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Original Article

Depressive symptoms in pregnant women with gestational diabetes: A cross-sectional comparative study using historical data

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ABSTRACT

Objectives: The objective of this study was to evaluate the frequency and severity of depressive symptoms in pregnant women with gestational diabetes mellitus (GDM) compared with healthy pregnant controls and to examine their association with sociodemographic and clinical characteristics.

Materials and methods: This cross-sectional comparative study included 50 pregnant women evaluated between March 1996 and June 1996. Twenty-five pregnant women diagnosed with GDM by a two-step protocol (a 50-g glucose challenge test at 24-28 weeks of gestation, followed by a 100-g, 3-h oral glucose tolerance test in women with a 1-h value ≥ 140 mg/dL) and 25 healthy pregnant women without any medical complications were enrolled as controls. Depressive symptoms were assessed using the Turkish-validated Zung Self-Rating Depression Scale. Sociodemographic and obstetric data were collected through a structured face-to-face interview. Statistical analyses (independent-samples t-test and Pearson chi-square test) were performed using SPSS.

Results: A total of 50 pregnant women, comprising 25 women diagnosed with GDM (mean age: 31.0 ± 5.7 years; range, 25 to 37 years) and 25 healthy pregnant controls (mean age: 27.2 ± 5.4 years; range, 21 to 33 years) without diabetic, obstetric, or other medical complications, were evaluated. In unadjusted analyses, the GDM group was significantly older than controls (t = 2.39, $p = 0.02$); height, weight, educational attainment, and socioeconomic status did not differ significantly between groups. Depressive symptoms were significantly more frequent in the GDM group than in controls ($\chi^2 = 37.8$, $p < 0.05$). Within the GDM group, symptom severity was predominantly mild (60%, 15/25), with no depressive symptoms in 28% (7/25) and moderate symptoms in 12% (3/25). Depressive symptom severity was not significantly associated with treatment modality (diet alone *vs.* diet plus insulin; $\chi^2 = 4.32$, $p = 0.36$), self-monitoring of blood glucose ($\chi^2 = 15.69$, $p = 0.47$), body mass index ($p = 0.264$), gravidity, parity, or the presence of diabetic retinopathy or nephropathy ($p = 0.20$ and $p = 0.45$, respectively).

Conclusion: In this cross-sectional comparative study, GDM was associated with a significantly higher frequency of depressive symptoms than in healthy pregnancies, predominantly of mild severity. No statistically significant associations were detected between depressive symptom severity and treatment modality, glycemic self-monitoring, obstetric history, or the assessed diabetic complications. Because the data derive from a single historical cohort assessed with instruments and diagnostic thresholds specific to that period, these findings should be regarded as hypothesis-generating rather than confirmatory; adequately powered, contemporary studies are needed.

Keywords: Depressive symptoms, gestational diabetes mellitus, Zung Self-Rating Depression Scale.

Gestational diabetes mellitus (GDM) is glucose intolerance first recognized during pregnancy and is associated with adverse maternal outcomes, including an increased risk of preeclampsia and operative delivery, as well as fetal complications such as macrosomia and neonatal hypoglycemia.[1] Beyond these physiological consequences, the psychological burden of GDM has received comparatively less clinical attention. Gestational diabetes mellitus affects a substantial and rising proportion of pregnancies worldwide and carries implications that extend beyond the index pregnancy.[1,2]

A bidirectional relationship between diabetes and depression is well established in the general adult literature: individuals with diabetes show a higher prevalence of depressive symptoms than the general population,[3] and depression has in turn been linked with poorer glycemic control.[4] Whether an analogous

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relationship applies to GDM, a heterogeneous and typically transient condition of pregnancy, is comparatively understudied.[5] More recent evidence specific to GDM has begun to address this gap: a systematic review reported a pooled antenatal/postnatal depressive symptom prevalence of approximately 28% among women with GDM, corresponding to a 2- to 4-fold increase relative to non-GDM pregnancies,[6] and subsequent reviews have similarly described a bidirectional relationship between GDM and depressive symptoms.[7,8] Most of this evidence, however, derives from high-income, contemporary cohorts; a meta-analysis focused on low- and middle-income countries reported a pooled odds ratio of 1.92 (95% CI: 1.24-2.97) for perinatal depressive symptoms in GDM, underscoring that regionally and historically diverse data remain comparatively scarce.[9]

The primary aim of this study was to compare the frequency and severity of depressive symptoms between pregnant women with GDM and healthy pregnant controls and to explore whether depressive symptoms in the GDM group were related to sociodemographic characteristics, treatment modality, glycemic self-monitoring, or diabetic complications.

