






# The effect of gestational diabetes mellitus on sexual function, anxiety, depression and quality of life in pregnant women

 <sup>1</sup>Canan SATIR ÖZEL  
 <sup>2</sup>Özgür EFİLOĞLU  
 <sup>3</sup>İlayda LOÇLAR KARALAP  
 <sup>4</sup>Asif YILDIRIM  
 <sup>3</sup>Abdulkadir TURGUT

<sup>1</sup>Department of Obstetrics and Gynecology, Istanbul Medeniyet University, Göztepe Prof. Dr. Süleyman Yalçın City Hospital, Istanbul, Turkey

<sup>2</sup>Department of Urology, Istanbul Medeniyet University, Göztepe Prof. Dr. Süleyman Yalçın City Hospital, Istanbul, Turkey

<sup>3</sup>Department of Obstetrics and Gynecology, Istanbul Medeniyet University Faculty of Medicine, Istanbul, Turkey

<sup>4</sup>Department of Urology, Istanbul Medeniyet University Faculty of Medicine, Istanbul, Turkey

## ORCID ID

CSÖ : 0000-0001-5287-5114  
ÖE : 0000-0003-4757-803X  
İLK : 0000-0002-6968-4450  
AY : 0000-0002-3386-971X  
AT : 0000-0002-3156-2116



## ABSTRACT

**Objective:** Gestational diabetes during pregnancy causes many adverse effects in mothers and affects them in various aspects. The aim is to investigate the impact of gestational diabetes during the course of pregnancy on patients' quality of life, depression and anxiety levels, and sexual functions.

**Material and Methods:** The study was conducted on 131 third-trimester pregnant women (healthy pregnant women: 79, patients with GDM: 52) by using the WHO Quality of Life-BREF (WHOQOL-BREF), Female Sexual Function Index (FSFI), Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI) between September 2020 and August 2021. The patients with GDM were then divided according to their treatment strategies (Lifestyle Modification: 43 and Insulin Therapy: 9) for further evaluations.

**Results:** Healthy pregnant women have a higher score ( $69.30 \pm 14.68$ ) on the general health domain of WHOQOL-BREF than patients with GDM ( $63.22 \pm 18.25$ ) with statistical significance ( $p=0.037$ ). The Insulin Therapy Group has a significantly ( $p=0.008$ ) lower psychological health score ( $60.18 \pm 18.05$ ) on the psychological health domain of WHOQOL-BREF than the Lifestyle Modification Group ( $76.06 \pm 15.05$ ). There was no significant difference in FSFI, BAI, BDI, and other domains of WHOQOL-BREF scores between the two groups and treatment strategies.

**Conclusion:** Suffering from GDM or using different treatment options has no impact on patients' quality of life, levels of depression or anxiety, or sexual function.

**Keywords:** Anxiety, depression, gestational diabetes, quality of life, sexual dysfunction.

**Cite this article as:** Satir Özel C, Efiloğlu Ö, Loçlar Karalap İ, Yıldırım A, Turgut A. The effect of gestational diabetes mellitus on sexual function, anxiety, depression and quality of life in pregnant women. Zeynep Kamil Med J 2024;55(2):94–101.

**Received:** June 22, 2023 **Revised:** September 09, 2023 **Accepted:** October 07, 2023 **Online:** May 09, 2024

**Correspondence:** Canan SATIR ÖZEL, MD. İstanbul Medeniyet Üniversitesi, Göztepe Prof. Dr. Süleyman Yalçın Şehir Hastanesi, Kadın Hastalıkları ve Doğum Kliniği, İstanbul, Türkiye.

**Tel:** +90 216 606 52 00 **e-mail:** drcanansatirozel@gmail.com

Zeynep Kamil Medical Journal published by Kare Publishing. Zeynep Kamil Tıp Dergisi, Kare Yayıncılık tarafından basılmıştır.

**OPEN ACCESS** This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).



## INTRODUCTION

Diabetes Mellitus (DM) is a disease of glucose metabolism and occurs in pregnant women in three groups such as pre-gestational diabetes (diagnosed before the onset of pregnancy, e.g. Type 1 and Type 2 DM), gestational diabetes (diagnosed at any time during the antenatal period but not expected to persist postpartum), and diabetes in pregnancy (firstly diagnosed in pregnant women with hyperglycemia and meeting WHO criteria for diabetes in the non-pregnant state).<sup>[1]</sup>

According to the most recent (2021) International Diabetes Federation records, gestational diabetes mellitus (GDM) affects approximately 16% of pregnancies worldwide.<sup>[2]</sup> Struggling with a health condition such as gestational diabetes during a delicate process of pregnancy affects the patient's quality of life, anxiety, depression status, and sexual function.<sup>[3–5]</sup>

