OPEN ACCESS

Scholars International Journal of Obstetrics and Gynecology

Abbreviated Key Title: Sch Int J Obstet Gynec
ISSN 2616-8235 (Print) |ISSN 2617-3492 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Elevated Serum Uric Acid Levels in the First Trimester as a Predictor of Gestational Diabetes Mellitus

Kavya Balasubramanian[1]*, Sowmiya Sathyamoorthy[2], Murugalakshmi Krishnan[3]

[1]Senior Registrar, Department of Obstetrics and Gynaecology, Lotus Hospital, Erode, Tamil Nadu, India
[2]Assistant Professor, Department of Obstetrics and Gynaecology, Coimbatore Medical College and Hospital, Coimbatore, Tamil Nadu, India
[3]Professor, Department of Obstetrics and Gynaecology, Coimbatore Medical College and Hospital, Coimbatore, Tamil Nadu, India

DOI: https://doi.org/10.36348/sijog.2025.v08i08.001 | **Received:** 02.06.2025 | **Accepted:** 29.07.2025 | **Published:** 04.08.2025

***Corresponding author:** Kavya Balasubramanian
Senior Registrar, Department of Obstetrics and Gynaecology, Lotus Hospital, Erode, Tamil Nadu, India

Abstract

Background: Gestational Diabetes Mellitus (GDM) is a common pregnancy complication linked to higher perinatal risks for mother and baby. Elevated serum uric acid levels can contribute to insulin resistance by inhibiting the insulin-mediated release of endothelial nitric oxide and directly impacting the adipocytes. During the first trimester, serum uric acid levels are similar to pre-conception levels, so increased levels may signal a higher GDM risk. ***Objective:*** Our study was conducted to analyse the relationship between first-trimester serum uric acid levels and the development of GDM. Additionally, we sought to evaluate the potential of elevated serum uric acid as an early predictor of GDM. ***Methods:*** This prospective observational study recruited eligible antenatal women with live singleton pregnancies and a gestational age of less than 15 weeks who attended the outpatient clinic using convenience sampling. Pregnant women with a gestational age above 15 weeks, overt diabetes mellitus, those taking steroids in any form, or consuming drugs known to increase serum uric acid levels, as well as women with gout, other endocrine disorders, chronic renal disease, liver disease, cardiovascular disorders, or who smoked, were excluded. Blood tests were conducted, and serum uric acid levels exceeding 3.5 mg/dL were regarded as elevated. The study participants underwent an oral glucose tolerance test (OGTT) between 24 and 28 weeks of gestation. GDM was diagnosed according to the criteria of the Diabetes in Pregnancy Study Group India (DIPSI). A statistical analysis was performed, including measures of diagnostic performance. ***Results:*** One hundred and eight antenatal women participated in the study, with a mean age of 23.6 (± 4.08) years. Most women (46.3%) were aged 21 to 25, and the majority (56.5%) were primigravida. The prevalence of GDM in this group was 19.4% (21/108). A univariate analysis was performed to investigate the relationship between serum uric acid levels and various factors. Women with first-trimester serum uric acid levels exceeding 3.5 mg/dL demonstrated a significant ($p < 0.001$) correlation with abnormal OGTT results. The diagnostic performance tests for elevated first-trimester serum uric acid levels in predicting GDM revealed a sensitivity of 90.5% and a negative predictive value of 97.1%. ***Conclusion:*** We concluded that elevated serum uric acid in the first trimester is linked to a higher risk of developing GDM and may serve as a screening tool for early identification.

Keywords: Gestational diabetes mellitus, First-trimester uric acid level.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is a common complication that can arise during pregnancy. It is more prevalent in the South Asian region than in other parts of the world [1]. Pregnancies affected by GDM are associated with a higher risk of perinatal complications for both the mother and the baby [2]. In non-pregnant individuals, elevated levels of uric acid are an independent risk factor for developing type 2 diabetes mellitus within ten years, with this association being notably stronger in females compared to males [3]. Additionally, a positive correlation exists between serum uric acid levels and insulin resistance. High serum uric acid levels can contribute to insulin resistance by inhibiting the insulin-mediated release of endothelial nitric oxide and directly affecting adipocytes [4].

During pregnancy, several physiological changes occur: there is a significant increase in

glomerular filtration rate, a decrease in the reabsorption of uric acid in the renal tubules, and the influence of estrogen all lead to a noticeable decline in serum uric acid levels from the eighth week of gestation until 24 weeks, with levels returning to normal around the time of delivery [5]. It is important to note that during the first trimester, serum uric acid levels are comparable to pre-conceptional levels. Therefore, elevated levels during this period may signal an increased risk of developing GDM [6].

Based on this understanding, our study aimed to analyse the relationship between first-trimester serum uric acid levels and the development of GDM. By assessing the potential of elevated serum uric acid as an early predictor of GDM, we hope to enhance early detection methods, which could lead to timely intervention and management, ultimately reducing the risk of serious complications.