MATERIALS AND METHODS

This cross-sectional comparative study was conducted at the Family Medicine Outpatient Clinic and the Perinatology Outpatient Clinic, İstanbul University, Cerrahpaşa Faculty of Medicine between March 1996 and June 1996. A written informed consent was obtained from each patient. This study was conducted in accordance with the ethical standards in place at the time of data collection at İstanbul University, Cerrahpaşa Faculty of Medicine. The surviving historical study records do not contain a contemporary ethics committee approval number. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Pregnant women presenting to the Obstetrics and Gynecology Outpatient Clinic for routine antenatal care underwent a 50-g glucose challenge test between 24 and 28 weeks of gestation. Women with a 1-h post-load glucose value ≥ 140 mg/dL underwent a confirmatory 100-g, 3-h oral glucose tolerance test (OGTT); those meeting the glycemic thresholds in use at the time of the study were diagnosed with GDM and referred to the Perinatology Outpatient Clinic for ongoing management. Women diagnosed with GDM and referred from other health facilities were also eligible if they met the study criteria. Twenty-five consecutively enrolled women with confirmed GDM constituted the case group. The control group comprised 25 pregnant women without any diabetic, obstetric, or other medical complication recruited consecutively from the outpatient clinic. The exact recruitment procedure for the control group (*e.g.*, consecutive *vs.* convenience sampling) and the numbers of women assessed for eligibility, excluded, or declining participation are not documented in the source study records and could not be reconstructed; this is acknowledged as a limitation below.

Diagnostic criteria

The specific glycemic threshold values applied to the confirmatory 100-g OGTT are not specified in the surviving study documentation. Therefore, the exact historical diagnostic definition of GDM cannot be reconstructed. As this study was conducted before the widespread adoption of International Association of the Diabetes and Pregnancy Study Groups (IADPSG) criteria, the diagnostic protocol reflects contemporaneous local practice rather than currently endorsed international criteria; this limits direct comparability with GDM cohorts diagnosed under modern criteria.

Assessment

A structured face-to-face interview of approximately 30 min was conducted with each participant, covering sociodemographic characteristics (age, educational attainment, self-reported socioeconomic status, height, and weight), habits, and obstetric and medical history (gravidity, parity, prior GDM, and family history of diabetes). Depressive symptoms were then assessed using the Turkish-validated version of the Zung Self-Rating Depression Scale (SDS), a 20-item self-report instrument in which raw scores are converted to an SDS index (0-100). An SDS index below 50 was classified as within normal limits (no depressive symptoms); 50-59 as mild; 60-69 as moderate-to-marked; and ≥ 70 as

severe depressive symptoms. In the GDM group, additional clinical data were recorded, including treatment modality (diet alone *vs.* diet plus insulin), frequency of self-monitoring of blood glucose, glycated hemoglobin (HbA1c), blood pressure category, and the presence of retinopathy or nephropathy.

Statistical analysis

Data were analyzed using SPSS Statistics for Windows, Version 26.0 software (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) and compared using the independent-samples t-test. Categorical variables were compared using Pearson's chi-square test. A p-value < 0.05 was considered statistically significant. No multivariable regression model was constructed; associations reported here are therefore unadjusted bivariate comparisons.

RESULTS

A total of 50 pregnant women, comprising 25 women diagnosed with GDM (mean age: 31.0 ± 5.7 years; range, 25 to 37 years) and 25 healthy pregnant controls (mean age: 27.2 ± 5.4 years; range, 21 to 33 years) without diabetic, obstetric, or other medical complications, were included in the study. Sociodemographic and anthropometric characteristics of the two groups are summarized in Table 1. The GDM group was significantly older than the control group ($t = 2.39$, $p = 0.02$), consistent with the known association between advancing maternal age and GDM risk. Height and weight did not differ significantly between groups ($t = 1.33$ and $t = 1.60$, respectively), nor did body mass index (29.2 ± 5.9 *vs.* 27.8 ± 2.8 kg/m^2; $p = 0.264$). Educational attainment and self-reported socioeconomic status were also comparable between groups (Table 1).