Studies have shown that quality of life may be affected in patients with gestational diabetes due to concerns about their health and that of the newborn, requiring close follow-up for taking control of the disease and using regular insulin.<sup>[6]</sup> In addition, pregnant women with GDM are aware of the fact that uncontrolled disease could be the cause of pregnancy complications and adverse neonatal outcomes, which increases their anxiety and depression levels.<sup>[7]</sup> A few recent studies declared that patients with gestational diabetes also experience sexual function problems.<sup>[4]</sup>

The literature is limited for such a complex disease that affects the individual's life in various aspects. In our study, we aimed to investigate the impact of gestational diabetes on patients' lives in different dimensions such as quality of life, anxiety and depression levels, and sexual function by comparing patients with gestational diabetes and the control group during their pregnancy period with validated, unbiased, accepted questionnaires.

## MATERIAL AND METHODS

### Study Design and Setting

This study was performed on 131 participants at the education and research hospital between 1<sup>st</sup> of September 2020 to 30<sup>th</sup> of August 2021. The protocol has been reviewed and approved by the Clinical Research Ethics Committee of the Hospital (approval number: 2020/0500). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Patients who attended the obstetrics outpatient clinic for regular checkups were selected voluntarily for the study. After written informed consent was obtained from all participants, patients were asked to complete validated Turkish forms of the World Health Organization Quality of Life—BREF (WHOQOL-BREF), Female Sexual Function Index (FSFI), Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI). The questionnaires were completed by participants after being interviewed and given clear instructions by two of the authors (Satır Özel, Loclar Karaalp), reducing the problems that can arise in a self-completion approach to such a long questionnaire.

### Study Population

The inclusion criteria were women who were older than 20 years of age, had third-trimester pregnancy, had been sexually active with the same partner for at least 6 months, and had a 75 g oral glucose tolerance test (OGTT) at least 4 weeks ago at 24–28 weeks.

The exclusion criteria were women currently diagnosed with type 1 and type 2 DM, situations where sexual intercourse is not recommended such as placenta previa, premature rupture of membranes, threatened premature birth, those who use drugs that may affect sexual functions (antihypertensive, antidepressant, anxiolytic drugs, etc.), those with diagnosed psychological diseases (depression, schizophrenia, neurosis, etc.), alcohol and substance addiction, pregnancies after rape, hospitalization in the last 30 days, and patients who could not be together with their partner in the last month.

### Sampling Method

Pregnant women were divided into two different groups as the control group and patients with GDM according to the results of the 75 g OGTT performed at 24–28 weeks of gestation. After fasting for approximately 8 hours, patients were given 75 g glucose and blood glucose levels were measured at zero (fasting), first, and second hours. According to the results, the diagnosis of gestational diabetes was excluded in values lower than 92 mg/dl at the zero hour, 180 mg/dl at the first hour, and 153 mg/dl at the second hour, and the pregnant women were considered healthy in this respect.<sup>[8]</sup> If one value is higher than the cut-off levels, patients have been diagnosed with GDM. Hemoglobin A1c (HbA1c), also known as glycosylated hemoglobin, levels of patients with GDM were also recorded.

Both groups were compared in terms of the difference in sexual function score, anxiety score, depression score, and quality of life score, and the effect of the presence of gestational diabetes on the scores was investigated. In addition, the group with GDM was divided into 2 subgroups according to the type of treatment, such as the lifestyle modification group and the insulin therapy group (in addition to lifestyle modification), and compared in terms of the effect of the treatment method on the scores.

### Instruments

In our study, the Turkish validation and reliability of the World Health Organization Quality of Life—BREF (WHOQOL-BREF), Female Sexual Function Index (FSFI), Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI) were used.<sup>[9–12]</sup>

The WHOQOL-BREF test is an unbiased test providing clinicians with an evaluation of the quality of life (QoL) in both healthy and ill patients. It consists of 26 questions in 4 domains: physical (somatic), psychological, social relationships, and environmental. Responses are scored from 1 to 5, and a cumulative score is obtained for each domain. The total score is not calculated. A higher score represents better QoL as specified by the respondent.<sup>[13]</sup> In the validated WHOQOL-BREF, the 27<sup>th</sup> question is a national question and has not been included in the scoring, and the 1<sup>st</sup> and 2<sup>nd</sup> questions were calculated as the general health score, unlike the original.

