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ASSOCIATION OF MATERNAL OBESITY, AGE, AND HEREDITY WITH GESTATIONAL DIABETES: EVIDENCE FROM A CROSS-SECTIONAL STUDY

Dr. Pawan Preet Kaur[1*], Dr Navreet Kaur[2]

[1*]Assistant Professor, Department of Gynaecology & Obstetrics, Varun Arjun Medical College & Rohilkhand Hospital, Shahjahanpur, India.
[2]Assistant Professor, Department of General Medicine, Varun Arjun Medical College & Rohilkhand Hospital, Shahjahanpur, India.

***Corresponding Author:** Dr Pawan Preet Kaur
*Email Id: pawan.jas@gmail.com

ABSTRACT

Background: Gestational diabetes mellitus (GDM) is a growing public health concern in India, driven by rising rates of obesity, sedentary lifestyles, and genetic predisposition. Early detection of clinical risk factors is essential to mitigate adverse maternal and fetal outcomes. Despite extensive data on GDM prevalence, there is limited literature on the clinical profiling of affected women in tertiary care settings in northern India.

OBJECTIVES: To describe the clinical and demographic profile of women diagnosed with gestational diabetes mellitus (GDM) at a tertiary care hospital in northern India, with particular emphasis on risk factors such as age, body mass index (BMI), parity, and family history of diabetes.

METHODS: This descriptive, observational, retrospective, and cross-sectional study was conducted at Varun Arjun Medical College and Rohilkhand Hospital from January 2024 to December 2024. A total of 150 antenatal women diagnosed with GDM were included. Data regarding age, height, weight, BMI, pregnancy number, and family history of diabetes were extracted from hospital records and analyzed using descriptive statistics. BMI categories were defined using Asian-specific cutoffs. GDM diagnosis was based on institutional criteria following a 75 g oral glucose tolerance test.

RESULTS: The mean age of participants was 34.73 ± 6.44 years, and the mean BMI was 33.45 ± 4.62 kg/m². Most women were obese (121, 80.67%) with least in Normal category (2, 1.33%). Among women in their first three pregnancies (n=95), the majority (42.11%) were in their third pregnancy. A positive family history of diabetes was reported in 66.0% of the participants. All women included were confirmed cases of GDM.

CONCLUSIONS: Maternal age above 30 years, obesity, and a positive family history of diabetes emerged as dominant clinical features in women with GDM. These findings support the integration of early risk-based screening and lifestyle interventions into routine antenatal care in similar settings.

Key Words: Body Mass Index; Pregnancy, Parity; Heredity; Risk Assessment; Antenatal Screening

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as glucose intolerance with onset or first recognition during pregnancy and remains one of the most common medical complications affecting pregnant women globally [1]. With changing lifestyle patterns and increasing urbanization, the prevalence of GDM has been rising steadily, particularly in low- and middle-income countries such as India [2]. According to the International Diabetes Federation, GDM affects nearly one in six pregnancies worldwide, with India accounting for a significant proportion of these cases [3].

India is often referred to as the diabetes capital of the world, and this burden extends into the antenatal population. Various population-based studies conducted across India have reported the prevalence of GDM to range from 10% to 35%, depending on the region and screening criteria used [4–6]. Urban areas and southern states have shown particularly high rates, but recent studies indicate a growing prevalence in semi-urban and northern regions as well [7,8]. Despite the increasing burden, routine universal screening and targeted interventions are not uniformly practiced across public and private healthcare settings.

GDM is associated with a spectrum of adverse maternal and fetal outcomes, including preeclampsia, macrosomia, neonatal hypoglycemia, and a heightened risk of developing type 2 diabetes mellitus later in life for both mother and child [9,10]. Early identification and management of high-risk women through antenatal screening remain key to mitigating these complications. Major risk factors implicated in GDM include advanced maternal age, high body mass index (BMI), a family history of diabetes, and multiparity [11–13]. In particular, obesity is now recognized as one of the strongest modifiable risk factors, especially when combined with other elements like genetic predisposition or advancing parity [14].

