ORIGINAL RESEARCH PAPER

Clinical Biochemistry

INTERRELATIONSHIP BETWEEN INFLAMMATORY STATUS AND β-CELL FUNCTION IN GESTATIONAL DIABETES MELLITUS: A CASE–CONTROL STUDY USING CRP AND C-PEPTIDE

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INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of varying severity with onset or first recognition during pregnancy. It is among the most common metabolic disorders encountered during pregnancy and contributes significantly to maternal and fetal complications including preeclampsia, macrosomia, neonatal hypoglycemia, and future development of type 2 diabetes mellitus.

Pregnancy is associated with physiological insulin resistance due to placental hormones such as human placental lactogen, cortisol, progesterone, estrogen, and prolactin. Normally, pancreatic β-cells compensate by increasing insulin secretion. However, inadequate β-cell compensation in predisposed women leads to gestational diabetes mellitus.

Recent evidence has highlighted the role of chronic low-grade inflammation in the pathogenesis of GDM. Inflammatory mediators interfere with insulin signaling pathways resulting in insulin resistance and altered glucose metabolism. C-reactive protein (CRP), synthesized by the liver in response to inflammatory cytokines, serves as a sensitive marker of systemic inflammation and has been found elevated in GDM patients.

C-peptide is released during cleavage of proinsulin into insulin and reflects endogenous insulin secretion. Increased serum C-peptide levels indicate increased pancreatic β-cell activity secondary to insulin resistance.

Understanding the relationship between inflammatory status and β-cell function may provide insight into disease progression and aid in early identification of women at increased risk of metabolic complications. Hence, the present study was undertaken to evaluate serum CRP and C-peptide levels in gestational diabetes mellitus and compare them with healthy pregnant controls.

AIM AND OBJECTIVES

Aim

To study the interrelationship between inflammatory status and β-cell function in gestational diabetes mellitus using serum CRP and C-peptide levels.

Objectives

1. To estimate serum CRP levels in GDM patients and healthy pregnant controls.
2. To estimate serum C-peptide levels in GDM patients and controls.
3. To compare serum CRP and C-peptide levels between cases and controls.
4. To evaluate correlation between inflammatory status and β-cell function in gestational diabetes mellitus.

MATERIALS AND METHODS

This was a cross-sectional study conducted to evaluate the interrelationship between inflammatory status and β-cell function in gestational diabetes mellitus using CRP and C-peptide. The study was conducted in the Department of Biochemistry at a tertiary healthcare center in Central India. The study was conducted over a period of 4 months from JAN 2026 to APRIL 2026. The study was carried out on a total of 100 subjects fulfilling inclusion and exclusion criteria. The study group consisted of 50 diagnosed cases of gestational diabetes mellitus admitted in the Department of Obstetrics and Gynaecology and 50 age-matched healthy pregnant women attending antenatal OPD as controls.

Inclusion Criteria

- Pregnant women with gestational age >24 weeks
- Singleton pregnancy
- Group 1: Healthy pregnant women
- Group 2: Diagnosed GDM patients

Exclusion Criteria

- Subjects unwilling to participate
- Twin or multiple pregnancy
- Pre-existing diabetes mellitus
- Renal disease
- Liver disorders
- Hypertension
- Cardiac disease
- Epilepsy

Under aseptic precautions, fasting venous blood samples were collected from all study participants after obtaining informed consent. Samples were centrifuged and serum was separated for biochemical analysis.

Estimation of serum CRP was done by immunoturbidimetric method using standard kits supplied by Transasia Bio-Medicals Ltd. on Erba XL 640. Serum C-peptide estimation was performed by chemiluminescent immunoassay method using Mindray analyzer CL1200i with commercially available reagents.

The obtained data were tabulated and analyzed using IBM SPSS Statistics. Quantitative variables were expressed as mean ± standard deviation. Student's t-test was used for comparison between groups. Pearson's correlation coefficient was used to assess association between CRP and C-peptide levels. A p-value less than 0.05 was considered statistically significant.

RESULTS

Comparison of Biochemical Parameters in Cases and Controls

Parameter	Cases (Mean ± SD)	Controls (Mean ± SD)	p-value
Fasting Blood Glucose (mg/dL)	145.6 ± 18.4	84.2 ± 9.1	Significant (p<0.05)
CRP (mg/L)	8.42 ± 2.16	3.21 ± 1.04	Significant (p<0.05)
C-Peptide (ng/mL)	4.82 ± 1.23	2.31 ± 0.88	Significant (p<0.05)

DISCUSSION

The present study evaluated inflammatory status and β-cell function in gestational diabetes mellitus using serum CRP and C-peptide levels. The study demonstrated significantly elevated serum CRP levels among GDM patients compared to healthy pregnant controls, suggesting the presence of systemic inflammation in gestational diabetes mellitus.

Pregnancy itself is associated with physiological insulin resistance, which becomes exaggerated in GDM due to hormonal and metabolic alterations. Inflammatory cytokines such as TNF-α and IL-6 impair insulin receptor signaling pathways and contribute to insulin resistance. CRP, being an acute phase reactant synthesized by the liver, reflects the inflammatory state associated with altered glucose metabolism.

The present study also showed significantly elevated serum C-peptide levels in GDM subjects. C-peptide is secreted in equimolar concentration with endogenous insulin and serves as a marker of pancreatic β-cell function. Elevated C-peptide levels indicate compensatory hyperinsulinemia secondary to increasing insulin resistance during pregnancy.

A positive correlation was observed between CRP and C-peptide levels in GDM patients, suggesting that inflammatory status may influence pancreatic β-cell activity. Persistent inflammatory stress may increase insulin demand leading to enhanced β-cell secretory response. However, prolonged insulin resistance and inflammation may eventually contribute to β-cell dysfunction and impaired glucose tolerance.

The findings of the present study are consistent with previous studies demonstrating elevated inflammatory markers and altered insulin secretion in gestational diabetes mellitus. Early assessment of inflammatory and metabolic biomarkers may help in identifying women at increased risk of adverse maternal and fetal outcomes and future development of type 2 diabetes mellitus.

CONCLUSION

The present study demonstrated significantly elevated serum CRP and C-peptide levels in gestational diabetes mellitus patients compared to healthy pregnant women. Increased CRP levels indicate systemic inflammation, while elevated C-peptide levels reflect altered β-cell function and compensatory hyperinsulinemia associated with insulin resistance.

A significant positive correlation between CRP and C-peptide suggests that inflammatory status and β-cell dysfunction are interrelated mechanisms contributing to the pathogenesis of gestational diabetes mellitus. Assessment of inflammatory and metabolic biomarkers may serve as useful adjuncts for early diagnosis and management of high-risk pregnancies.

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