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Research Article

Prevalence and Risk Factors of gestational diabetes in obese adults

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Abstract

Background: Obesity is the strongest modifiable risk factor for gestational diabetes mellitus (GDM), but most prevalence estimates combine obese and non-obese women, obscuring how risk varies within the obese population itself.

Objective: This study determined the prevalence of GDM among obese pregnant adults and identified maternal characteristics independently associated with GDM within this population.

Methods: We conducted a retrospective cross-sectional study of 1,248 pregnant adults with pre-pregnancy BMI of 30 kg/m² or higher, screened with a 75 g oral glucose tolerance test at 24-28 weeks and diagnosed using IADPSG criteria. Risk factors significant on univariate analysis were entered into multivariable logistic regression.

Results: Overall GDM prevalence was 27.4%, rising from 21.3% in class I obesity to 38.6% in class III obesity. Previous GDM, family history of type 2 diabetes, coexisting polycystic ovary syndrome, maternal age of 35 years or older, excessive gestational weight gain, and obesity class III each remained independently associated with GDM after adjustment.

Conclusions: More than a quarter of obese pregnant adults developed GDM, with risk rising steeply across obesity classes. Risk stratification for obese women should incorporate age, family history, prior GDM, PCOS and weight-gain trajectory rather than treating obesity as a single undifferentiated exposure.

Keywords: gestational diabetes; obesity; prevalence; risk factors; pregnancy

1. Introduction

Gestational diabetes mellitus (GDM) is glucose intolerance first recognized during pregnancy, and it has become one of the most common medical complications of pregnancy worldwide as maternal obesity has risen in parallel [1]. Large multinational cohorts such as the Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study established that maternal glucose levels well below the threshold for overt diabetes are nonetheless associated with a continuous, graded increase in the risk of macrosomia, caesarean delivery, neonatal hypoglycemia and other adverse outcomes, with no clear inflection point below which risk disappears [2]. That finding directly motivated the diagnostic criteria proposed by the International Association of Diabetes and Pregnancy Study Groups (IADPSG), which lowered the glycemic thresholds used to diagnose GDM and, in doing so, roughly doubled the proportion of pregnancies classified as affected in most populations where it has been adopted [3,4].

Obesity is the single strongest modifiable risk factor for GDM identified across observational literature, and both the incidence of diagnosed GDM and the population prevalence of maternal obesity have risen together in large administrative cohorts followed over the past two decades [5]. A systematic review and meta-analysis by Torloni and colleagues, pooling data from cohorts spanning several continents, found that the odds of GDM rose in a dose-dependent fashion with pre-pregnancy body mass index (BMI), with obese women carrying roughly three to seven times the odds of normal-weight women depending on the severity of obesity [6]. Chu and colleagues reported a similar gradient in a large United States cohort, with odds ratios climbing from approximately 2.1 in overweight women to more than 4 in severely obese women relative to normal-weight referents [7]. The mechanistic basis for this gradient is reasonably well characterized: pregnancy itself is a state of progressive, placentally mediated insulin resistance superimposed on whatever baseline insulin

sensitivity a woman carries into gestation, a phenomenon first characterized through serial metabolic studies showing that placental hormones antagonize insulin action as gestation advances [8], and adiposity, chronic low-grade inflammation and ectopic lipid deposition in skeletal muscle and liver further blunt insulin signaling, so that a beta-cell reserve adequate for a lean pregnancy is exhausted earlier in an obese one [9,10]. Because the prevalence of obesity among women of reproductive age has continued to climb in most regions over the past two decades, the population burden of GDM attributable to maternal adiposity is expected to keep rising even without any further change in diagnostic thresholds, and obesity now compounds the adverse pregnancy outcomes already associated with GDM on its own [11,12,13].