FSFI is a questionnaire used for clinical research by evaluating many aspects of female sexual function, with 19 questions consisting of 6 domains such as desire, arousal, lubrication, orgasm, satisfac-

Table 1: Demographic data			
	Control group (n=79)	Patient with GDM group (n=52)	p
Age	29.4±5.3	31.7±5.1	0.013
Spouse age	33.4±6.6	34.4±5.8	0.388
Duration of marriage (year)	6.2±5.6	6.9±5.3	0.465
Gravida			0.120
1	35 (44.3%)	17(32.7%)	
2	18 (22.8%)	15 (28.8%)	
3	18 (22.8%)	8 (15.4%)	
4	2 (2.5%)	7 (13.5%)	
5	5 (6.3%)	4 (7.7%)	
6	1 (1.3%)	0 (0%)	
7	0 (0%)	1 (1.9%)	
Parity			0.252
0	37 (46.8%)	20 (38.5%)	
1	23 (29.1%)	16 (30.8%)	
2	16 (20.3%)	12 (23.1%)	
3	1 (1.3%)	4 (7.7%)	
4	2 (2.5%)	0 (0%)	
Abortion			0.576
0	65 (82.3%)	40 (76.9%)	
1	11 (13.9%)	10 (19.2%)	
2	2 (2.5%)	1 (1.9%)	
3	1 (1.3%)	0 (0%)	
4	0 (0%)	1 (1.9%)	
Number of vaginal birth			0.521
0	47 (59.5%)	36 (69.2%)	
1	18 (22.8%)	9 (17.3%)	
2	11 (13.9%)	4 (7.7%)	
3	6 (3.8%)	3 (5.8%)	0.026
Number of cesarean birth			
0	65 (82.3%)	34 (65.4%)	
1	11 (13.9%)	8 (15.4%)	
2	3 (3.8%)	8 (15.4%)	
3	0 (0%)	2 (3.8%)	
Current body mass index (BMI)	29.9±5.08	31.3±5.6	0.165
Pregestational BMI	25.4±5.05	27.1±5.32	0.081
Planned pregnancy	61 (77.2%)	33 (63.5%)	0.087
Education			0.588
Illiterate	1 (1.3%)	2 (3.8%)	
Primary and secondary school	30 (38%)	20 (38.5%)	
High school	17 (21.5%)	14 (26.9%)	
University and postgraduate	31 (39.2%)	16 (30.8%)	
Spouse education			0.709
Illiterate	1 (1.3%)	1 (1.9%)	

Table 1 (cont): Demographic data

	Control group (n=79)	Patient with GDM group (n=52)	p
Primary and secondary school	29 (36.7%)	24 (46.2%)	
High school	24 (30.4%)	14 (26.9%)	
University and postgraduate	25 (31.6%)	13 (25%)	
Employment			0.840
Employed	21 (26.6%)	13 (25%)	
Unemployed	58 (73.4%)	39 (75%)	
Spouse employment			0.654
Employed	77 (97.5%)	51 (98.1%)	
Unemployed	2 (2.5%)	1 (1.9%)	
Monthly income of house			0.271
Income below minimum wage	14 (17.7%)	12 (23.1%)	
Income between minimum wage and triple	56 (70.9%)	30 (57.7%)	
Income beyond three fold minimum wage	9 (11.4%)	10 (19.2%)	
Gestational week of when questionnaire filled in	35.4±3.35	35.4±3.21	0.980
Gestational week of at 75 gr OGTT	26.1±1.52	25.9±1.21	0.320
0 <sup>th</sup> hour blood glucose level (mg/dl)	80.7±6.44	97.2±21.66	0.000
1 <sup>st</sup> hour blood glucose level (mg/dl)	120.5±28.62	189.41±32.94	0.000
2 <sup>nd</sup> hour blood glucose level (mg/dl)	106.5±22.98	148.6±38.06	0.000

GDM: Gestational diabetes mellitus; OGTT: Oral glucose tolerance test.

tion, and pain. Each domain is scored according to respondents' answers, with a minimum to maximum range of 1–5, 0–5, 0–5, 0–5, 0–5, and 0–5 respectively, resulting in an additive score range of 2–36. If the total score is  $\leq 26$ , it suggests a risk for sexual dysfunction.<sup>[14]</sup>

Beck Depression Inventory is a clinically used self-report screening inventory comprising 13 cognitive and 8 somatic multiple-choice questions to measure the seriousness of depression. Each question is scored on a scale of 0–3 according to the respondent's answer to the statements. The total score represents the severity of the depression. The cut-off points for severity scores are: 0–9 minimal; 10–16 mild; 17–29 moderate; and 30–63 severe.<sup>[15,16]</sup>

Beck Anxiety Inventory is a self-report questionnaire consisting of 21 questions used to document anxiety levels clinically. Each question is rated on a 4-point Likert scale ranging from 0–3, and the total obtained score range is 0–63. A total score of 0–21 is determined as low anxiety, 22–35 as moderate anxiety, and 36–63 as potentially concerning levels of anxiety (severe).<sup>[17]</sup> Validation and reliability were studied in the Turkish population.<sup>[9]</sup>

