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ELEVATED FIRST TRIMESTER SERUM URIC ACID AS A PREDICTOR FOR GESTATIONAL DIABETES MELLITUS: A PROSPECTIVE OBSERVATIONAL STUDY

Obstetrics & Gynaecology

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is associated with adverse maternal and fetal outcomes. Early prediction enables timely intervention. **Objective:** To evaluate whether elevated first trimester serum uric acid predicts development of GDM. **Methods:** A prospective observational study was conducted on 100 antenatal women (<13 weeks) at ASRAM, Andhra Pradesh. First trimester serum uric acid was measured, and GDM was diagnosed by OGTT at 24–28 weeks. **Results:** Of 100 women, 24 developed GDM. Elevated uric acid (>4.2 mg/dL) was seen in 43 patients, of whom 22 developed GDM. Highly significant association was found between elevated uric acid and GDM ($p < 0.001$). **Conclusion:** Elevated first trimester uric acid is a simple, early marker associated with GDM risk and can guide early preventive measures.

KEYWORDS

INTRODUCTION

GDM is glucose intolerance recognized for the first time during pregnancy [1]. It contributes to complications like macrosomia, preeclampsia, cesarean delivery, and neonatal hypoglycemia [2]. Long-term, it predisposes both mother and offspring to metabolic diseases like type 2 diabetes mellitus (T2DM) and obesity [3].Routine GDM screening occurs at 24–28 weeks. However, this timing may be too late for intervention. Identifying early biomarkers is essential. Serum uric acid, long known for its role in gout, is increasingly implicated in insulin resistance and oxidative stress [5,6].Normally, uric acid falls in early pregnancy due to hemodilution and hormonal effects. Elevated levels may signal metabolic dysregulation and predict adverse outcomes, including GDM [7–9]. This study investigates whether uric acid in the first trimester can serve as a predictor for GDM.

MATERIALS AND METHODS

Study Area: Alluri Sitarama Raju Academy of Medical Sciences (ASRAM), Eluru, Andhra Pradesh.
Study Population: 100 antenatal women attending outpatient clinic in their first trimester (<13 weeks gestation), between May 2024 and October 2025.
Study Design: Prospective observational study.
Sample Size: 100 women.

Inclusion and Exclusion Criteria:

Inclusion Criteria

- Gestational age <13 weeks
- Single viable intrauterine pregnancy

Exclusion Criteria

- Known pregestational diabetes
- Multiple pregnancy
- Renal, hepatic, thyroid, or cardiovascular disease
- Smoking
- Use of medications affecting uric acid (aspirin, caffeine, diuretics)

RESULTS AND ANALYSIS

Demographics

- Age range: Most (44%) were 21–25 years
- Parity: 53% primigravida, 47% multigravida

Table 1: Distribution of Patients According to Age

Age Group (years)	Number of Patients	Percentage
Upto 20	11	11%
21–25	44	44%
26–30	28	28%
>30	17	17%
Total	100	100%

Table 2: Distribution of Patients According to Parity

Parity	Number of Patients	Percentage
Primigravida	53	53%
Multigravida	47	47%
Total	100	100%

Serum Uric Acid Levels

- Normal (<4.2 mg/dL): 57 women
- Elevated (>4.2 mg/dL): 43 women

Table 3: Cross Tabulation of Serum Uric Acid and GDM Incidence

Serum Uric Acid	GDM Present	GDM Absent
Normal (n = 57)	2	55
Elevated (n = 43)	22	21
Total (n = 100)	24	90

GDM Incidence

- 24 women diagnosed with GDM by IADPSG criteria [4]
- 22 had elevated uric acid; 2 had normal levels

Statistical Analysis

- Chi-square = 23.3, $p < 0.001$ (significant)
- Sensitivity: 91.7%
- Specificity: 72.4%
- PPV: 51.2%
- NPV: 96.5%
- Odds Ratio: 28.9

Table 4: Diagnostic Accuracy of Serum Uric Acid for Predicting GDM

Test Parameter	Value
Sensitivity	91.7%
Specificity	72.4%
Positive Predictive Value	51.2%
Negative Predictive Value	96.5%
Odds Ratio	28.9

Table 5: Parity-wise Distribution of GDM Cases

Parity	GDM Present	Total in Group	Percentage with GDM
Primigravida	10	53	18.9%
Multigravida	14	47	29.8%
Total	24	100	24%

P-value = 0.21 (Not statistically significant)

Parity and age showed no significant correlation with GDM.

DISCUSSION

Gestational diabetes mellitus (GDM) is a multifactorial condition arising from an interplay of genetic, hormonal, and environmental factors that result in glucose intolerance during pregnancy. Physiologically, insulin resistance increases during the second and third trimesters to ensure adequate glucose supply to the fetus. This adaptation is mediated by placental hormones like human placental lactogen (hPL), progesterone, estrogen, cortisol, and growth hormone. However, in women predisposed to metabolic dysfunction, the pancreatic β-cells are unable to compensate for this increased demand, leading to hyperglycemia and clinical manifestation of GDM [3,4].

In recent years, uric acid has emerged as a potential biomarker for metabolic diseases due to its association with oxidative stress, inflammation, and endothelial dysfunction. Uric acid is the final product of purine metabolism and has pro-oxidant properties in the intracellular environment. Elevated levels are thought to impair insulin signaling by reducing nitric oxide bioavailability, promoting vascular inflammation, and increasing oxidative stress within adipocytes and vascular tissues [6]. These effects may precede the onset of hyperglycemia and could explain the strong correlation between first trimester uric acid levels and subsequent GDM diagnosis.

In the present study, a highly significant association was observed between elevated serum uric acid (>4.2 mg/dL) in the first trimester and the development of GDM later in pregnancy ($p < 0.001$). Among the 43 women with elevated uric acid, 22 developed GDM, compared to only 2 out of 57 with normal levels. The calculated odds ratio of 28.9 indicates that women with elevated uric acid had nearly 29 times the risk of developing GDM compared to those with normal levels.

These findings are consistent with several previous studies. Laughon et al. observed that higher uric acid levels in early pregnancy were associated with increased risk of GDM, independent of BMI [5]. Rasika et al. also identified serum uric acid as a significant early predictor, reporting a sensitivity of 70% and specificity of 80% at a cut-off of 3.6 mg/dL [7]. Singh et al. reported that women with uric acid >5 mg/dL had significantly higher risk of abnormal OGTT and GDM [9]. The diagnostic metrics in our study with sensitivity 91.7%, specificity 72.4%, and NPV 96.5%—suggest that serum uric acid is a highly reliable early screening marker, particularly useful in ruling out GDM in low-risk women.

Importantly, the high negative predictive value suggests that a normal uric acid level may effectively rule out future GDM, reducing unnecessary anxiety and follow-up testing in low-risk women. This makes it a valuable tool for primary care and rural healthcare settings where resource-intensive screening like OGTT may be impractical. Despite its promise, serum uric acid should not be used in isolation to predict GDM. Factors such as BMI, family history, diet, and physical activity also contribute to GDM risk. However, when combined with demographic and clinical indicators, uric acid testing could form part of a broader first trimester risk assessment model.

Given its affordability, ease of testing, and biological relevance, serum uric acid is a practical candidate for integration into early antenatal screening programs. Future research with larger, multicenter cohorts and long-term follow-up is needed to validate its predictive power across different populations and to establish universally accepted cut-off values.

CONCLUSION

Elevated first trimester serum uric acid is strongly associated with GDM. It is a valuable, inexpensive early biomarker. Women with high uric acid levels can be identified and managed early, potentially improving both maternal and fetal outcomes.

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