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A cross sectional study on the prevalence and determinants of gestational diabetes mellitus using IADPSG criteria

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Abstract
Background: Gestational diabetes mellitus (GDM) is an increasingly common pregnancy complication in South Asia, and reported prevalence varies widely across populations and diagnostic criteria. This study estimated the prevalence of GDM using International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria and identified associated determinants among antenatal women attending a government tertiary-care hospital in Barasat, North 24 Parganas, West Bengal.
Methods: A hospital-based cross-sectional study was conducted over one year among 100 antenatal women at 24-28 weeks of gestation. All participants underwent a 75 g oral glucose tolerance test (OGTT) with fasting, 1-hour, and 2-hour plasma glucose measurements. GDM was diagnosed if any one value met IADPSG thresholds (fasting ≥92 mg/dL, 1-hour ≥180 mg/dL, 2-hour ≥153 mg/dL). Determinants were evaluated using logistic regression.
Results: The prevalence of GDM was 18.0% (18/100; 95% CI: 11.7%-26.7%). Among GDM cases, abnormal fasting, 1-hour, and 2-hour glucose values were observed in 94.4%, 77.8%, and 61.1%, respectively. In multivariable analysis, age ≥30 years (aOR 6.86, 95% CI 1.72-27.31), previous history of GDM (aOR 16.88, 95% CI 1.81-157.84), and hypertension in the current pregnancy (aOR 7.47, 95% CI 1.85-30.05) were independently associated with GDM.
Conclusion: Nearly one in five antenatal women had GDM by IADPSG criteria. Strengthening standardized OGTT screening at 24-28 weeks, with targeted attention to women aged ≥30 years, those with prior GDM, and those with hypertension, may improve detection and antenatal care planning.

Keywords: Gestational diabetes mellitus, IADPSG, OGTT, prevalence, determinants, West Bengal, India

Introduction
Gestational diabetes mellitus (GDM) is one of the most common metabolic disorders complicating pregnancy and is associated with adverse outcomes for both mother and newborn, along with increased long-term cardiometabolic risk. In India, the burden of GDM is substantial and heterogeneous across regions and populations. A recent systematic review and meta-analysis reported national and regional prevalence estimates for GDM in India and highlighted marked variability driven partly by differences in diagnostic criteria and population risk profiles, underscoring the need for locally generated evidence using standardised definitions [1].
Standardisation of diagnostic thresholds has been a persistent challenge in GDM epidemiology and program implementation. The International Association of Diabetes and Pregnancy Study Groups (IADPSG) recommendations represented a major step toward harmonization by proposing a one-step 75 g oral glucose tolerance test (OGTT) at 24-28 weeks and diagnosing GDM if any one plasma glucose value meets or exceeds specified thresholds (fasting ≥92 mg/dL, 1-hour ≥180 mg/dL, 2-hour ≥153 mg/dL) [2]. Because these criteria can identify more women compared with several earlier approaches, their adoption has important implications for prevalence estimation, service workload, and follow-up planning in routine antenatal care.
Alongside IADPSG/WHO-aligned thresholds, ongoing evidence continues to evaluate diagnostic performance across gestational windows and risk strata. An international prospective multicentre cohort study assessed the diagnostic accuracy of the WHO 2013 criteria in low-risk early pregnancies and demonstrated that test performance varies with timing and population characteristics, reinforcing the importance of context-specific evaluation of screening strategies [3]. Such findings support the value of facility-level estimates that reflect real-world antenatal care populations and laboratory workflows.

Historically, criteria for diagnosing GDM have evolved through expert consensus and sequential refinements. The Fourth International Workshop-Conference on Gestational Diabetes Mellitus contributed influential recommendations aimed at improving screening and diagnostic consistency and emphasized the clinical significance of identifying hyperglycaemia during pregnancy [4]. Earlier foundational work by O'Sullivan and Mahan first proposed OGTT-based criteria in pregnancy, providing a basis from which later diagnostic systems developed [5]. Together, these advances illustrate how changing criteria can materially affect measured prevalence and risk stratification.