### Statistical Analysis

One-sample Kolmogorov-Smirnov test was used to check whether the data showed normal distribution for numerical variables. Mean±standard deviation was found in data with normal distribution, and median (interquartile range (IQR)) values were recorded in data without normal distribution. Numerical variables were compared with Student's t-test when parametric test criteria were met. In the absence of these cri-

teria, the Mann-Whitney U test was used. Pearson Chi-Square Test and Fisher's Exact Test were used to determine whether there was a difference between the percentages of categorical variables. For all tests, the probability of a first type error was  $\alpha=0.05$ . Statistical analysis of the study was performed using IBM SPSS 22.0 package program.

### RESULTS

According to the OGTT results, 79 healthy participants in the control group and 52 participants in the GDM patient group were included in the study. The demographic data of both groups participating in the study are documented in Table 1. Patient age and number of cesarean sections were statistically significantly higher in the GDM group than in the control group.

The questionnaire results are documented in separate sections in Table 2. The general health score of WHOQOL-BREF was significantly higher in the control group than in the GDM group. In contrast, no statistically significant difference was observed between both groups in terms of FSFI, BDI, and BAI scores.

The subgroup data analysis is documented in Table 3. In Group 2, 43 patients were treated with diet and exercise, while 9 patients used insulin in addition to diet and exercise. No patients were taking oral antidiabetic drugs. For GDM patients, a subgroup analysis was performed between those treated with lifestyle modification and those receiving insulin therapy. The psychological health score of WHOQOL-BREF was found to be significantly lower in the insulin therapy group, while no difference was found in all other domains.

**Table 2: WHOQOL-BREF, BDI, BAI and FSFI scores between main groups**

	Control group (n=79)	Patient with GDM group (n=52)	p
BAI total score	12.25±8.86	9.58±7.52	0.075
Low anxiety	66 (83.5%)	49 (94.2%)	
Moderate	12 (15.2%)	3 (5.8%)	0.174
Severe	1 (1.3%)	0 (0%)	
FSFI total score	15.91±10.54	13.45±10.68	0.197
Desire	2.71±1.16	2.35±1.01	0.099
Arousal	2.31±1.65	1.96±1.67	0.236
Orgasm	2.46±2.09	2.07±2.14	0.362
Lubrication	2.89±2.14	2.46±2.21	0.344
Satisfaction	3.07±2.50	2.53±2.52	0.249
Pain	2.45±2.03	2.06±2.07	0.338
BDI total score	9.65±7.23	10.75±7.72	0.407
Minimal	45 (57%)	28 (53.8%)	
Mild	20 (25.3%)	17 (32.7%)	0.736
Moderate	13 (16.5%)	6 (11.5%)	
Severe	1 (1.3%)	1 (1.9%)	
WHOQOL-BREF			
General health	69.30±14.68	63.22±18.25	0.037
Physical health	63.56±16.97	61.60±16.89	0.519
Psychological health	72.04±12.69	73.31±16.56	0.621
Social relationship	56.96±15.82	55.12±13.97	0.498
Social environment	69.38±13.58	64.72±16.01	0.076

GDM: Gestational diabetes mellitus; BAI: Beck anxiety inventory; FSFI: Female Sexual Function Index; BDI: Beck Depression Inventory; WHOQOL-BREF: World Health Organization Quality of Life—BREF.

## DISCUSSION

There are many studies in the literature investigating the impact of gestational diabetes on QoL. However, these studies are mostly qualitative studies performed by interviews with GDM patients about their experience over the course of pregnancy.<sup>[18,19]</sup> Quantitative studies are rare but are tending to increase.

Pantartzis et al.<sup>[20]</sup> showed that the WHOQOL-BREF social environment score of the control group (30.8±3.4) was significantly higher than that of patients with GDM (28.5±3.9). They claim that the diagnosis of GDM affects the QoL of pregnant patients in the third trimester negatively. Iwanowicz-Palus et al.<sup>[21]</sup> supported this argument with a study of 676 patients in Poland. The study showed that patients with GDM had worse quality in all domains of WHOQOL-BREF (general quality of life, general health, physical health, psychological, social relationships, and environment).

In our study, the general quality of life score was significantly higher in the control group compared to patients with GDM, while in the other domains no significant results were obtained. This result is also supported by a recent meta-analysis, which states that QoL would be significantly compromised as patients cope with GDM.<sup>[9]</sup> It is clear that having GDM during pregnancy affects a patient's quality of life. At this point, it can be suggested that the patients should be examined carefully and supported in each outpatient follow-up visit.