Depressive symptoms, assessed with the Zung SDS, were significantly more frequent in the GDM group than in the control group ($\chi^2 = 37.8$, $p < 0.05$). Within the GDM group, the severity distribution was: no depressive symptoms in 28% (7/25), mild symptoms in 60% (15/25), and moderate-to-marked symptoms in 12% (3/25), as shown in Table 2. A detailed severity breakdown for the control group is not available in the source records; the between-group comparison rests on the overall chi-square statistic reported above.

Table 1. Sociodemographic and anthropometric characteristics of the GDM and control groups

	GDM group (n = 25)		Control group (n = 25)		Test statistic	
	n	Mean ± SD	n	Mean ± SD	t	*p*
Characteristic					2.39	0.02
Age (year)		31.0 ± 5.7		27.2 ± 5.4	1.33	NS
Height (cm)		162.1 ± 5.4		160.4 ± 3.5	1.60	NS
Weight (kg)		76.8 ± 15.0		71.4 ± 7.4		0.264
Body mass index (kg/m^2)		29.2 ± 5.9		27.8 ± 2.8		
Educational level						
Primary school	8	32	11	44		
Middle school	2	8	5	20		NS
High school	9	36	5	20		
University	6	24	4	16		
Socioeconomic status						
Low	1	4	2	8		
Middle	15	60	21	84		NS
High	9	36	2	8		

GDM, gestational diabetes mellitus; SD, standard deviation; NS, not statistically significant ($p \geq 0.05$). Educational level and socioeconomic status percentages are calculated within each group (n = 25); the original source records expressed these as percentages of the combined sample (n = 50), which have been converted here to within-group percentages for clarity.

Table 2. Severity of depressive symptoms (Zung Self-Rating Depression Scale) in the GDM group

	GDM group (n = 25)		
Zung SDS category	n	%	SDS index range
No depressive symptoms	7	28	<50
Mild depression	15	60	50-59
Moderate-to-marked depression	3	12	60-69
Severe depression	0	0	≥70
Total	25	100	

GDM, gestational diabetes mellitus; GDM, gestational diabetes mellitus; SDS, self-rating depression scale. Depressive symptoms were significantly more frequent in the GDM group than in controls ($\chi^2 = 37.8$, $p < 0.05$); a comparable severity breakdown for the control group is not available in the source records. No participant in the GDM group met the severe-depression threshold.

Table 3. Depression severity by treatment modality in the GDM group

	Diet alone		Diet + insulin		Non-adherent		Total	
Depression severity	n	%	n	%	n	%	n	%
None	2	8	4	16	1	4	7	28
Mild	10	40	4	16	1	4	15	60
Moderate	1	4	1	4	1	4	3	12
Total	13	52	9	36	3	12	25	100

GDM, gestational diabetes mellitus. Percentages are of the total GDM group (n = 25). Pearson $\chi^2 = 4.32$, $p = 0.36$ (not statistically significant). 'Non-adherent' refers to participants who did not follow the recommended treatment protocol.

Within the GDM group, depressive symptom severity was not significantly associated with treatment modality ($\chi^2 = 4.32$, $p = 0.36$), as shown in Table 3. Depressive symptoms were numerically more frequent among the small number of women who were not adherent to the prescribed treatment (2 of 3 women; 66%) and among those managed with diet plus insulin (5 of 9; 55%) than among those managed with diet alone, although these differences did not reach statistical significance. Self-monitoring of blood glucose was not significantly associated with depressive symptoms ($\chi^2 = 15.69$, $p = 0.47$). Gravidity, parity, and number of live births were not significantly associated with depressive symptoms in either group ($p > 0.05$ for all comparisons). The presence of diabetic retinopathy or nephropathy was not significantly associated with depressive symptoms ($p = 0.20$ and $p = 0.45$, respectively); at the time of assessment, the great majority of participants had not yet been evaluated for these complications, which typically manifest later in pregnancy whereas the available data were insufficient to reliably evaluate an association between microvascular complications and depressive symptoms. The mean HbA1c in the GDM group was 5.2 ± 0.6%. Blood pressure category (normotensive, hypotensive, or hypertensive) did not differ significantly between groups. A family history of diabetes was present in 60% of women in the GDM group (24% first-degree, 16% second-degree, 20% both), and 32% had experienced GDM in a previous pregnancy.