Although several large-scale studies have examined the epidemiology of GDM in southern India, there is a relative paucity of detailed clinical profiling studies in tertiary care settings from the northern part of the country. Furthermore, most available literature focuses primarily on prevalence rates or outcomes without stratifying risk factors in a real-world antenatal population. This gap in literature and the observed clinical trends in our outpatient services prompted the need for a focused retrospective assessment of GDM risk characteristics among antenatal women attending our institution.

The present study was therefore undertaken to clinically profile women diagnosed with gestational diabetes mellitus attending a tertiary care hospital in northern India. The objective was to describe their demographic and anthropometric characteristics, evaluate the frequency of associated risk factors such as obesity, parity, and heredity, and generate insights for strengthening targeted screening and preventive strategies in similar healthcare settings.

Despite increasing awareness and surveillance, gestational diabetes mellitus remains underdiagnosed and inconsistently profiled in many parts of India, particularly in northern semi-urban and rural populations. While several large-scale studies have focused on GDM prevalence, few have specifically addressed the clinical characteristics and risk stratification of affected women in real-world hospital-based settings. Given the rising burden of maternal obesity, advancing maternal age, and familial predisposition to diabetes, there is a critical need to understand the demographic and anthropometric profiles of women most at risk.

This study was justified because it would fill this gap by retrospectively analyzing routinely collected antenatal data from a tertiary care hospital. The research aims to generate evidence that can inform local screening practices and guide early intervention strategies by identifying patterns related to age, BMI, parity, and heredity.

The purpose of the study is to describe the clinical and demographic characteristics of women diagnosed with gestational diabetes mellitus and to evaluate the frequency of key risk factors, thereby supporting more targeted and timely antenatal care interventions in similar healthcare settings.

MATERIAL AND METHODS

Study Design and Setting

This was a descriptive, observational, retrospective, and cross-sectional study conducted at the Department of Pharmacology, Varun Arjun Medical College and Rohilkhand Hospital, Shahjahanpur, India. The study was carried out over a period of one year, from January 2024 to December 2024.

Study Population

The study included data from 150 female subjects who visited the hospital for antenatal care or diabetes screening during the study period. Inclusion criteria comprised women aged 18 years and above with documented weight, height, age, pregnancy number, BMI, and family history of diabetes. Patients with incomplete records or known endocrine disorders other than gestational diabetes were excluded.

Data Collection Procedure

Data were retrospectively collected from hospital medical records, including antenatal case sheets and digital health records maintained in the Department of Obstetrics and Gynaecology. Parameters extracted included age, pregnancy number, body weight (kg), height (cm), BMI (kg/m²), and family history of diabetes (heredity). The presence of gestational diabetes was recorded based on the hospital's standard diagnostic criteria, consistent with IADPSG guidelines and institutional protocol.

Measurement Tools and Units

Weight was measured in kilograms (kg) using a digital weighing scale (Omron Healthcare Co. Ltd., Kyoto, Japan), ensuring minimal clothing and no footwear during measurement. Height was recorded in centimeters (cm) using a wall-mounted stadiometer (Seca GmbH & Co. KG, Hamburg, Germany) with the participant standing upright against the scale with heels together and head in the Frankfort horizontal plane. Body mass index (BMI) was then calculated using the standard formula: weight in kilograms divided by the square of height in meters (kg/m²).

Ethical Considerations

Approval for the study was obtained from the Institutional Ethics Committee (IEC) of Varun Arjun Medical College and Rohilkhand Hospital. Since the study was retrospective in nature and involved anonymized data collection from existing hospital records, the requirement for informed consent was waived by the IEC.

Statistical Analysis

Data were entered into Microsoft Excel 2021 (Microsoft Corporation, Redmond, WA, USA) and analyzed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as mean ± standard deviation (SD) for continuous variables such as age, BMI, weight, and height. Categorical variables like pregnancy number, heredity, and presence of gestational diabetes were expressed in frequencies and percentages. No inferential statistics were applied as the study aimed solely to describe patterns and distribution.