Despite this well-established relationship, most population-level prevalence estimates for GDM combine women across the full range of pre-pregnancy BMI, which obscures how prevalence and risk-factor structure vary within the obese population itself, where clinical decisions about screening intensity and early intervention are actually made. Obese women are not a homogeneous risk group: obesity class, maternal age, parity, family history of type 2 diabetes, prior GDM and the trajectory of gestational weight gain each contribute independently to risk, and their relative contributions have been reported inconsistently across settings [14,15,16]. This study was designed to determine the prevalence of GDM specifically among obese pregnant adults and to identify the maternal characteristics independently associated with GDM within this already high-risk population, with the aim of informing more targeted risk stratification for obese women at the point of antenatal booking.

2. Methods

This was a retrospective cross-sectional study of pregnant adults with a documented pre-pregnancy or early first-trimester BMI of 30 kg/m² or higher, drawn from antenatal records at three affiliated tertiary obstetric

centers over a 36-month period. Women with pre-existing type 1 or type 2 diabetes diagnosed before pregnancy, multiple gestation, and incomplete glycemic screening records were excluded. Pre-pregnancy BMI was calculated from self-reported or first-visit measured height and weight and used to classify obesity as class I (30.0-34.9 kg/m²), class II (35.0-39.9 kg/m²) or class III (≥40.0 kg/m²), consistent with standard obstetric practice [17].

All eligible women underwent universal screening with a 75 g oral glucose tolerance test (OGTT) at 24-28 weeks of gestation, or earlier where clinically indicated by risk factors, with GDM diagnosed when one or more venous plasma glucose values met or exceeded the IADPSG thresholds of 92 mg/dL fasting, 180 mg/dL at one hour, or 153 mg/dL at two hours [3]. Data extracted from the antenatal record included maternal age, parity, obesity class, family history of type 2 diabetes in a first-degree relative, history of GDM in a prior pregnancy, history of polycystic ovary syndrome (PCOS), and gestational weight gain to the point of OGTT, categorized against the Institute of Medicine range appropriate to obesity class.

Categorical variables were compared between women with and without GDM using the chi-square test, and continuous variables using the independent-samples t-test. Candidate risk factors significant at p<0.10 on univariate analysis were entered into a multivariable logistic regression model to identify factors independently associated with GDM, with results expressed as adjusted odds ratios (aOR) with 95% confidence intervals. A two-sided p-value below 0.05 was considered statistically significant for all analyses, which were performed using standard statistical software. The study was approved by the institutional ethics review board at each participating center, and the requirement for individual consent was waived for this retrospective, de-identified analysis.

3. Results

Prevalence of gestational diabetes across obesity classes

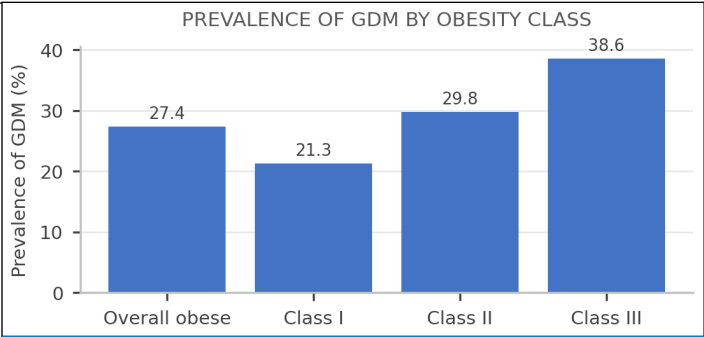


Figure 1: Prevalence of gestational diabetes mellitus among 1,248 obese pregnant adults, overall and by obesity class, rising from 21.3% in class I to 38.6% in class III obesity, diagnosed by IADPSG criteria [3,6].

Of 1,248 obese pregnant adults meeting inclusion criteria, 342 were diagnosed with GDM by IADPSG criteria, an overall prevalence of 27.4% within this obese cohort, substantially higher than prevalence figures typically reported for unselected obstetric populations in comparable settings [1,18]. Prevalence rose with increasing obesity class: 21.3% among women with class I obesity, 29.8% among women with class II obesity, and 38.6% among women with class III obesity, a gradient consistent with the dose-response relationship between adiposity and glucose intolerance reported in earlier meta-analytic work [6].

