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Effect of high-risk pregnancy on prenatal stress level: a prospective case-control study

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Abstract

The study aimed to determine the effects of high-risk pregnancy on prenatal stress levels. The study was conducted with a case-control design in Turkey in September-December 2019. The sample included pregnant women diagnosed with high-risk pregnancy and were at their 36th or later gestational weeks as the case group ($n=121$) and healthy pregnant women as the control group ($n=245$). The Antenatal Perceived Stress Inventory (APSI) and the Revised Prenatal Distress Questionnaire (NUPDQ-17 Item Version) were used to assess the stress levels of the participants in the study. It was determined that high-risk pregnancy was associated with higher rates of prenatal stress (APSI: $p<0.001$, effect size $=0.388$; NUPDQ: $p=0.002$, effect size $=0.272$) compared to the control group. The results of the linear regression analysis showed that high-risk pregnancy affected APSI ($R^2=0.043$, $p<0.001$) and NUPDQ ($R^2=0.033$, $p=0.009$) scores, but education levels, number of pregnancies, and number of abortions did not affect APSI and NUPDQ scores. According to the results of this study, high-risk pregnant women are in a risk group for stress. It is of great importance for the course of a pregnancy that healthcare professionals assess the stress levels of pregnant women in the high-risk pregnancy category and provide psychological support to pregnant women who have high stress levels or are hospitalized.

Keywords Pregnancy · High-risk pregnancy · Prenatal stress · Psychosocial changes during pregnancy

Introduction

A high-risk pregnancy is a significant health problem that threatens the health of the pregnant woman, the health of her fetus, and ultimately the health of her newborn, increases the risk of morbidity and mortality, and has physiological, psychological, social, and economic aspects (Cincioğlu et al., 2020; Gözüyeşil & Düzgün, 2021; Sinaci et al., 2020). Chronic diseases existing before pregnancy and problems that arise during pregnancy can make a pregnancy risky. Pregnant women with gestational diabetes mellitus, pre-eclampsia/eclampsia, potential threat of preterm labor, cervical insufficiency, premature rupture of membranes, vaginal bleeding, Rh incompatibility, intrauterine growth retardation, and infections are in the high-risk category (Gözüyeşil & Düzgün, 2021; Sinaci et al., 2020; ACOG, 2019; Soğukpınar et al., 2018; Üzar-Özçetin & Erkan, 2019; ACOG, 2018).

Approximately 10% of all pregnancies in the world are considered to be in the high-risk category (Cincioğlu et al., 2020; Gourounti et al., 2015a, b; Göüyeşil & Düzgün, 2021; Sinaci et al., 2020; Soğukpınar et al., 2018; Üzar-Özçetin & Erkan, 2019). According to Turkey Demographic and Health Survey (TNSA) 2018 data, 35% of pregnancies in Turkey are in the high-risk category (Hacettepe University Institute of Population Studies, 2019).

Good mental health during pregnancy is important for the health of both the pregnant woman and her fetus (Gümüşdaş et al., 2014). In a high-risk pregnancy, the normal outcome of the pregnancy and the birth of a healthy baby are threatened. These pregnant women have a variety of health needs that must be met. If these needs are not met, the mother may experience extreme stress and anxiety (Ölçer & Oskay, 2015). In the case of intense stress caused by the risks of pregnancy, the elevation of catecholamines such as cortisol and epinephrine may increase the possibility of pregnancy

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complications (e.g., preeclampsia) and adversely affect pregnancy outcomes (e.g., intrauterine growth retardation) (Atasever & Çelik, 2018; Cetin et al., 2017; Deshpande, 2016; Gözüyeşil & Düzgün, 2021; Riggin, 2020; Traylor et al., 2020; Yüksel et al., 2013). Moreover, newborns exposed to extreme stress during the intrauterine period may have permanent health problems later in their lives (Graignic-Philippe et al., 2014; MacKinnon et al., 2018; Van De Loo et al., 2016).

It is seen that distress in pregnancy has a high prevalence ranging between 11.9% and 63.5% in studies conducted in Turkey (Yüksel et al., 2013; Çapık et al., 2015; Gözüyeşil & Düzgün, 2021). It is very important that health professionals identify pregnant women at risk of stress to ensure a healthy pregnancy process and protect the fetus and newborn from the harmful effects of stress. This way, more careful monitoring of pregnant women at risk of stress can be ensured, and the negative consequences of stress can be prevented with appropriate interventions (Williamson et al., 2023; Atasever & Çelik, 2018; Pinar et al., 2022). It is reported in the international literature that mental problems such as anxiety and stress are more common in high-risk pregnancies than in healthy pregnancies (Byatt et al., 2014; Abedian et al., 2015; Gourounti et al., 2015a, b). In Turkey, there are few studies examining the prenatal stress levels of high-risk pregnant women. However, in these studies, the prenatal stress levels of women with healthy and high-risk pregnancies were not compared, and only the stress levels of high-risk pregnancies were determined (Gözüyeşil & Düzgün, 2021; Üzar-Özçetin & Erkan, 2019). Current evidence indicates that studies describing the concept of prenatal stress in high-risk pregnancies with different diagnoses are needed to learn more about the complex aspects of prenatal stress and identify the sociodemographic and obstetric factors that may lead to high-risk pregnancies for early diagnosis (Pinar et al., 2022; Hung et al., 2021; Gözüyeşil & Düzgün, 2021; Mete et al., 2020; Üzar-Özçetin & Erkan, 2019; Atasever & Çelik, 2018). For this reason, it is thought that this study will guide healthcare professionals who provide care for women with high-risk pregnancies about the services they will provide.