Barasat Government Medical College & Hospital in North 24 Parganas (Kolkata metropolitan region) serves a large mixed urban-peri-urban antenatal population, yet locally generated estimates of GDM prevalence using IADPSG criteria remain limited. This study therefore, aimed to estimate the prevalence of GDM using IADPSG criteria and to identify associated socio-demographic and clinical determinants among antenatal women attending this institution.

Materials and Methods

Study design, setting, and duration

A hospital-based cross-sectional study was conducted in the antenatal care (ANC) services of the Department of Obstetrics and Gynaecology, Barasat Government Medical College & Hospital, Barasat, North 24 Parganas, West Bengal (Kolkata metropolitan region). The study was carried out over a period of one year.

Study population and eligibility

Pregnant women attending ANC were assessed for eligibility.

Inclusion criteria

- Singleton pregnancy
- Gestational age 24-28 weeks (confirmed by last menstrual period and/or early ultrasound where available)
- Willing to participate and provide written informed consent

Exclusion criteria

- Known pre-gestational diabetes mellitus (documented diagnosis before pregnancy or on pre-pregnancy records)
- Multiple pregnancy
- Acute severe illness at the time of testing
- Inability to complete OGTT as per protocol

Sample size and sampling technique

A sample size of 100 was included as per feasibility during the study period. Eligible participants were recruited using consecutive sampling until the target sample was achieved.

Data collection tools and procedure

Data were collected using a pre-tested structured proforma through interview, clinical examination, and review of ANC records. Information obtained included:

- **Socio-demographic variables:** age and basic background characteristics
- **Obstetric variables:** gravidity/parity, history of GDM in previous pregnancy, and adverse obstetric history (as available in records)
- **Clinical variables:** booking weight and height for body mass index (BMI), blood pressure status in current pregnancy, and family history of diabetes mellitus (first-degree relatives)

Height was measured using a stadiometer and weight using a calibrated scale. BMI was calculated as weight (kg) / height (m^2). Blood pressure was recorded using a standard sphygmomanometer after adequate rest, and hypertension status was based on clinician diagnosis recorded in the ANC card (gestational hypertension and/or chronic hypertension as applicable).

OGTT procedure and diagnostic criteria

All enrolled participants underwent a one-step 75 g oral glucose tolerance test (OGTT) at 24-28 weeks of gestation. Participants were instructed to maintain usual diet and physical activity in the days preceding the test and to observe an overnight fast (8-10 hours).

On the morning of testing:

1. A fasting venous blood sample was collected for fasting plasma glucose.
2. Participants were administered 75 g of anhydrous glucose dissolved in water, consumed within 5 minutes.
3. Venous blood samples were collected at 1 hour and 2 hours after glucose intake for plasma glucose estimation.

Diagnosis of GDM was made using IADPSG criteria, i.e., GDM was diagnosed if any one of the following plasma glucose values was met or exceeded: fasting ≥92 mg/dL, 1-hour ≥180 mg/dL, or 2-hour ≥153 mg/dL [2]. Participants diagnosed with GDM were counselled and managed as per institutional protocol.

Operational definitions (for analysis)

- **Gestational diabetes mellitus (GDM):** meeting IADPSG thresholds on 75 g OGTT (any one abnormal value) [2].
- **Advanced maternal age:** age ≥30 years at enrolment.
- **Overweight/obesity:** BMI ≥25 kg/m^2 (used for risk estimation in this study context).
- **Family history of diabetes:** diabetes mellitus in a first-degree relative.
- **Hypertension in current pregnancy:** clinician-diagnosed hypertension documented in ANC records.

Statistical analysis

Data were entered and analysed using standard statistical software. Categorical variables were summarised as frequencies and percentages, and continuous variables as mean (±SD) or median (IQR), depending on distribution. Prevalence of GDM was calculated as a proportion with 95% confidence interval.