RESULTS

The mean age of the 150 women diagnosed with gestational diabetes mellitus was 34.73 ± 6.44 years. The mean body weight and height were 81.00 ± 9.94 kg and 155.91 ± 7.11 cm, respectively. The calculated mean BMI was 33.45 ± 4.62 kg/m² [Table & Figure 1].

Table 1: Descriptive Summary of Continuous Clinical Parameters Among Women Diagnosed with Gestational Diabetes Mellitus

Variable	Mean	Standard Deviation
Age (years)	34.73	6.44
Weight (kg)	81.00	9.94
Height (cm)	155.91	7.11
BMI (kg/m²)	33.45	4.62

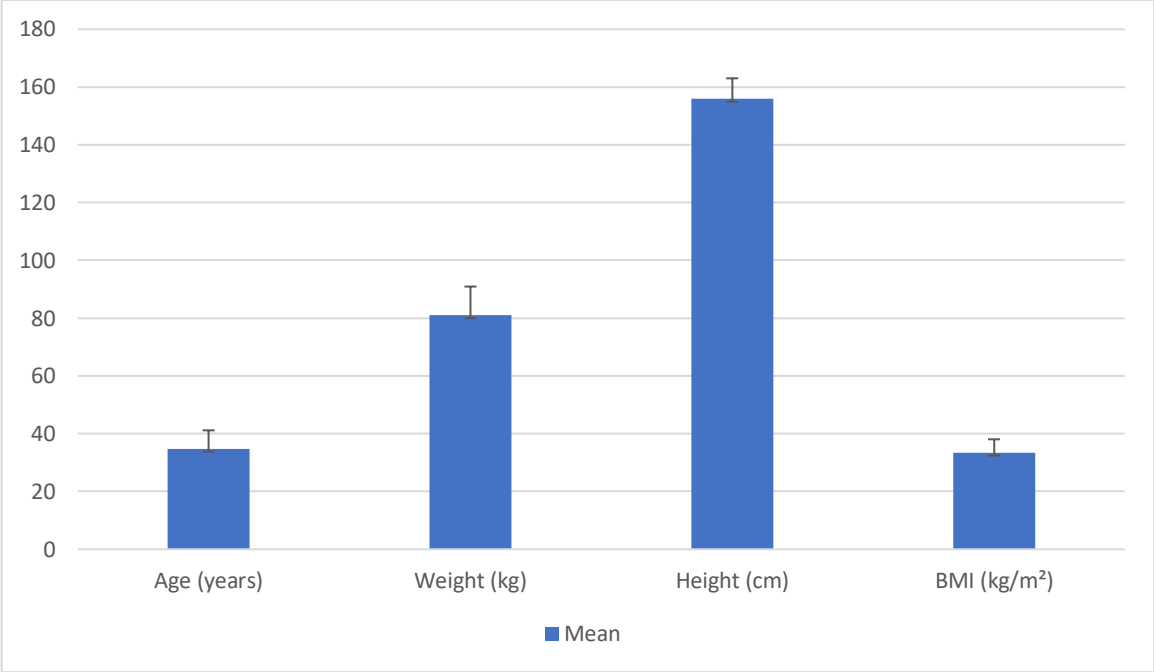

Figure 1: Descriptive Summary of Continuous Clinical Parameters Among Women Diagnosed with Gestational Diabetes Mellitus

Among the 95 women in their first three pregnancies, 42.11% were in their third pregnancy, 40.00% in their second, and 17.89% in their first pregnancy [Table & Figure 2].