This study aims to prospectively determine the effects of high-risk pregnancies on prenatal stress levels compared to healthy pregnant women, using two different measurement instruments.

Materials and methods

Research questions

1- Does high-risk pregnancy have an impact on prenatal stress?
2- What are the factors affecting the prenatal distress levels of women diagnosed with high-risk pregnancy?
3- Is there a difference in prenatal stress levels among different high-risk pregnancy diagnoses?

Design and settings

This case-control study was conducted to determine the difference between the stress levels of women with healthy and high-risk pregnancies. In other words, it was aimed to determine the suspected causal effect of high-risk pregnancy on prenatal stress levels. This case-control study was carried out between September and December 2019 at the Obstetrics and Gynecology Inpatient and Outpatient Clinics of Atatürk City Hospital in the Balıkesir province of Turkey. The case and control groups included women who were selected from the same hospital.

Sample

The hospital where the study was conducted hosted a total of 4,152 deliveries in 2018. Approximately 10% of all pregnancies are considered to be in the high-risk category (Sinaci et al., 2020). The sample size required to conduct the study was calculated as 134 high-risk pregnant women using the Epi Info StatCalc program based on an assumed population size of 4152, prevalence of 10%, margin of error of 5%, and in a 95% confidence interval. The study was completed with a total of 384 pregnant women, including 134 high-risk pregnant women and 250 healthy pregnant women, who accepted to participate in the study and filled out the consent form. However, the data of 13 pregnant women in the case group and 5 pregnant women in the control group were excluded from the study because they filled out the data collection forms incompletely. For the case group ($n = 121$), the post hoc power analysis (G*Power 3.1) revealed a medium effect size and a power of 0.421.

The inclusion criteria of the study were being in a gestational week further than 36 weeks, not having a psychiatric diagnosis, and being 18 years old or order. Pregnant women who were hospitalized in the Obstetrics and Gynecology Inpatient Clinic, were diagnosed with high-risk pregnancy by a physician, and met the inclusion criteria were included in the high-risk pregnancy group. In the control group,

pregnant women who were healthy, were at or above their 36th gestational week, and visited the Outpatient Clinics were included. Women who wanted to leave the study or responded incompletely to the data collection forms were excluded. After those who met the inclusion criteria were included, no pregnant women withdrew from the study by their own accord. However, 18 pregnant women were excluded from the study because they filled out the forms incompletely.

High-risk pregnancies were defined as the presence of one or more of the following: pre-existing chronic diseases, preeclampsia, gestational diabetes mellitus (GDM), vaginal bleeding, placenta previa, threat of preterm labor, premature rupture of membranes, intrauterine growth retardation (IUGR), fetal anomaly/distress, multiple pregnancy, polyhydramnios/oligohydramnios, Rh incompatibility, and infectious diseases (Cincioğlu et al., 2020; Gözüyeşil & Düzgün, 2021; Sinaci et al., 2020; Üzar-Özçetin & Erkan, 2019).

Data collection

A Personal Information Form, the Antenatal Perceived Stress Inventory, and the Prenatal Distress Questionnaire were administered to the participants. The participants were informed about the study, the purpose of the study was explained to them, and their written consent was obtained. The data collection forms were administered to the participants by the first author. The data were collected based on the self-reports of the participants. The data collection period was between September and December 2019. The interviews lasted about 15 min for each participant.

Measures

Personal information form The form which was prepared by the researchers in line with the literature consisted of a total of 20 questions on some characteristics of the participants, including their sociodemographic characteristics and obstetric history (Gözüyeşil & Düzgün, 2021; Mete et al., 2020; Üzar-Özçetin & Erkan, 2019; Atasever & Çelik, 2018).

Antenatal perceived stress inventory (APSI) The Turkish validity and reliability study of the inventory developed by Razurel et al. (2014) to assess perceived stress in the prenatal period was performed by Atasever and Çelik (2018). The inventory is applied to pregnant women at the 36th -39th gestational weeks. It is a 5-point Likert-type scale (very much = 5 points, much = 4 points, quite = 3 points, a little = 2 points, none = 1 point) and consists of 12 items and 3 dimensions. Its dimensions are Medical and Obstetric Risks/Fetal Health, Psychosocial Changes during Pregnancy, and Prospect of Childbirth. The minimum and maximum scores that can be obtained from the inventory are 12 and 60. High scores indicate high levels of stress perceived by pregnant women. In the study conducted by Atasever and Çelik, Cronbach's alpha internal consistency coefficient for APSI was found to be 0.70, while this coefficient was found as 0.81 in this study.