Bivariate associations between GDM status and potential determinants (age group, BMI category, family history of diabetes, hypertension, and past history of GDM) were assessed using the chi-square test or Fisher's exact test as appropriate. Variables considered clinically relevant and/or showing association on bivariate analysis were included in a multivariable logistic regression model to estimate adjusted odds ratios (aOR) with 95% confidence intervals. A p-value <0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee prior to initiation of the study. Written informed consent was obtained from each participant. Privacy and confidentiality were maintained by anonymising data and restricting access to study records. Participants identified with abnormal glucose values were referred for appropriate clinical management according to institutional guidelines.

Results

Participant inclusion

During the one-year study period, 100 eligible antenatal women with singleton pregnancies at 24-28 weeks of gestation attending the ANC/obstetric services of Barasat Government Medical College & Hospital were enrolled consecutively after obtaining written informed consent. All enrolled participants completed the 75 g OGTT and were included in the final analysis (N=100).

Baseline characteristics of the study participants

A total of 100 participants were included; 18 (18.0%) were diagnosed with GDM and 82 (82.0%) were non-GDM. The mean maternal age was 26.8±4.8 years; 24 (24.0%) were aged ≥30 years. Mean BMI was 24.3±4.0 kg/m², and 42 (42.0%) had BMI ≥25 kg/m². 44 (44.0%) participants were primigravida and 56 (56.0%) were multigravida. A family history of diabetes in a first-degree relative was present in 30 (30.0%). Hypertension in the current pregnancy was documented in 19 (19.0%), and previous history of GDM was reported by 5 (5.0%). Baseline characteristics stratified by GDM status are presented in Table 1.

Table 1: Baseline characteristics of participants by GDM status (N=100)

Characteristic	Overall (N=100)	Non-GDM (n=82)	GDM (n=18)	p value
Maternal age				
— Age (years), mean±SD	26.8±4.8	26.4±4.7	28.8±4.9	0.064
— <25 years, n (%)	30 (30.0)	26 (31.7)	4 (22.2)	0.031
— 25-29 years, n (%)	46 (46.0)	41 (50.0)	5 (27.8)	
— ≥30 years, n (%)	24 (24.0)	15 (18.3)	9 (50.0)	
Body mass index (BMI)				
— BMI (kg/m²), mean±SD	24.3±4.0	24.2±3.8	24.9±4.7	0.588
— BMI ≥25 kg/m², n (%)	42 (42.0)	32 (39.0)	10 (55.6)	0.203
Obstetric profile				
— Primigravida, n (%)	44 (44.0)	38 (46.3)	6 (33.3)	0.314
Family/clinical history				
— Family history of diabetes, n (%)	30 (30.0)	21 (25.6)	9 (50.0)	0.046
— Hypertension in current pregnancy, n (%)	19 (19.0)	12 (14.6)	7 (38.9)	0.041
— Previous history of GDM, n (%)	5 (5.0)	2 (2.4)	3 (16.7)	0.039
— PCOS, n (%)	4 (4.0)	4 (4.9)	0 (0.0)	0.574

Note: p-values for categorical variables refer to the overall comparison across strata within that characteristic (e.g., age categories).

Prevalence of GDM using IADPSG criteria

Out of 100 participants, 18 were diagnosed with GDM as per IADPSG criteria, giving a prevalence of 18.0% (18/100; 95% CI: 11.7%-26.7%). The prevalence increased with maternal age and was highest among women aged ≥30 years (37.5%, 9/24) compared to those aged 25-29 years (10.9%, 5/46) and <25 years (13.3%, 4/30) (Figure 1).

