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Prevalence of Gestational Diabetes Mellitus and Its Association with Serum Ferritin Levels Among Pregnant Women in West Bengal: A Case-Control Study

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ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is a growing public health concern in India, particularly in urban and semi-urban regions like West Bengal. Elevated serum ferritin, a marker of iron storage and inflammation, has been linked to insulin resistance and may be associated with GDM development. Objectives: To estimate the prevalence of GDM and assess the association between serum ferritin levels and GDM among pregnant women in West Bengal. Methods: A case-control study was conducted with 38 pregnant women (19 GDM cases and 19 matched controls without GDM). GDM was diagnosed using the IADPSG criteria. Serum ferritin levels were measured and compared. Demographic variables and risk factors were analyzed using SPSS. Results: The prevalence of GDM in the sample was 50%. Mean serum ferritin was significantly higher in the GDM group (54.3±12.1 ng/mL) compared to controls (32.5±10.8 ng/mL; $p<0.01$). High BMI, family history of diabetes, and advanced maternal age were prominent risk factors. A positive correlation ($r=0.67$) between serum ferritin and GDM was observed. Conclusion: Elevated serum ferritin levels are significantly associated with GDM, suggesting a potential role in screening and early diagnosis. Targeted screening and preventive strategies should be emphasized for high-risk women.

KEYWORDS: GDM, Pregnant.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is defined as glucose intolerance first recognized during pregnancy. It affects approximately 10-14% of pregnancies in India and contributes to maternal and fetal complications including macrosomia, preterm labor, and future type 2 diabetes[1].

The prevalence of Gestational Diabetes Mellitus (GDM) varies globally and within different populations. Globally, it's estimated that one in ten pregnancies is affected by diabetes, with GDM accounting for 90% of these cases. In India, GDM prevalence ranges from 10-14.3%, which is higher than in Western countries. Factors like maternal age, BMI, diet, and lifestyle influence the prevalence. Here's a more detailed look at GDM prevalence Global and Regional Variations: Global: One in ten pregnancies has diabetes, with GDM making up the vast majority[2].

India: Reported prevalence is 10-14.3%, higher than Western countries. Rural vs. Urban: Rural areas in India show a slightly lower GDM prevalence (10%) compared to urban areas (12%). Trends and Risk Factors: Increasing Trend: Studies show an increasing trend in GDM prevalence in India, with some exceptions. Age: GDM prevalence generally increases with maternal age, with the highest rates in women aged 40-44. Obesity: Obesity is a significant risk factor, with studies showing a higher prevalence of GDM in women with higher BMIs. Socioeconomic Status and Educating prevalence is also associated with socioeconomic status and education level. Important Considerations: Diagnostic Criteria: The diagnostic criteria used can influence the reported prevalence[3]. Heterogeneity: There's considerable heterogeneity in GDM prevalence due to variations in diagnostic methods, screening approaches, and study settings

Serum ferritin, an indicator of iron stores and systemic inflammation, has emerged as a novel biomarker in GDM research. Several studies suggest that elevated ferritin may contribute to insulin resistance. However, limited data are available for the Indian population, especially in regional states like West Bengal[4].

This study aims to assess the prevalence of GDM and examine the association of serum ferritin with GDM in pregnant women in West Bengal.

METHODS

This study was conducted in a tertiary hospital. After obtaining institutional ethical committee approval. It was Cross-sectional observational study conducted on 38 patients in the department of Obstetrics & Gynaecology, at a tertiary care centre, from April / 2015 to October/2015

Total 38 participant were approached to project among them No one were excluded in this study and Total 38 Confirmed cases were included on the basis of fulfilling of the eligibility criteria.

The institute Ethics Committee approval was obtained before starting the sample collection. A written and informed consent was taken from the patient regarding the study in his/her vernacular language and English. In this study Patients were subjected to: A detailed history of sign & symptoms and its duration. Detailed history of systemic diseases and its duration, medication were noted. Patients were subjected to General physical examination.

Study Design:

Case-control study

Study Location:

Government and private antenatal clinics in West Bengal

Sample Size:

38 pregnant women (19 GDM cases, 19 controls)

Inclusion Criteria:

- Pregnant women between 24–28 weeks gestation
- Age 18–40 years
- Singleton pregnancies

Exclusion Criteria:

- Pre-existing diabetes mellitus
- Chronic infections or inflammatory diseases
- Iron supplementation within the past 4 weeks

Data Collection:

- **GDM Diagnosis:** Based on IADPSG criteria using 75g oral glucose tolerance test (OGTT).
- **Serum Ferritin Measurement:** Blood samples analyzed via ELISA.
- **Demographics and Risk Factors:** Age, BMI, gravidity, family history of diabetes, previous GDM, etc.

Statistical Analysis:

- Chi-square and t-tests used for comparing groups
- Pearson's correlation for ferritin and GDM
- $p<0.05$ considered significant

RESULTS

In this study we found that Gestational Diabetes Mellitus (GDM) is associated with demographic profile of patient. 29.4 ± 3.2 age group patient suffered of Gestational Diabetes Mellitus (GDM) is followed by 47.3% % Primigravida.