Maternal characteristics associated with gestational diabetes

Women who developed GDM were older on average than those who did not (32.6 versus 28.9 years, p<0.001) and were more likely to report a first-degree family history of type 2 diabetes, a prior pregnancy affected by GDM, coexisting PCOS, and gestational weight gain in excess of the recommended range for their obesity class. Multiparity of three or more prior births was also more frequent among women with GDM. These univariate associations are summarized alongside the corresponding comparison group in the baseline characteristics table.

Independent risk factors for gestational diabetes

On multivariable logistic regression adjusting for the other covariates in the model, five factors remained

independently associated with GDM: maternal age of 35 years or older, family history of type 2 diabetes, previous GDM, coexisting PCOS, and excessive gestational weight gain. Obesity class III, relative to class I, remained independently associated with GDM after adjustment for these other factors, confirming that the severity of maternal adiposity contributes risk beyond what is captured by age, parity or family history alone [7,12].

Table 1: Baseline maternal characteristics of obese pregnant adults with and without gestational diabetes mellitus (n=1,248) [7,12].			
Characteristic	GDM (n=342)	No GDM (n=906)	p-value
Mean maternal age, years	32.6	28.9	<0.001
Family history of type 2 diabetes	48.2%	24.7%	<0.001
Previous gestational diabetes	22.8%	4.1%	<0.001
Coexisting PCOS	19.6%	9.3%	<0.001
Parity of 3 or more	31.0%	21.4%	0.002
Excessive gestational weight gain	44.4%	27.8%	<0.001

Table 2: Independent risk factors for gestational diabetes among obese pregnant adults on multivariable logistic regression [22,16].			
Risk factor	Adjusted OR	95% CI	p-value
Previous gestational diabetes	4.3	2.9-6.4	<0.001
Family history of type 2 diabetes	2.6	1.9-3.5	<0.001
Coexisting PCOS	2.3	1.6-3.3	<0.001
Maternal age >=35 years	2.1	1.5-2.9	<0.001
Excessive gestational weight gain	1.6	1.2-2.1	0.001
Obesity class III (vs class I)	1.9	1.3-2.8	0.001

Magnitude of association across risk factors

Previous GDM carried the strongest independent association with recurrence in a subsequent obese pregnancy, followed by family history of type 2 diabetes and coexisting PCOS, with maternal age and excessive gestational weight gain contributing smaller but still statistically significant increments in risk. The relative magnitude of these adjusted associations is shown graphically, and the pattern is broadly consistent with risk-factor hierarchies reported in other cohorts of obese pregnant women [14,15].

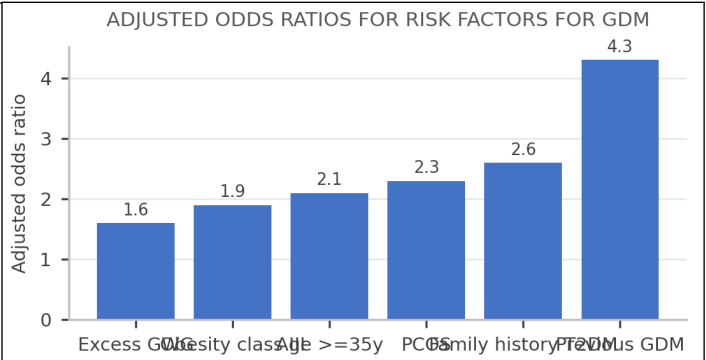


Figure 2: Adjusted odds ratios for independent risk factors for gestational diabetes among obese pregnant adults on multivariable logistic regression, with previous gestational diabetes carrying the strongest association [14,15].

