comparison of fasting blood glucose and Uric acid with HbA1c levels among the study group

Parameters	**Normal healthy control (N = 50)**	**Pre diabetic group (N = 50)**	**Diabetic group (N = 50)**	**P – value**
HbA1c	5.16 ± 0.33[a]	5.96 ± 0.22[b]	11.7 ± 1.42[c]	**0.001**
Uric acid	5.11 ± 1.30	6.26 ± 1.09	3.99 ± 1.03	**0.028**
FBS	95.81 ± 10.23	102.72 ± 13.02[b]	237.34 ± 59.82[c]	**0.001**
A statistical significance difference was noted in FBS,uric acid with HbA1c levels in all the three groups. Values are given as mean ± SD for fifty persons each group (n = 50).Values are considered significantly different at P < 0.05 with post hoc LSD test. Comparisons are made between:				
a Normal healthy control vs Prediabetic				
b Normal healthy control vs Diabetic				
c Prediabetic vs Diabetic				

Table 2
Correlation of Fasting blood glucose Uric acid, Urea with HbA1c among the study group

Variable	r value	P value
Normal healthy control		
Uricacid	0.323	0.022
FBS	0.161	0.265
Pre diabetic group		
Uricacid	-0.110	0.449
FBS	0.367	0.009
Diabetic group		
Uricacid	0.103	0.476
FBS	0.679	0.001
A statistical significance difference was noted in FBS,uric acid, urea, creatinine and lipid profile compared with HbA1c levels in all the three groups for fifty persons each group (n = 50).Values are considered significantly different at $P < 0.05$ with post hoc correlation test.		

Discussion

Metabolic abnormalities and long-term consequences are hallmarks of diabetes mellitus, the most prevalent endocrinological illness [4]. Increased aging of the population, urbanization, and physical inactivity are all contributing factors to the rise in diabetes prevalence worldwide. China and India contribute significantly to the over 80% of people with diabetes who live in emerging nations.

. In the current study, we found that the serum uric acid level in the diabetic group significantly decreased as fasting blood glucose and HbA1c levels increased. However, numerous prior studies have shown that elevated serum uric acid levels are linked to elevated blood glucose in type 2 diabetes mellitus because of impaired glucose tolerance and insulin resistance [4, 7, 11,12] Additionally, some studies found that uric acid levels increase as blood glucose concentrations rise in the normal and prediabetic population [4–7]. These findings are controversial, but other studies found that uric acid levels decrease as blood glucose and HbA1c levels rise in diabetic patients [4, 13–18] which supports our findings. The reason why type 2 diabetic patients have an inverse relationship between HbA1c and uric acid is still unknown.

Limitations of the study

One of the drawbacks of our study is the small sample size under inquiry. A larger sample size could lead to more solid conclusions about diabetic complications. At-risk patients should be screened to identify and treat dysglycemia, which is a common risk factor for gout, myocardial infarction, and renal failure.

Conclusion

The elevated HbA1c levels tend to decrease serum uric acid levels in type 2 diabetic patients, suggesting that those with higher HbA1c may be less likely to develop hyperuricemia and gout. This is the novelty of this study.

Declarations

Conflict of interest:

The authors declare no competing interests.

Ethical approval:

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent:

Informed consents were taken from all the subjects who were willing to participate in the study.

Consent for publication:

For this type of study consent for publication is not required.

Author Contribution

Author contribution: RS, Writing – original draft. EM, Supervision and Validation, VT, Data curation, RB, methodology EN, review & editing.

Acknowledgement

Data Availability

Data availability: Data will be made available on request

Funding: This study received no funding.

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