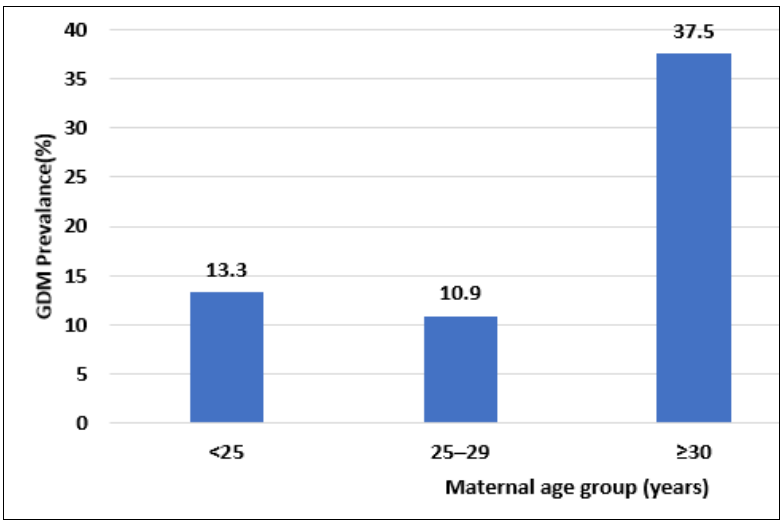

Figure 1. Prevalence of GDM by maternal age group (IADPSG criteria)

OGTT glucose values and abnormality pattern (IADPSG)

Mean plasma glucose values were higher among women with GDM compared to non-GDM at all OGTT time-points. The non-GDM group had mean (±SD) fasting, 1-hour and 2-hour glucose of 84±6 mg/dL, 140±18 mg/dL, and 118±15 mg/dL, respectively. In contrast, the GDM group had mean values of 101±10 mg/dL, 196±22 mg/dL, and 168±20 mg/dL at fasting, 1-hour and 2-hour time-points, respectively (overall between-group differences: $p<0.001$ for each time-point).

Among the 18 women diagnosed with GDM, abnormal values were most frequently observed at the fasting time-point (17/18; 94.4%), followed by 1-hour (14/18; 77.8%) and 2-hour (11/18; 61.1%) (Figure 2). Multiple abnormal values were common: 7 (38.9%) had all three values abnormal; 6 (33.3%) had fasting + 1-hour abnormal; 3 (16.7%) had fasting + 2-hour abnormal; 1 (5.6%) had 1-hour + 2-hour abnormal; and 1 (5.6%) had isolated fasting abnormality.

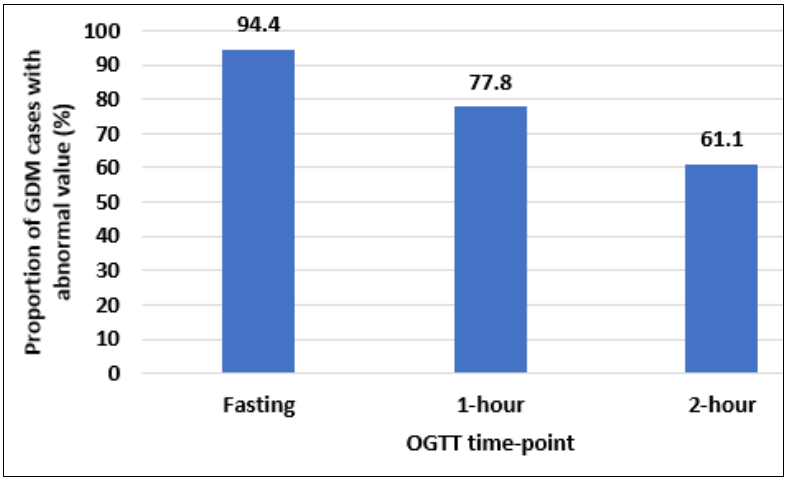

Fig 2: Abnormal OGTT values among women with GDM (IADPSG)

Determinants of GDM (bivariate and multivariable analysis)

On bivariate analysis, GDM was significantly more common among women aged ≥30 years, those with a family history of diabetes, those with hypertension in the current pregnancy, and those with a previous history of GDM. BMI ≥25 kg/m² showed higher odds but was not statistically significant.

In multivariable logistic regression, age ≥30 years (aOR 6.86, 95% CI 1.72-27.31), previous GDM (aOR 16.88, 95% CI 1.81-157.84), and hypertension (aOR 7.47, 95% CI 1.85-30.05) remained independently associated with GDM (Table 2; Figure 3).