Table 2: Distribution of Pregnancy Number Among Women in Their First to Third Pregnancy Diagnosed with Gestational Diabetes Mellitus

Pregnancy Number	Frequency (n)	Percentage (%)
1	17	17.89
2	38	40.00
3	40	42.11
Total	**95**	**100.00**

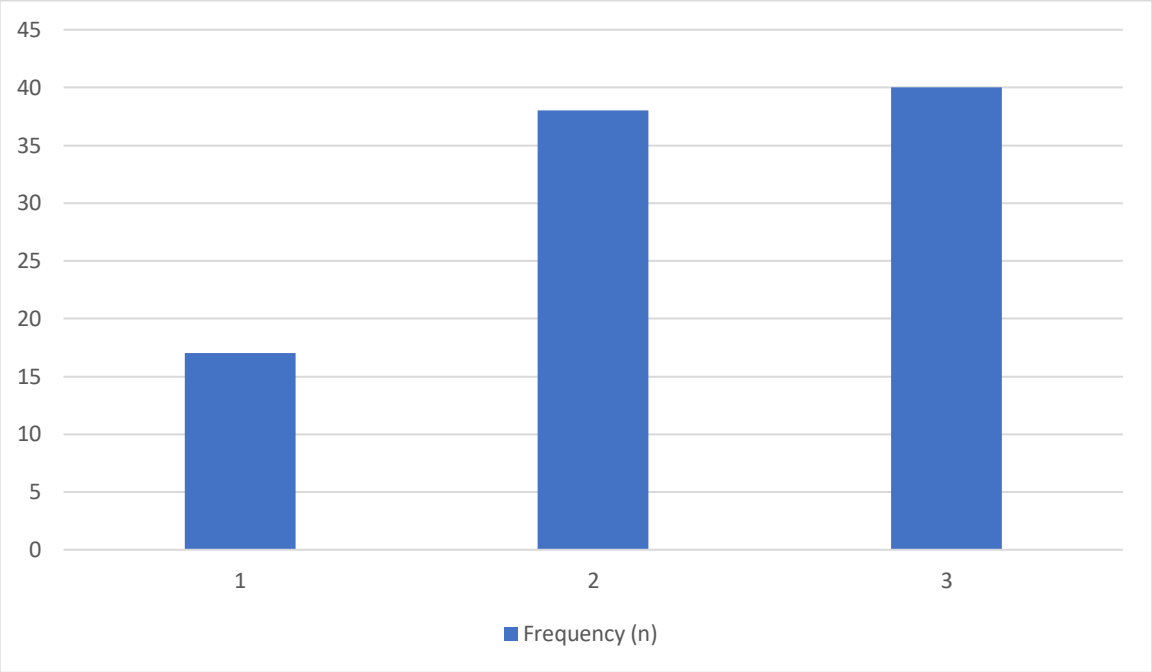

Figure 2: Distribution of Pregnancy Number Among Women in Their First to Third Pregnancy Diagnosed with Gestational Diabetes Mellitus

A positive family history of diabetes was reported in 66.0% of all participants [Table & Figure 3].

Table 3: Distribution of Family History of Diabetes (Heredity) Among Women Diagnosed with Gestational Diabetes Mellitus

Heredity Status	Frequency (n)	Percentage (%)
Absent	51	34.00
Present	99	66.00
Total	**150**	**100.00**