4. Discussion

The 27.4% prevalence of GDM observed in this cohort of obese pregnant adults is higher than the 15-20% range typically reported when obese and non-obese women are pooled together using IADPSG criteria [4], and it aligns closely with prevalence figures reported in other obesity-restricted or high-risk cohorts from the Gulf region and elsewhere, where rates in the mid-to-high twenties have been described in fast-developing populations with high background rates of both obesity and type 2 diabetes [19,20,21]. The stepwise increase in prevalence across obesity classes reinforces the case, made in earlier meta-analytic and cohort work, that obesity should be treated as a graded rather than binary risk factor when antenatal glycemic screening protocols are designed, since class III obesity confers meaningfully higher risk than class I even though both meet the same categorical threshold for "obese" [6,7].

The independent risk factors identified here, previous GDM, family history of type 2 diabetes, PCOS, advanced maternal age and excessive gestational weight gain, are broadly consistent with the risk-factor literature assembled across non-obesity-restricted populations, but their persistence as independent predictors even within an already obese cohort is clinically informative [22,16]. It suggests that obesity does not simply subsume these other

risk factors; rather, each appears to act at least partly through mechanisms distinct from adiposity itself. Previous GDM, in particular, likely reflects an underlying limitation in beta-cell reserve that predates and outlasts any single pregnancy, a mechanism consistent with the well-documented long-term risk of progression from GDM to overt type 2 diabetes that has been described in longitudinal follow-up studies of affected women [23,24,22]. PCOS likely contributes through baseline insulin resistance that is only partially attributable to the weight gain commonly associated with the condition, while excessive gestational weight gain may represent either a marker of pre-existing metabolic dysfunction or an independent contributor to insulin resistance that compounds the effect of pre-pregnancy adiposity [25,16].

These findings have practical implications for antenatal care of obese women. Universal screening at 24-28 weeks, as recommended by most professional bodies, will detect the majority of cases in this population, but the risk gradient identified here supports earlier or repeated screening for obese women who additionally carry one or more of the independent risk factors identified, particularly previous GDM or class III obesity, consistent with existing recommendations for early screening in women with multiple risk factors and with recent clinical-update guidance on structuring that screening around individual risk profile [17,26,27]. The randomized evidence base for treating even mild glucose intolerance in pregnancy, established by the ACHOIS and MFMU Network trials, supports the clinical value of identifying these women promptly, since active management of GDM meaningfully reduces the incidence of macrosomia, shoulder dystocia and other perinatal complications relative to routine care [28,29]. Because obese women who develop GDM appear to combine two independently adverse exposures, maternal adiposity and glucose intolerance, they represent a subgroup in whom the adverse pregnancy outcomes associated with hyperglycemia described in the HAPO cohort may be

further amplified by the metabolic and mechanical consequences of obesity itself [2,30].

This study has several limitations. Its retrospective design relies on the completeness and accuracy of antenatal record documentation, particularly for family history and prior pregnancy outcomes, which were not independently verified. Pre-pregnancy weight was self-reported for a substantial proportion of participants, which may have introduced misclassification of obesity class, most plausibly biasing prevalence estimates toward the null rather than inflating the observed gradient. The cohort was drawn from tertiary referral centers, which may not be representative of community obstetric populations, and the study could not evaluate genetic or biochemical markers, such as fasting insulin or HOMA-IR, that might refine risk stratification beyond the clinical variables captured here [31,32]. Prospective cohorts incorporating standardized pre-pregnancy weight measurement and biochemical risk markers would help confirm and extend these findings.

5. Conclusion

Gestational diabetes affects more than a quarter of obese pregnant adults in this cohort, with prevalence rising from roughly one in five women with class I obesity to nearly two in five women with class III obesity. Previous GDM, family history of type 2 diabetes, PCOS, advanced maternal age and excessive gestational weight gain each contributed independently to risk beyond obesity class itself, indicating that risk stratification for obese pregnant women should incorporate these factors rather than treating obesity as a single undifferentiated exposure. Targeted early screening for obese women who carry one or more of these additional risk factors, alongside universal screening at 24-28 weeks for the remainder, offers a pragmatic approach to earlier detection and management consistent with the outcome benefits demonstrated in randomized treatment trials [29,28,33].

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