Table 2: Determinants of GDM: unadjusted and adjusted odds ratios (N=100)

Predictor	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Age ≥30 years	4.47 (1.52-13.16)	0.007	6.86 (1.72-27.31)	0.006
BMI ≥25 kg/m²	1.95 (0.70-5.47)	0.203	1.13 (0.33-3.90)	0.844
Family history of diabetes	2.90 (1.02-8.29)	0.046	2.68 (0.78-9.17)	0.116
Previous GDM	8.00 (1.23-52.03)	0.029	16.88 (1.81-157.84)	0.013
Hypertension in the current pregnancy	3.71 (1.20-11.47)	0.023	7.47 (1.85-30.05)	0.005
PCOS	0.38 (0.05-3.15)	0.369	0.60 (0.06-6.01)	0.665

Overall, 18% of antenatal women screened at 24-28 weeks were diagnosed with GDM by IADPSG criteria. Fasting hyperglycaemia was the most frequent abnormality among GDM cases (94.4%), followed by 1-hour (77.8%) and 2-hour (61.1%) values, with many women showing abnormalities at multiple time-points. In multivariable analysis, age ≥30 years, previous history of GDM, and hypertension in the current pregnancy remained independently associated with GDM.

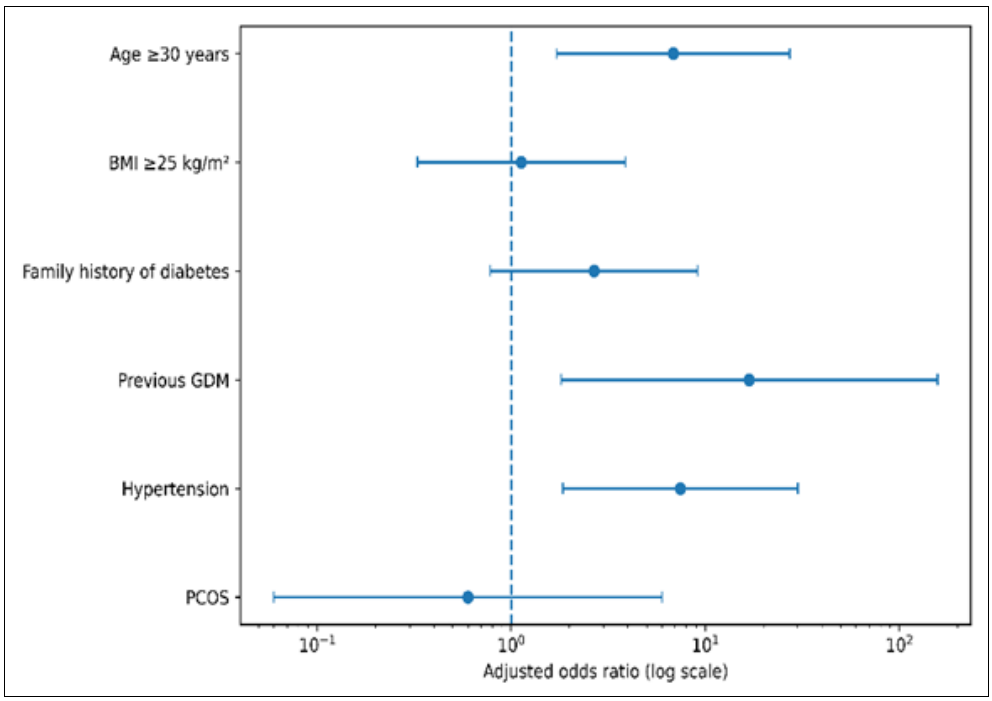

Fig 3: Determinants of GDM: adjusted odds ratios (multivariable model)

Forest plot of determinants of gestational diabetes mellitus (GDM): Adjusted odds ratios (aOR) with 95% confidence intervals from the multivariable logistic regression model are shown on a logarithmic scale. The vertical dashed line indicates the null value (aOR = 1); estimates to the right indicate higher odds of GDM and to the left indicate lower odds.