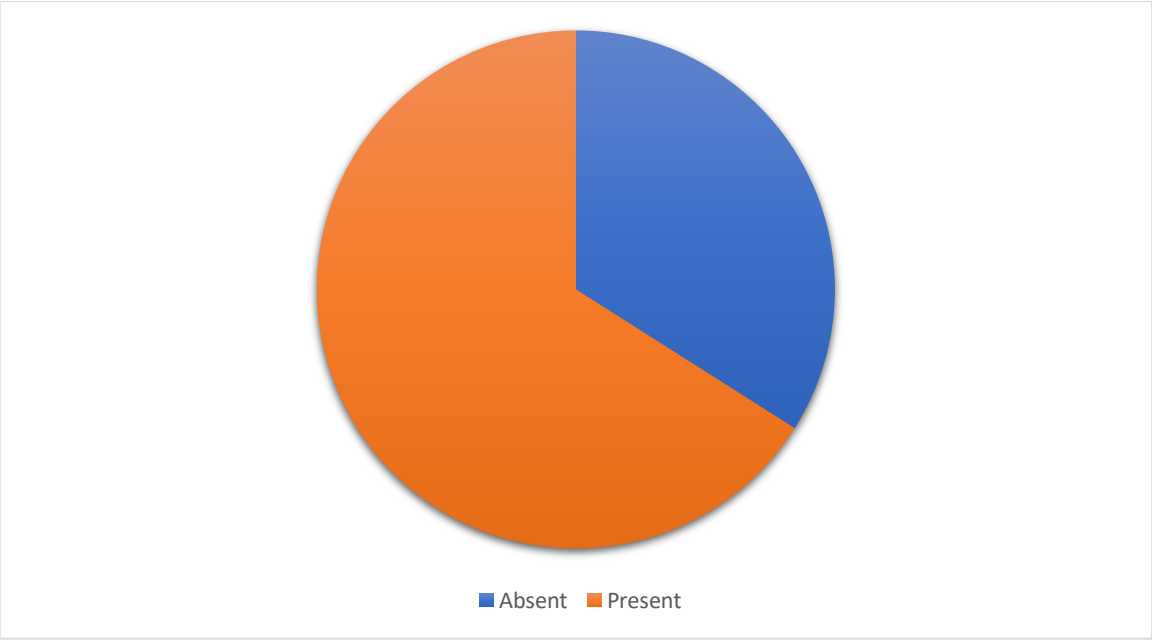

Figure 3: Distribution of Family History of Diabetes (Heredity) Among Women Diagnosed with Gestational Diabetes Mellitus

Age group analysis showed that 30.00% of participants were in the 31–35 year age group, followed by 26.00% in the 36–40 group, and 18.00% in the 26–30 age group. The smallest age group was <25 years (4.67%) [Table & Figure 4].

Table 4: Age-Wise Distribution of Women Diagnosed with Gestational Diabetes Mellitus Based on Defined Age Groups

Age Group	Frequency (n)	Percentage (%)
<25	7	4.67
26–30	27	18.00
31–35	45	30.00
36–40	39	26.00
41–45	22	14.67
Total	**150**	**100.00**

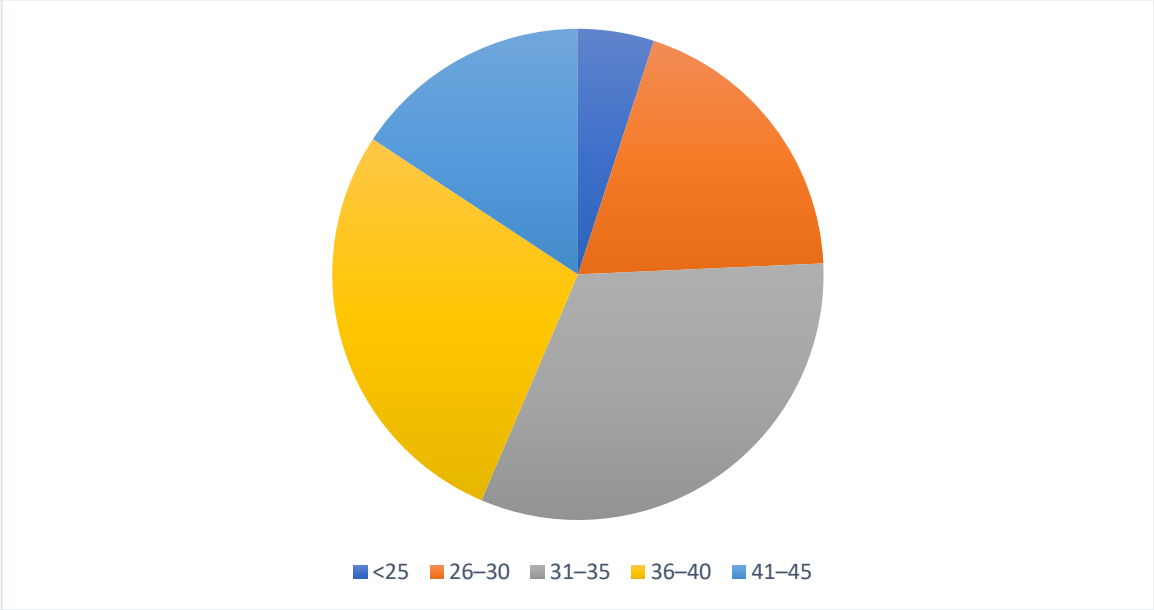

Figure 4: Age-Wise Distribution of Women Diagnosed with Gestational Diabetes Mellitus Based on Defined Age Groups