Our patients with GDM were divided into two groups according to their treatment options, such as lifestyle modification. In our study, WHOQOL-BREF scores were higher in patients with lifestyle modification compared to those on insulin. When WHOQOL-BREF was evaluated in detail, the psychological domain was significantly higher (p=0.008) in GDM patients controlled with diet. This outcome is supported by a study of 339 participants conducted in 2019, which demonstrates higher general quality of life and psychological scores in patients with GDM controlled by diet and exercise compared to those controlled by diet and insulin treatment.<sup>[22]</sup>

In another study with 114 patients with GDM, it was shown that the general health score and physical activity scores were significantly higher in the patients with GDM treated only with diet.<sup>[6]</sup> On the other hand, Pantartzis et al.<sup>[20]</sup> stated that the type of treatment of GDM does not seem to have a further effect on the QoL of the subgroup of patients with GDM. In addition, Abolfathi et al.<sup>[23]</sup> showed in 2021 that low-income patients with GDM had worse psychological scores.

Although pregnancy is the most joyful time of expectation, coping with complications can cause significant psychological challenges for women. It is expected that psychological domain scores would be higher in patients knowing that complications could be controlled with easy and accessible treatment methods such as diet and exercise because insulin therapy is an expensive treatment option and requires commitment.

Many physicians have studied female sexual dysfunction (FSD) and diabetes in the literature. However, there are a limited number of studies that investigated FSD and GDM, and their results are controversial. Souza et al.<sup>[4]</sup> investigated the FSFI results of second-trimester patients with GDM and compared them with low-risk pregnancies. They stated that although all domains have a higher score of FSFI in the low-risk pregnancy group, only the total score and orgasm domain were statistically significant. On the other hand, in another study investigating FSD with a different questionnaire (Golombok-Rust Inventory of Sexual Satisfaction) in Türkiye, it was shown that sexual functions of third-trimester patients with GDM are better than those of healthy pregnant women.<sup>[24]</sup> In another study, Ribeiro et al.<sup>[25]</sup> claimed that the sexual function of 87 third-trimester pregnant women with and without gestational diabetes did not differ according to the FSFI survey. The same author also stated that overweight women with GDM in the third trimester have worse FSD than normal-weight women with GDM.<sup>[26]</sup>

In our study, we have not found a significant difference in sexual dysfunction between patients with and without GDM during their third trimester. In addition to that, the fact that FSFI scores are below 26 in both groups means that all participant women have poor sexual functions. This may be attributed to the stress of pregnancy itself and the difficulty of disclosing their thoughts as a cultural



**Table 3: Subgroup analysis due to treatment method**

	Lifestyle modification group (n=43)	Insulin therapy group (n=9)	p
HbA1c	5.79±0.52	5.74±0.62	0.809
Age	31.35±4.59	33.78±7.19	0.200
Spouse age	34.02±5.61	36.33±7.17	0.290
Duration of marriage (year)	6.83±5.22	7.50±6.32	0.740
Current BMI	31.28±5.85	31.51±5.06	0.913
Pregestational BMI	26.55±5.43	29.46±4.19	0.138
0 <sup>th</sup> hour blood glucose level (mg/dl)	93.88±12.77	112.56±42.56	0.227
1 <sup>st</sup> hour blood glucose level (mg/dl)	187.60±35.18	199.13±13.93	0.369
2 <sup>nd</sup> hour blood glucose level (mg/dl)	145.71±39.72	163.88±24.50	0.220
BAI total score	8.81±7.18	13.22±8.51	0.111
Low-anxiety	41 (95.3%)	8 (94.2%)	0.450
Moderate	2 (4.7%)	1 (5.8%)	
Severe	0 (0%)	0 (0%)	
FSFI total score	13.14±11.11	14.97±8.67	0.592
Desire	2.31±1.06	2.53±0.78	0.491
Arousal	1.99±1.75	1.83±1.31	0.874
Orgasm	1.96±2.16	2.62±2.06	0.524
Lubrication	2.47±2.29	2.43±1.90	0.551
Satisfaction	2.42±2.63	3.02±2.01	0.694
Pain	1.96±2.10	2.53±1.94	0.777
BDI total score	10.02±6.20	14.22±12.73	0.360
Minimal	25 (58.1%)	3 (33.3%)	0.082
Mild	14 (32.6%)	3 (33.3%)	
Moderate	4 (9.3%)	2 (22.2%)	
Severe	0 (0%)	1 (11.1%)	
WHOQOL-BREF			
General health	63.66±19.05	61.11±14.58	0.707
Physical health	61.69±16.94	59.92±17.56	0.746
Psychological health	76.06±15.05	60.18±18.05	0.008
Social relationship	56.27±13.11	49.62±17.35	0.197
Social environment	65.84±16.28	59.37±14.23	0.275

BMI: Body Mass Index; BAI: Beck anxiety inventory; FSFI: Female Sexual Function Index; BDI: Beck Depression Inventory; WHOQOL-BREF: World Health Organization Quality of Life—BREF.

feature. Patients might not clearly express their complaints; they hide their sexual problems and do not share them easily. Finally, treatment variation of GDM has shown no significant differences in sexual function in our results.