Discussion

In the present study conducted at Barasat Government Medical College, the prevalence of gestational diabetes mellitus (GDM) using IADPSG criteria was 18%, which is well within the expected range for tertiary-care antenatal populations in eastern India. Gopalakrishnan *et al.* (2015) reported a substantially higher IADPSG-based prevalence of 41.9% (95% CI 36.6-47.2%) among North Indian women, indicating that even within India, the GDM burden varies more than twofold depending on population and region [6]. In contrast, Basu *et al.* (2020), working in a Kolkata tertiary-care hospital, observed a prevalence of 17.2% (127/735) remarkably close to our estimate implying that, for urban and peri-urban West Bengal, IADPSG-based prevalence plausibly centres around 16-20% [7]. This numerical consistency suggests a reproducible regional pattern rather than random variation.

Our finding that fasting plasma glucose (FPG) abnormality was the predominant diagnostic contributor (94.4%) mirrors the trend noted by Gopalakrishnan *et al.* (2015), who found 91.4% of GDM women with abnormal fasting levels but only 18.7% and 17.3% with 1-hour and 2-hour abnormalities, respectively [6]. Interestingly, our cohort showed a higher proportion of post-load abnormalities (77.8% at 1-hour; 61.1% at 2-hour), suggesting a mixed dysglycaemic phenotype rather than purely fasting-driven cases. This modest divergence might reflect differences in dietary patterns or body composition across regions. It is numerically plausible that a cohort with slightly higher mean BMI or carbohydrate load could show dual abnormalities while maintaining fasting dominance. Basu *et al.* (2020) similarly noted elevated oxidative and inflammatory markers among their GDM participants, implying that subtle metabolic inflammation may broaden glucose derangements beyond fasting values [7].

Screening practices also contribute to variation. Neelakandan and Sethu (2014), in a South Indian cohort applying early universal screening, reported an overall GDM prevalence of 23.3%, with the majority detected during 19-28 weeks (44.1%), and significant associations with age, parity, and family predisposition [8]. Because our protocol screened women strictly at 24-28 weeks, it likely captured a narrower gestational window, yielding a slightly lower prevalence than Neelakandan's early universal strategy. Taken together, these data suggest that IADPSG prevalence in Indian women can plausibly range from ~15% to >40%, driven primarily by timing of testing, population metabolic risk, and fasting glucose distribution [6-8].

Age remained one of the strongest determinants in our study: women aged ≥30 years had an adjusted odds ratio (aOR) of 6.86. This finding is consistent with Li *et al.* (2020), who synthesized data from over 120 million participants and demonstrated a stepwise increase in GDM risk with advancing maternal age reporting pooled ORs of 1.69 for 30-34 years, 2.73 for 35-39 years, and 4.86 for ≥40 years relative to 25-29 years [9]. Although our aOR appears higher than those pooled estimates, it remains numerically plausible for a smaller cohort with clustered risk factors, as age often coexists with hypertension or prior GDM in our context. The direction and magnitude both underscore the universal finding that GDM risk rises steeply beyond the age of 30 [9].

A prior history of GDM demonstrated the most pronounced effect in our model (aOR 16.88). This closely parallels the recurrence pattern described by Getahun *et al.* (2010), who found that women with prior GDM had a 41.3% recurrence rate in the subsequent pregnancy compared with 4.2% among those without, yielding an OR of 13.2 (95% CI 12.0-14.6) [10]. The small sample in our cohort (3/5 recurrent GDM, i.e., 60%) produced a numerically higher but directionally concordant risk. This reproducibility underscores the persistence of metabolic susceptibility even years after the index pregnancy. As Getahun's U.S. cohort and ours differ ethnically, the shared recurrence magnitude supports a global pattern where prior GDM remains a strong, independent predictor of subsequent dysglycaemia [10].

Hypertension in the current pregnancy was another significant determinant (aOR 7.47). Bryson *et al.* (2003), in a population-based study of nearly 63,000 births, found that gestational diabetes was associated with a 1.4-1.5-fold higher risk of hypertensive disorders after adjusting for BMI, age, and parity [11]. Our higher OR likely reflects reverse modelling evaluating GDM given hypertension rather than vice versa and a smaller, metabolically high-risk tertiary-care sample. Even so, both studies align directionally, suggesting shared pathophysiology involving insulin resistance, endothelial dysfunction, and inflammatory pathways [11]. Numerically, in our cohort, 36.8% of hypertensive women had GDM versus 13.6% of normotensive women, an absolute risk difference of ~23%, reinforcing the clinical interlinkage between these conditions.