METHODS

This prospective observational study was conducted at Coimbatore Medical College and Hospital from March 2020 to March 2021. The Institutional Ethics Committee approved the protocol. One hundred and eight antenatal women who met the inclusion criteria were recruited into the study after obtaining informed written consent using a convenience sampling method. Antenatal women with live singleton pregnancies and a gestational age of less than 15 weeks who attended the outpatient clinic for regular antenatal check-ups were enrolled in the study. Pregnant women with a gestational age above 15 weeks, overt diabetes mellitus, those taking steroids in any form, or consuming drugs known to increase serum uric acid levels, as well as women with gout, other endocrine disorders, chronic renal disease, liver disease, cardiovascular disorders, or smokers, were excluded. After the initial antenatal assessment, 10 mL of venous blood was collected and sent to the laboratory for baseline investigations, including serum uric acid levels. The serum uric acid level was determined using the colorimetric method. Data on baseline demographic characteristics and laboratory test results were documented in a standard proforma. The study participants underwent an oral glucose tolerance test (OGTT) between 24 and 28 weeks of gestation. A diagnosis of gestational diabetes mellitus was made if the two-hour plasma glucose level was ≥ 140 mg/dL, according to the Diabetes in Pregnancy Study Group India (DIPSI) criteria. A serum uric acid level exceeding 3.5 mg/dL was considered elevated based on previous study cut-offs. All data were entered into a Microsoft Excel spreadsheet. Statistical analysis was performed using Microsoft Excel 2019 (Microsoft Corp., Redmond, WA, USA). Descriptive statistics were utilised to summarise population characteristics. Categorical variables were expressed as frequency or percentage, and continuous variables as mean with standard deviation. IBM SPSS Statistics ver. 26.0 (IBM Corp., Armonk, NY, USA) was used to perform univariate analysis, with a P value of < 0.05 indicating significance. Analysis of variance (ANOVA) was employed to assess the significance of study parameters among three or more groups. The Chi-square/Fisher Exact test was applied to evaluate the significance of categorical data across two or more groups. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated to assess the diagnostic accuracy of elevated first-trimester serum uric acid as a predictor of GDM.

RESULTS

Between March 2020 and March 2021, 108 antenatal women who met the inclusion and exclusion criteria were recruited to the study. The mean age of our study population was 23.6 (± 4.08) years. The majority (46.3 %) of study participants were between 21 and 25 years of age, and the majority (56.5%) were primigravid women. The baseline demographic and clinical characteristics are summarised in Table 1. The incidence of GDM in our study population was 19.4% (21/108). The mean two-hour plasma glucose level was 108.8 (±27.3) mg/dL, and the mean first-trimester serum uric acid level was 3.4 (±0.9) mg/dL in our study.

A univariate analysis was performed to analyse the relationship between serum uric acid levels and various parameters, as shown in Table 2. The comparison of baseline variables (age, parity and risk factors) with serum uric acid levels at <15 weeks of gestation didn't show any significance. Women with elevated first-trimester serum uric acid levels > 3.5 mg/dL showed a significant association with abnormal OGTT done between 24 and 28 weeks. The tests to assess the diagnostic accuracy of an elevated first-trimester serum uric acid level (> 3.5 mg/dL) in predicting GDM showed a sensitivity of 90.5%, specificity of 77%, positive predictive value of 48.7%, and negative predictive value of 97.1%.

Table 1: Demographic and population characteristics

Parameters	Number (%)
Age	
18 to 20 years	28 (25.9)
21 to 25 years	50 (46.3)
26 to 30 years	23 (21.3)
31 to 36 years	7 (6.5)
Gravida:	
Primigravida	61 (56.5)
G2	37 (34.3)
G3	10 (9.3)
Risk factors	
None	98 (90.7)
Fibroid	1 (0.9)
Hypothyroidism	6 (5.6)
Rheumatic heart disease	2 (1.9)
Hepatitis B infection	1 (0.9)
Serum uric acid level	
≤ 3.5 mg/ dL	69 (63.9)
>3.5 mg/dL	39 (36.1)
OGTT results	
<140 mg/dL (non-GDM group)	87 (80.6)
≥ 140mg/dL (GDM group)	21 (19.4)

Table 2: Comparison of first-trimester serum uric acid levels with various parameters

Study Parameter	First trimester serum uric acid level ≤ 3.5 mg/ dL	First trimester serum uric acid level > 3.5 mg/ dL	P value
Age			
18 to 20 years	20	8	
21 to 25 years	33	17	0.198
26 to 30 years	14	9	
31 to 36 years	2	5	
Gravida:			
Primigravida	39	22	
G2	23	14	0.900
G3	7	3	
Risk factors			
None	65	33	
Fibroid	0	1	
Hypothyroidism	65	33	0.157
Rheumatic heart disease	0	2	
Hepatitis B infection	1	0	
OGTT results			
<140 mg/dL (non-GDM group)	67	20	< 0.001
≥ 140mg/dL (GDM group)	2	19	

DISCUSSION

Diabetes is one of the most common medical complications which occurs in pregnancy. Early intervention and appropriate treatment in patients with GDM or at increased risk of developing GDM will help prevent the adverse maternal and fetal outcomes. The main focus of our study was to analyse the association of elevated uric acid levels in the first trimester and the subsequent development of GDM. The incidence of GDM in our study was 19.4%, which is similar to the prevalence reported by Seshaiah *et al.,*[1]. In our study, we used the DIPSI criteria for the diagnosis of GDM, which has the advantage of being a one-step method for both screening and diagnosing GDM.