The American College of Obstetricians and Gynecologists Committee Opinion recommends the use of a depression inventory at least once during pregnancy or the first year postpartum to document new-onset depression related to pregnancy.<sup>[27]</sup>

In 2018, Pace et al.<sup>[28]</sup> showed in their retrospective study with a high number of participants that GDM increased the incidence of depression by 2-fold in the second and third trimesters of pregnancy. The same study also revealed that GDM is a risk factor for depression in the first year postpartum and beyond. Another study in 2015 compared depression scores of diabetes type 1, diabetes type 2, and GDM. They claimed that although there is an association between diabetes and depression, the correlation is not significant, and approximately 13% of the GDM patients experienced severe depression.

This ratio is significantly lower than that of other type 1 and type 2 DM groups.<sup>[29]</sup> Gezginç et al.<sup>[30]</sup> investigated BDI scores between glucose tolerance abnormality and depression in 24–28-week pregnant women and found that BDI scores were significantly higher in the group with abnormal glucose results. However, the subgrouping of the patients was based on the results of the 50 g glucose intolerance test, but the confirmation of GDM was not performed following the 100 g glucose intolerance test.

In the literature, there is only one study investigating the BDI score of patients with or without GDM during the course of pregnancy. Keskin et al.<sup>[31]</sup> claimed that there are no statistically significant differences between the two groups. In our study, we also found that there is no significant difference between patients with GDM and the control group in their BDI scores. Furthermore, GDM treatment differences have no statistically significant effect on the depression scores of the subgroups. The cut-off score of BDI is determined as 17 in an analysis of the validity and reliability of its use in Turkish university students, which means above 17 demonstrates clinical depression.<sup>[32]</sup> In our study, all groups have BDI scores lower than this value. Further studies are needed to reveal the relationship between GDM and depression during pregnancy.

The relationship between anxiety and GDM is controversial, and it is not clear which one causes the other. Many studies support that anxiety causes many hormonal dysregulations, such as increased secretion of cortisol and insulin resistance, leading to GDM.<sup>[33,34]</sup> In a study of 1,426 singleton pregnancies, it was shown that GDM was higher in patients with anxiety than in those non-anxious ones.<sup>[35]</sup> In contrast, some studies determined that GDM is also a reason for the development of anxiety. Lee et al.<sup>[36]</sup> showed that the prevalence of anxiety is higher among GDM patients in their cross-sectional study with 526 participants using the Depression, Anxiety, and Stress 21 questionnaire. In addition, they found that the risk of developing anxiety increases in GDM patients of younger ages.<sup>[36]</sup> The same study group also found a positive relationship between neonatal respiratory distress and the presence of depression symptoms in patients with GDM one year later.<sup>[37]</sup> A recent meta-analysis declared that patients with GDM have a significantly higher risk of developing postpartum depression.<sup>[38]</sup>

Our study is unique in that we used the BAI to determine the anxiety level of the patients. In our study, there is no significant difference between the control group and patients with GDM.

In the literature, Hui et al.<sup>[39]</sup> claimed that the patients whose diabetes was regulated with insulin during pregnancy have higher anxiety about diet management compared to those who received only diet treatment. As we evaluated subgroups of GDM treatment strategies, insulin users have higher BAI scores than the diet-regulated group, but this was not statistically significant. This result is supported by Langer and Langer,<sup>[40]</sup> who found that there is no significant impact of insulin usage on negative mood in GDM patients compared to diet treatment.

Our study is unique in that it is the first study to evaluate different aspects of specified diabetes patients who are pregnant using four different validated questionnaires (WHOQOL-BREF, FSFI, BDI, BAI). The most important limitation is that the investigation is specified solely to the third trimester of pregnancy, and no previous questionnaire scores have been provided pre-pregnancy. Another limitation is the relatively small sample size. The patients' group was divided

into two treatment subgroups, so the reduced sample size may lead to insignificant statistical results. Finally, the study was conducted in a specific cultural community, so heterogeneous results may occur when compared to worldwide results.

Our recommendation for future studies is to explore the anxiety, depression, QoL, and sexual functions of this targeted group with a more multicultural, multicenter approach and more participants. In addition, they might investigate the comparison of anxiety, depression, QoL, and sexual functions in patients with pre-gestational diabetes, GDM, and healthy populations.