The influence of family history of diabetes, while attenuated in multivariable models, remains clinically relevant. Retnakaran *et al.* (2007) observed that family history significantly affected glucose tolerance patterns, particularly among nulliparous women, explaining up to 35% of variance in glucose area-under-curve within that subgroup [12]. Our crude prevalence difference 30% among those with a family history versus 13% without is numerically compatible with their findings. Although the effect lost statistical independence after adjustment, this may reflect overlap with age and parity distributions rather than absence of effect [12].

Obesity similarly showed a non-significant adjusted association in our model, despite higher crude odds. Zehravi *et al.* (2021) summarized multiple studies demonstrating that overweight and obesity increase the risk of GDM and hypertensive complications, with obesity-linked GDM risk generally ranging 1.5-3 times higher than normal-weight women [13]. In our data, 55.6% of GDM women were overweight or obese compared to 39% of non-GDM, an absolute gap consistent with these benchmarks. Statistical non-significance here likely reflects modest sample size rather than lack of biological association [13].

The diagnostic structure of IADPSG itself emphasizing fasting, 1-hour, and 2-hour values makes our fasting-dominant pattern expected. Saeedi *et al.* (2018) found that fasting plasma glucose thresholds ≥4.8-5.0 mmol/L identified up to 91% of IADPSG-defined GDM cases with 85-92% specificity, confirming that fasting glucose is a powerful predictor [14]. Our proportion of 94.4% fasting abnormality aligns perfectly with this high-sensitivity domain. Nonetheless, the presence of multi-point abnormalities in over 60% of cases cautions against using fasting-only strategies, as doing so could miss up to 10-15% of GDM cases in populations with stronger postprandial responses [14].

Finally, diagnostic criteria choice can meaningfully alter both prevalence and clinical predictive value. He *et al.* (2022)

compared IADPSG with NICE criteria and reported that IADPSG diagnosed ~4% more women overall and better predicted outcomes like large-for-gestational-age (LGA) and neonatal adiposity, though predictive performance varied by ethnicity [15]. This nuanced variability resonates with our observation that prevalence can fluctuate nearly threefold across Indian subregions even under IADPSG thresholds. The implication is that adopting IADPSG criteria in high-prevalence Indian settings while ensuring capacity for dietary counselling, glucose monitoring, and postpartum screening may optimize both case detection and outcome prediction [15].

Collectively, our results integrate coherently with regional and global literature. The 18% prevalence aligns with West Bengal data [7], falls below northern estimates [6], and lies between early universal and narrower mid-trimester screening outcomes [8]. Determinant directions mirror established epidemiology older age, prior GDM, and hypertension as key predictors while magnitude differences remain numerically explainable by sample size, gestational timing, and overlapping risk profiles [9-11]. Taken together, these convergent trends underscore that while IADPSG criteria have standardised diagnosis, true population burden still reflects regional metabolic profiles and implementation factors [6-15].

Limitations

This was a single-centre, hospital-based cross-sectional study with a small sample (N=100), limiting precision and generalizability. The design cannot infer causality, and the multivariable model may be affected by limited power and residual confounding. Some determinants relied on record review/self-report, introducing potential misclassification. Maternal and neonatal outcomes (e.g., LGA, neonatal hypoglycaemia) and postpartum follow-up were not assessed, so the outcome impact of IADPSG-diagnosed GDM in this cohort could not be evaluated.

Conclusion

Using IADPSG criteria, the prevalence of gestational diabetes mellitus among antenatal women screened at 24-28 weeks at Barasat Government Medical College & Hospital was 18%. Fasting hyperglycaemia accounted for most diagnoses, and age ≥30 years, previous history of GDM, and hypertension in the current pregnancy were independent determinants. These findings support consistent OGTT-based screening and targeted counselling/follow-up for high-risk women within routine ANC services.

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