Based on BMI classification adapted for the Asian population, a significant majority (80.67%) of women were categorized as obese, followed by 14.67% as pre-obese. Only 3.33% were overweight and 1.33% had a normal BMI [Table & Figure 5].

Table 5: Body Mass Index (BMI) Classification of Women Diagnosed with Gestational Diabetes Mellitus Using Asian-Specific Cut-Offs

BMI Category	Frequency (n)	Percentage (%)
Normal	2	1.33
Overweight	5	3.33
Pre-obese	22	14.67
Obese	121	80.67
Total	**150**	**100.00**

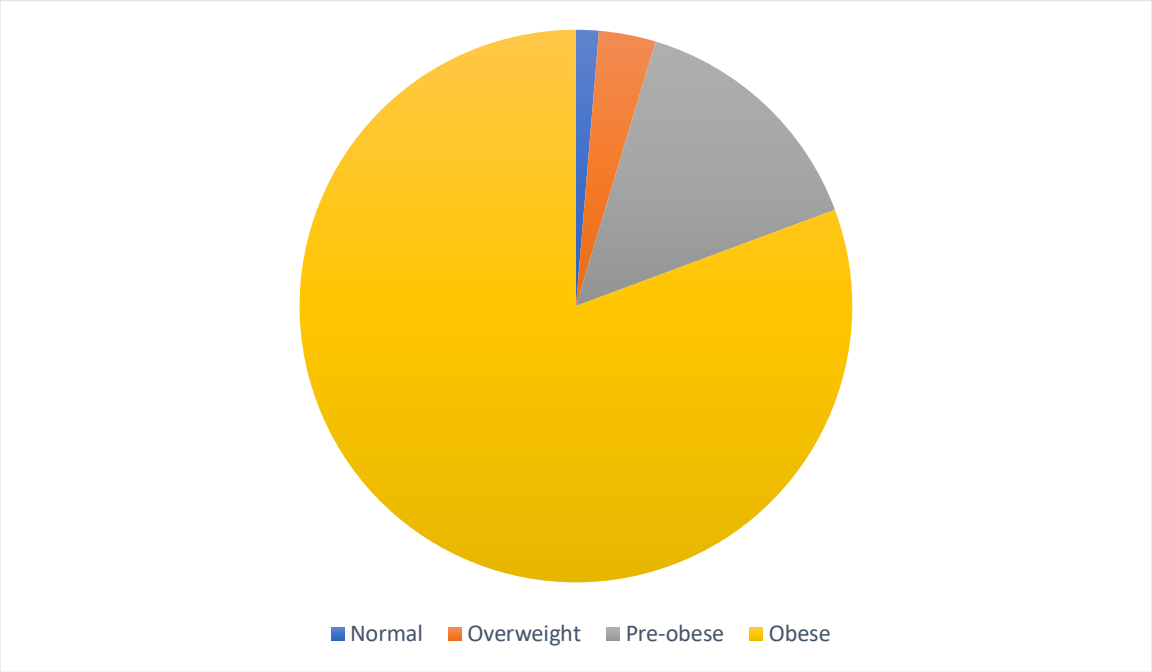

Figure 5: Body Mass Index (BMI) Classification of Women Diagnosed with Gestational Diabetes Mellitus Using Asian-Specific Cut-Offs

DISCUSSION

This study provides a clinical profile of women diagnosed with gestational diabetes mellitus (GDM) in a tertiary care setting in northern India. The findings highlight key demographic and anthropometric patterns that are consistent with prior Indian literature.