## Statement

**Ethics Committee Approval:** The Istanbul Medeniyet University, Göztepe Prof. Dr. Süleyman Yalçın City Hospital Clinical Research Ethics Committee granted approval for this study (date: 12.08.2020, number: 2020/0500).

**Author Contributions:** Concept – CSÖ, ÖE; Design – CSÖ, ÖE; Supervision – AY, AT; Resource – CSÖ; Materials – İLK, CSÖ; Data Collection and/or Processing – İLK, CSÖ; Analysis and/or Interpretation – ÖE; Literature Search – ÖE, CSÖ; Writing – CSÖ, ÖE, İLK; Critical Reviews – AT, AY.

**Conflict of Interest:** The authors have no conflict of interest to declare.

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Use of AI for Writing Assistance:** Not declared.

**Financial Disclosure:** The authors declared that this study has received no financial support.

**Peer-review:** Externally peer-reviewed.

## REFERENCES

- Hod M, Kapur A, Sacks DA, Hadar E, Agarwal M, Di Renzo GC, et al. The International Federation of Gynecology and Obstetrics (FIGO) initiative on gestational diabetes mellitus: A pragmatic guide for diagnosis, management, and care. *Int J Gynaecol Obstet* 2015;131(Suppl 3):S173–211.
- International Diabetes Federation. IDF diabetes atlas. Available at: [https://diabetesatlas.org/idfawp/resource-files/2021/07/IDF\\_Atlas\\_10th\\_Edition\\_2021.pdf](https://diabetesatlas.org/idfawp/resource-files/2021/07/IDF_Atlas_10th_Edition_2021.pdf). Accessed Apr 20, 2024.
- Marchetti D, Carrozzino D, Fraticelli F, Fulcheri M, Vitacolonna E. Quality of life in women with gestational diabetes mellitus: A systematic review. *J Diabetes Res* 2017;2017:7058082.
- Souza Fde O, Dias LA, Franco Mde M, Guirro EC, Cavalli Rde C, Lara LA, et al. Assessment of female sexual function in pregnant women with gestational diabetes mellitus. *J Sex Med* 2013;10:1350–4.
- Ross GP, Falhammar H, Chen R, Barraclough H, Kleivenes O, Gallen I. Relationship between depression and diabetes in pregnancy: A systematic review. *World J Diabetes* 2016;7:554–71.
- Bień A, Rzońca E, Kańczugowska A, Iwanowicz-Palus G. Factors affecting the quality of life and the illness acceptance of pregnant women with diabetes. *Int J Environ Res Public Health* 2015;13:13010068.
- Marquesim NA, Cavassini AC, Morceli G, Magalhães CG, Rudge MV, Calderon Ide M, et al. Depression and anxiety in pregnant women with diabetes or mild hyperglycemia. *Arch Gynecol Obstet* 2016;293:833–7.
- Metzger BE, Gabbe SG, Persson B, Buchanan TA, Catalano PA, Damm P, et al. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. *Diabetes Care* 2010;33:676–82.