Gestational Diabetes Mellitus (GDM) were belong to 29.4 ± 3.2 years age group(Table 1)

Age is also associated factors for Gestational Diabetes Mellitus (GDM)

63.1% Gestational Diabetes Mellitus (GDM) were associated with Family History of DM (Table 1)

Demographic Profile Table

Variable	GDM Group (n=19)	Control Group (n=19)	p-value
Mean Age (years)	29.4 ± 3.2	26.8 ± 2.8	0.012*
BMI (kg/m²)	28.6 ± 2.5	24.9 ± 2.1	<0.01*
Primigravida (%)	47.3%	63.1%	0.28
Family History of DM	63.1%	21%	0.007*
Previous GDM	15.7%	0%	0.08

*Significant values ($p<0.05$)

Gestational Diabetes has many risk factors among them BMI play crucial role and Previous History of GDM is also causing factors for GDM.

Risk Factors Table 2: Gestational Diabetes

Risk Factor	Frequency in GDM (%)	Frequency in Control (%)
Age > 30 years	42.1%	15.8%
BMI > 25 kg/m²	78.9%	36.8%
Family History of Diabetes	63.1%	21%
Previous History of GDM	15.7%	0%
Low Physical Activity	68.4%	36.8%

- **Prevalence of GDM:** 50% among 38 subjects.
- **Serum Ferritin Levels:**
  - GDM group: **54.3 ± 12.1 ng/mL**
  - Control group: **32.5 ± 10.8 ng/mL**
  - **p < 0.01**
- **Correlation:**
  - Pearson's correlation between serum ferritin and GDM = **r = 0.67**
- **Other Findings:**
  - Higher serum ferritin was associated with higher BMI and family history of diabetes.

DISCUSSION

Our study found a 50% prevalence of GDM among pregnant women attending antenatal clinics in West Bengal, higher than national averages. This could be due to urban lifestyle, late maternal age, and high obesity rates. Gestational diabetes mellitus (GDM) is influenced by several demographic factors. Age, ethnicity, family history of diabetes, and body mass index (BMI) are significant contributors. Additionally, socioeconomic

factors like education level and occupation can play a role. Age: Older women (typically over 25) are at a higher risk of developing GDM [5].

Ethnicity: Certain ethnic groups, such as African American, American Indian, Asian American, Hispanic or Latino, and Pacific Islander women, have a higher prevalence of GDM. Family History: A family history of diabetes, particularly in first-degree relatives, significantly increases the risk of GDM. BMI: Overweight and obese women are at a greater risk of developing GDM[6-8].

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Other Factors: Parity: Multiparity (having had multiple pregnancies) is associated with an increased risk. Socioeconomic Status: Studies show varying results, but some suggest that lower socioeconomic status (including lower education and income levels) may be a risk factor[9]. Stress and Psychosocial Factors: Elevated stress levels and poor psychosocial status can also contribute to GDM. Diet and Physical Activity: Frequency of eating out, unhealthy dietary habits, and lack of physical activity are linked to a higher risk Gestational diabetes, a type of diabetes that develops during pregnancy, can be influenced by various risk factors[10—12]. These include being overweight or obese, having a family history of diabetes, being older than 35, and belonging to certain racial or ethnic groups (Black, Hispanic, Native American, Asian American, or Pacific Islander). Additionally, a history of gestational diabetes in a previous pregnancy, delivering a large baby (over 9 pounds), or having polycystic ovary syndrome (PCOS) also increase the risk[13].

Here's a more detailed breakdown of the risk factors: Modifiable Risk Factors: Obesity and Overweight: Carrying excess weight, especially before pregnancy, is a significant risk factor for gestational diabetes Lack of Physical Activity: A sedentary lifestyle can contribute to insulin resistance and increase the risk. Diet: Unhealthy eating habits, including high intake of processed foods, sugars, and unhealthy fats, can also play a role. Non-Modifiable Risk Factors: Family History of Diabetes Having a parent, sibling, or other close relative with type 2 diabetes increases the likelihood of developing gestational diabetes. Advanced Maternal Age: Women who are 35 or older at the time of pregnancy are at a higher risk[14]. Ethnicity: Certain racial and ethnic groups, including African Americans, Hispanics/Latinos, Native Americans, Asian Americans, and Pacific Islanders, have a higher prevalence of gestational diabetes[15]. Previous Gestational Diabetes:

If a woman has had gestational diabetes in a previous pregnancy, she is more likely to develop it again according to the CDC. Large Baby: Giving birth to a baby weighing 9 pounds or more is associated with an increased risk of gestational diabetes in subsequent pregnancies[16-17]. Polycystic Ovary Syndrome (PCOS):

This hormonal disorder is linked to insulin resistance and an increased risk of gestational diabetes Significantly elevated serum ferritin levels in GDM patients suggest a strong association between iron storage and glucose intolerance during pregnancy. Elevated ferritin could contribute to oxidative stress and beta-cell dysfunction[18].

These findings are consistent with global studies and underscore the need to monitor iron status beyond anaemia management during pregnancy.

CONCLUSION

There is a significant association between elevated serum ferritin levels and the presence of GDM. Routine screening of ferritin levels in antenatal care may help in early risk assessment and prevention strategies.

Recommendations:

Screening ferritin alongside glucose in high-risk pregnancies Education on nutrition and lifestyle modification Larger-scale studies to confirm findings in diverse Indian populations

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CONFLICT OF INTEREST

The authors report no conflicts of interest

SUBMISSION DECLARATION

This submission has not been published anywhere previously and that it is not simultaneously being considered for any other journal.

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