The mean age of the study participants was 34.73 years, with the highest proportion of women falling in the 31–35 year age group. This is in agreement with the community-based study conducted by Seshiah et al. in Tamil Nadu, which identified the 30–35 year age group as the most affected by GDM, suggesting that advancing maternal age is a significant risk factor in the Indian context [16].

Obesity was a dominant clinical feature in this cohort, with 80.67% of participants categorized as obese based on BMI cutoffs adapted for Asian populations. This finding is supported by Mohan et al., who reported a high prevalence of both general and central obesity among Indian women, emphasizing its role in the development of insulin resistance and GDM [17]. The observed mean BMI of 33.45 kg/m² in our study exceeds the risk threshold for South Asians and underscores the need for BMI-specific antenatal risk stratification.

Family history of diabetes was present in 66.0% of the participants, indicating a strong genetic predisposition. Rajput et al., in their study from Haryana, also reported heredity as one of the most significant predictors of GDM among Indian women [18]. The current study reinforces these findings, as a greater proportion of GDM cases were observed among women with a positive family history [Table 4].

In terms of obstetric history, a focused analysis of women in their first three pregnancies revealed that the majority (42.11%) were in their third pregnancy. Although parity alone is not an established independent risk factor, studies such as that by Verma et al. have shown that GDM risk may increase with higher gravidity, particularly when combined with advanced maternal age and obesity [19].

The age group analysis further revealed that only 4.67% of participants were below 25 years, reaffirming previous studies that younger maternal age may be relatively protective. This supports the findings of Seshiah et al., who reported the lowest GDM prevalence in women younger than 25 years [16].

Despite its strengths in profiling high-risk groups using real-world hospital data, this study has certain limitations. Being retrospective and single-center in nature, it lacks information on potential

confounders such as diet, physical activity, and biochemical glycemic indices like HbA1c. However, the results provide a valuable foundation for early risk stratification using accessible parameters such as age, BMI, parity, and heredity.

Based on these findings, several new hypotheses and recommendations can be proposed. It is hypothesized that obesity, even in early pregnancies, plays an independent and significant role in the development of GDM among Indian women. A pre-pregnancy BMI above 30 kg/m² may act as a standalone risk factor irrespective of age or parity. Additionally, a positive family history of diabetes may amplify the risk of GDM even in younger women, potentially overriding the protective effect of lower maternal age. Increasing parity may also correlate with a cumulative metabolic burden contributing to GDM. In light of these insights, it is recommended that BMI and family history screening be incorporated into the first antenatal visit to facilitate early risk identification. Preconception counseling should be emphasized in primary healthcare settings to address modifiable risk factors such as obesity. A risk-based screening protocol that integrates age, BMI, parity, and heredity may improve the efficiency of GDM detection. Furthermore, this study supports the need for universal GDM screening in India and recommends future longitudinal research to evaluate long-term metabolic outcomes in women diagnosed with GDM.

CONCLUSION

In conclusion, this study highlights that maternal age above 30 years, obesity, and a positive family history of diabetes are prominent characteristics among women diagnosed with gestational diabetes mellitus in a tertiary care setting. These findings underscore the importance of incorporating these readily identifiable risk factors into antenatal screening protocols. While the retrospective design limited the ability to assess causal relationships and excluded variables such as diet and physical activity, the strength of the study lies in its real-world relevance and focus on clinical parameters routinely available in Indian healthcare settings. The results support the development of targeted screening strategies and lifestyle interventions to mitigate the burden of GDM, especially in resource-limited environments. Future prospective studies are warranted to validate these associations and explore the long-term implications of GDM on maternal and neonatal outcomes.

Source of Funding
None declared.

Conflicts of Interest
The authors declare no conflicts of interest.

ABBRIEVATIONS

GDM – Gestational Diabetes Mellitus
BMI – Body Mass Index
SD – Standard Deviation
OGTT – Oral Glucose Tolerance Test
HbA1c – Glycated Hemoglobin
n – Number of Participants
IDF – International Diabetes Federation
ADA – American Diabetes Association

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