9. Ulusoy M, Sahin NH, Erkmen H. Turkish version of the beck anxiety inventory: Psychometric properties. *J Cogn Psychother* 1998;12:163.
10. Oksuz E, Malhan S. Reliability and validity of the female sexual function index in Turkish population. *Sendrom* 2005;17:54–60.
11. Kapci EG, Uslu R, Turkcapar H, Karaoglan A. Beck depression inventory II: Evaluation of the psychometric properties and cut-off points in a Turkish adult population. *Depress Anxiety* 2008;25:e104–10.
12. Eser E, Fidaner H, Fidaner C, Eser Yalçın S, Elbi H, Göker E. Psychometric properties of the WHOQOL-100 and WHOOLBREF. *J Psychiatr Psychol Psychopharmacol* 1999;7:23–40.
13. Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. *Psychol Med* 1998;28:551–8.
14. Rosen R, Brown C, Heiman J, Leiblum S, Meston C, Shabsigh R, et al. The Female Sexual Function Index (FSFI): A multidimensional self-report instrument for the assessment of female sexual function. *J Sex Marital Ther* 2000;26:191–208.
15. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry* 1961;4:561–71.
16. Beck AT, Steer RA, Garbin MG. Psychometric properties of the beck depression inventory: Twenty-Five years of evaluation. *Clin Psychol Rev* 1988;8:77–100.
17. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol* 1988;56:893–7.
18. Carolan M, Gill GK, Steele C. Women's experiences of factors that facilitate or inhibit gestational diabetes self-management. *BMC Pregnancy Childbirth* 2012;12:99.
19. Neufeld HT. Food perceptions and concerns of aboriginal women coping with gestational diabetes in Winnipeg, Manitoba. *J Nutr Educ Behav* 2011;43:482–91.
20. Pantartzis KA, Manolopoulos PP, Paschou SA, Kazakos K, Kotsa K, Goulis DG. Gestational diabetes mellitus and quality of life during the third trimester of pregnancy. *Qual Life Res* 2019;28:1349–54.
21. Iwanowicz-Palus G, Zarajczyk M, Bień A. The relationship between health-related quality of life, acceptance of illness and characteristics of pregnant women with hyperglycemia. *Health Qual Life Outcomes* 2020;18:325.
22. Iwanowicz-Palus G, Zarajczyk M, Pięta B, Bień A. Quality of life, social support, acceptance of illness, and self-efficacy among pregnant women with hyperglycemia. *Int J Environ Res Public Health* 2019;16:3941.
23. Abolfathi M, Ashtarian H, Eskandari S, Irandoost SF, NeJhaddadgar N, Mirzaei N. Evaluation of quality of life in diabetic pregnant women. *Prim Care Diabetes* 2022;16:84–8.
24. Ozcan S, Kirca N. Comparison of women with gestational diabetes and healthy pregnant women in terms of quality of sex and sexual dysfunction. *Int J Caring Sci* 2018;11:1176–83.
25. Ribeiro MC, Nakamura MU, Scanavino Mde T, Torloni MR, Mattar R. Female sexual function and gestational diabetes. *J Sex Med* 2012;9:786–92.
26. Ribeiro MC, Nakamura MU, Torloni MR, Scanavino Mde T, Scamparini FB, Mattar R. Female sexual function of overweight women with gestational diabetes mellitus - A cross-sectional study. *PLoS One* 2014;9:e95094.
27. ACOG Committee Opinion No. 757 summary: Screening for perinatal depression. *Obstet Gynecol* 2018;132:1314–6.
28. Pace R, Rahme E, Da Costa D, Dasgupta K. Association between gestational diabetes mellitus and depression in parents: A retrospective cohort study. *Clin Epidemiol* 2018;10:1827–38.
29. Gemeay EM, Moawad SA, Mansour EA, Ebrahiem NE, Moussa IM, Nadrah WO. The association between diabetes and depression. *Saudi Med J* 2015;36:1210–5.
30. Gezginç K, Sahingöz M, Uguz F, Yazıcı F. Is depression associated with glucose tolerance abnormality in pregnant women? A cross-sectional study. *Arch Psychiatr Nurs* 2013;27:219–22.
31. Keskin FE, Ozyazar M, Pala AS, Elmali AD, Yılmaz B, Uygunoglu U, et al. Evaluation of cognitive functions in gestational diabetes mellitus. *Exp Clin Endocrinol Diabetes* 2015;123:246–51.
32. Hisli Sahin, N. Use of the beck depression inventory with Turkish university students: Reliability, validity, and factor analysis. *Turkish J Psychol* 1988;6:118–23.
33. Robinson DJ, Coons M, Haensel H, Vallis M, Yale JF. Diabetes and mental health. *Can J Diabetes* 2018;42(Suppl 1):S130–41.
34. OuYang H, Chen B, Abdulrahman AM, Li L, Wu N. Associations between gestational diabetes and anxiety or depression: A systematic review. *J Diabetes Res* 2021;2021:9959779.
35. Tang Y, Lan X, Zhang Y, Zhou F, Cai C, Zhang J, et al. Anxiety and depression on gestational diabetes mellitus in early pregnancy. *Wei Sheng Yan Jiu [Article in Chinese]* 2020;49:179–84.
36. Lee KW, Ching SM, Hoo FK, Ramachandran V, Chong SC, Tusimin M, et al. Prevalence and factors associated with depressive, anxiety and stress symptoms among women with gestational diabetes mellitus in tertiary care centres in Malaysia: A cross-sectional study. *BMC Pregnancy Childbirth* 2019;19:367.
37. Lee KW, Ching SM, Hoo FK, Ramachandran V, Chong SC, Tusimin M, et al. Neonatal outcomes and its association among gestational diabetes mellitus with and without depression, anxiety and stress symptoms in Malaysia: A cross-sectional study. *Midwifery* 2020;81:102586.
38. Azami M, Badfar G, Soleymani A, Rahmati S. The association between gestational diabetes and postpartum depression: A systematic review and meta-analysis. *Diabetes Res Clin Pract* 2019;149:147–55.
39. Hui AL, Sevenhuysen G, Harvey D, Salamon E. Stress and anxiety in women with gestational diabetes during dietary management. *Diabetes Educ* 2014;40:668–77.
40. Langer N, Langer O. Emotional adjustment to diagnosis and intensified treatment of gestational diabetes. *Obstet Gynecol* 1994;84:329–34.