The mean age of our study population was 23.6 (±4.08) years, which is similar to the findings reported by Kappaganthu *et al.,* [7]. However, the study by El-Gharib *et al.,* [8] reported a mean age of 27.26 (±3.13) years, suggesting that socioeconomic factors and cultural differences in our geographic region may influence this. Most of our participants were between the ages of 21 and 25 years (46.3%), with only 6.5% over 30 years old. Our study found no statistical significance between age and first-trimester serum uric acid levels (p = 0.198).

The majority of our study participants were primiparous (56.5%) women. Among the study participants, 22% of primiparous women and 24 % of multiparous women developed GDM. Our study found no statistical significance between parity and first-trimester serum uric acid levels (p = 0.900), which is consistent with the report by Ganta *et al.,* [9].

The majority of women in our study had no risk factors (90.7%), and we found no statistically significant difference between risk factors and first-trimester serum uric acid levels (p = 0.157).

Our study found that a first-trimester serum uric acid level above 3.5 mg/dL is strongly linked to abnormal OGTT results between 24 and 28 weeks (p < 0.001). This aligns with findings from Laughon *et al.,*.[10], Wolak *et al.,*.[11], and Zhao *et al.,*[12]. Additionally, using a cutoff of > 3.5 mg/dL for serum uric acid in the first trimester yields a sensitivity of 90.4% and a negative predictive value of 97.1% for predicting GDM. Therefore, this measure can serve as an effective screening tool to identify women at risk for developing GDM.

A major limitation of this study is that it was conducted at a single center over a limited period and involved a small sample size. Furthermore, participants were only followed up for up to 28 weeks, which may have resulted in missing women who developed GDM later in their pregnancy.

CONCLUSION

Our study concludes that elevated serum uric acid level in the first trimester is linked to a heightened risk of developing gestational diabetes mellitus (GDM). It may serve as a valuable screening tool for pregnant women in their first trimester to identify those at risk of GDM. However, large-scale multicenter studies are required to establish more definitive evidence.

Funding: None to declare.

Conflict of Interest: The authors declare that they have no conflicts of interest**.**

REFERENCE

1. Seshiah V, Balaji V, Balaji MS, Sanjeevi CB, Green A. Gestational diabetes mellitus in India. *J Assoc Physicians India*. 2004;52:707-711.
2. American Diabetes Association. Preconception care of women with diabetes. *Diabetes Care*. 2003;26 Suppl 1:S91-S93.
3. Dehghan A, van Hoek M, Sijbrands EJ, Hofman A, Witteman JC. High serum uric acid as a novel risk factor for type 2 diabetes. *Diabetes Care*. 2008;31(2):361-362.
4. Yoo TW, Sung KC, Shin HS, *et al.,*. Relationship between serum uric acid concentration and insulin resistance and metabolic syndrome. *Circ J*. 2005;69(8):928-933.
5. Dunlop W, Davison JM. The effect of normal pregnancy upon the renal handling of uric acid. *Br J Obstet Gynaecol*. 1977;84(1):13-21.
6. C R, Samal S, Ghose S. Association of Elevated first Trimester Serum Uric Acid Levels with Development of GDM. *J Clin Diagn Res*. 2014;8(12):OC01-OC5. doi:10.7860/JCDR/2014/8063.5226
7. Kappaganthu A, Sachan J, Shailaja G. Hyperuricemia in early pregnancy: a marker for gestational diabetes mellitus. *J Dental Med Sci*. 2014;13(12):51-4.
8. El-Gharib MN, Mahfouz AE, Morad MA, Farahat MA. Prediction of gestational diabetes by measuring first trimester maternal serum uric acid concentration. *Journal of Basic and Clinical Reproductive Sciences*. 2013;2(1):27-31.
9. Ganta SJ, Kulkarni SR. First trimester uric acid level: a reliable marker for gestational diabetes mellitus. *Int J Reprod Contracept Obs Gynecol*. 2019 Jun 1;8(6):2358-62.
10. Laughon SK, Catov J, Provins T, Roberts JM, Gandley RE. Elevated first-trimester uric acid concentrations are associated with the development of gestational diabetes. *Am J Obstet Gynecol*. 2009;201(4):402.e1-402.e4025.
11. Wolak T, Sergienko R, Wiznitzer A, Paran E, Sheiner E. High uric acid level during the first 20 weeks of pregnancy is associated with higher risk for gestational diabetes mellitus and mild preeclampsia. *Hypertens Pregnancy*. 2012;31(3):307-315.
12. Zhao Y, Zhao Y, Fan K, Jin L. Serum uric acid in early pregnancy and risk of gestational diabetes mellitus: A cohort study of 85,609 pregnant women. *Diabetes Metab*. 2022;48(3):101293.