DISCUSSION

In this cross-sectional comparative study, women with GDM reported depressive symptoms significantly more often than healthy pregnant controls, although the great majority of affected cases were of mild severity. This finding is broadly consistent with the wider literature linking diabetes with an elevated prevalence of depressive symptoms in non-pregnant adults.[3,4] It also aligns with GDM-specific meta-analytic estimates, which

report a pooled antenatal/postnatal depressive symptom prevalence of approximately 28% and a 2- to 4-fold increase in odds relative to non-GDM pregnancies,[6] as well as with more recent systematic reviews describing a similarly consistent, bidirectional association.[7] Given the cross-sectional design and the absence of a validated, pregnancy-specific depressive symptom measure, causal inference is not possible; the results are more accurately described as an association observed at a single point in the third trimester rather than evidence that GDM increases risk of depressive symptoms.

Several biological mechanisms have been proposed to link diabetes with depressive symptomatology, including insulin resistance, low-grade inflammation, and dysregulation of the hypothalamic-pituitary-adrenal axis.[3,10] These mechanisms were not directly assessed in the present study, and their relevance to GDM specifically, as opposed to diabetes in general, remains speculative. Notably, a study in women with GDM directly linked elevated inflammatory markers and reduced cardiovagal modulation with concurrent depressive symptoms at the 36th week of gestation, providing preliminary GDM-specific support for an inflammation-mediated pathway.[11]

Contrary to the initial expectation, depressive symptom severity in the GDM group was not significantly related to treatment modality, glycemic self-monitoring, or the presence of diabetic complications. The numerically higher, although non-significant, frequency of depressive symptoms among women who were non-adherent to treatment and among those requiring insulin in addition to diet may reflect the added psychological burden of a more intensive treatment regimen. Alternatively, it could reflect reverse causation, whereby depressive symptoms themselves interfere with treatment adherence. The present data cannot distinguish between these possibilities. This pattern parallels a recent prospective observational study in which insulin-treated GDM was associated with significantly higher anxiety than diet-treated GDM or healthy pregnancy, although depressive symptom scores did not differ significantly by treatment modality.[12] This is consistent with the non-significant but numerically higher frequency of depressive symptoms among insulin-treated and non-adherent participants in the present study.

Educational attainment and socioeconomic status did not differ significantly between the GDM and control groups in this cohort, and the available data did not permit a direct test of their association with depressive symptom severity within the GDM group. This differs from the broader literature linking lower socioeconomic status with adverse perinatal mental health outcomes,[13] and should not be taken as evidence against such an association; rather, it reflects a limitation of the available dataset, in which socioeconomic and educational variables were used to establish comparability between the case and control groups rather than analyzed as predictors of depressive symptom severity. Family support was not assessed in this cohort and could not be evaluated as a potential protective or risk factor, notwithstanding its documented relevance to perinatal depressive symptoms in other populations.[14,15] A meta-analysis of 64,449 pregnant women found that low social support was significantly associated with increased odds of antenatal depressive symptoms (adjusted odds ratio: 1.18, 95% confidence interval: 1.01-1.41),[16] and a systematic review similarly linked lower socioeconomic status with higher rates of postpartum depressive symptoms.[17]

This study has certain limitations. First, the data derive from a historical cohort; the diagnostic protocol for GDM and the psychometric instrument used to assess depressive symptoms (the Zung SDS) reflect practices of that period and predate the IADPSG diagnostic criteria now in widespread use, limiting the generalizability of these findings to contemporary GDM populations and antenatal care pathways. Second, the sample size was small (n = 25 per group) and drawn from a single tertiary center, which limits statistical power and generalizability; several subgroup comparisons (e.g., treatment modality, complications) involved very small cell counts. Third, the Zung SDS is a screening instrument and does not constitute a diagnostic interview for a depressive disorder; no structured clinical interview was performed. Fourth, all associations reported are unadjusted bivariate comparisons; no multivariable model was used

to account for potential confounding among age, treatment modality, glycemic control, and depressive symptoms. Fifth, the cross-sectional, single-timepoint design precludes any causal interpretation of the observed association between GDM and depressive symptoms.

In conclusion, in this cross-sectional comparative study based on a historical cohort, GDM was associated with a significantly higher frequency of depressive symptoms than in healthy pregnancies, predominantly of mild severity. No statistically significant associations were detected between depressive symptom severity and treatment modality, glycemic self-monitoring, obstetric history, or the assessed diabetic complications. These findings support continued attention to the psychological dimension of GDM but should be regarded as hypothesis-generating given the historical, single-center, and cross-sectional nature of the data. Adequately powered, multicenter, longitudinal studies using contemporary diagnostic criteria and validated depression and social-support instruments are needed to confirm these findings and to clarify the direction of the association.

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