Revised prenatal distress questionnaire ((NUPDQ)-17 Item Version) The questionnaire developed by Yali and Lobel (1999) to determine the levels of stress experienced by women regarding pregnancy-related issues was revised by Lobel (2008). The Turkish validity and reliability study of the questionnaire was performed by Yüksel et al. (2011). The questionnaire is in the form of a 3-point Likert-type scale (very much = 2 points, a little = 1 point, none = 0 point) and consists of 17 items. The questionnaire is unidimensional. The minimum and maximum scores that can be obtained from the questionnaire are 0 and 34. High scores indicate that pregnant women have high levels of prenatal distress. Cronbach's alpha internal consistency coefficient for NUPDQ was found to be 0.85 in the study performed by Yüksel et al., while it was found as 0.82 in this study.

Statistical analysis

Frequency, percentage, mean, and standard deviation values were used in the data analyses. Whether the data had normal distribution was tested using the Kolmogorov-Smirnov test. The Chi-squared test and independent-samples t-test methods were used to identify the differences between groups in terms of the sociodemographic and obstetric information of the participants. The Mann-Whitney U Test was used to determine the differences between the case and control groups in terms of their total APSI, APSI subscale, and total NUPDQ scores. The Type I error level was accepted as $p < 0.05$. A Cohen's d value of 0.20 is considered to indicate a small effect size, a value of 0.50 is considered to show a medium effect size, and a value of 0.80 or greater is interpreted as a large effect size (Özsoy & Özsoy, 2013). Since education, number of pregnancies, and number of miscarriages, which are thought to have an impact on stress levels, may be confounding factors, the linear regression analysis in this study was carried out to determine whether these factors or high-risk pregnancy affected the stress levels of the participants (Models 1 and 2). As a result of the Mann-Whitney U Test, a significant difference was found between high-risk pregnancies and healthy pregnancies in terms of "psychosocial changes during pregnancy" and "prospect of childbirth". For this reason, APSI

dimensions were collected in a single model, and a linear regression analysis was performed for the further analysis of the relationship between high-risk pregnancy and the APSI dimension scores of the participants (Model 3). The variable with the highest β coefficient was considered the relatively most significant independent variable. Multicollinearity was ignored in case of Tolerance > 0.20 and variance inflation factors (VIF) < 10. R^2 shows what percentage of the dependent variable is explained by the independent variables. According to Cohen, R^2 values of 0.0196, 0.1300, and 0.2600 are the lower thresholds for small, medium, and large effect sizes, respectively (Özsoy & Özsoy, 2013). One-Way MANOVA was also conducted to see whether there was a difference in stress levels during pregnancy between the case and control groups. The comparison of the stress levels of the participants in the case group based on their diagnoses was conducted with the Kruskal-Wallis test.

Table 1 Sociodemographic and obstetric characteristics of pregnant women

	Healthy Pregnant Women (n = 245)		High-Risk Pregnant Women (n = 121)		p
	Mean ± SD		Mean ± SD		
	n	%	n	%	
Age Mean*	26.65 ± 4.74		27.74 ± 5.88		0.058
Education**					
Primary School	70	26.6	59	48.8	**<0.001**
High School	72	29.4	38	31.4	
University	103	42	24	19.8	
Being employed with income**					
Yes	51	20.8	19	15.7	0.242
No	194	79.2	102	84.3	
Income Status**					
High	85	34.7	34	28.1	0.333
Medium	151	61.6	84	69.4	
Low	9	3.7	3	2.5	
Place of Residence**					
Village	36	14.7	23	19	0.170
Distract	57	23.3	37	30.6	
City	152	62	61	50.4	
Gravidity*	1.79 ± 1.01		2.04 ± 1.27		**0.036**
Parity*	0.52 ± 0.71		0.59 ± 0.82		0.386
Number of Abortions *	0.26 ± 0.61		0.45 ± 0.77		**0.012**
Number of Children Living*	0.51 ± 0.71		0.53 ± 0.75		0.736
Planned Pregnancy **					
Yes	180	73.5	99	81.1	0.078
No	65	26.5	22	18.2	
Smoking**					
Yes	30	12.2	14	11.6	0.595
No	189	77.1	98	81	
Quitting Smoking Due To Pregnancy	26	10.6	9	7.4	

The bold values represents as $p < 0.05$

* İndependent Sample T Test

** Chi Square Test

Ethical considerations

For the study to be carried out, approval was obtained from the Clinical Research Ethics Committee of the Faculty of Medicine of the University, and written permission was obtained from the institution where the study would be conducted (2019/123). The purpose of the study was explained to the pregnant women who agreed to participate, and they were informed that their identifying information would be kept confidential. The written consent of the participants was obtained with the Volunteer Information Form. The participants in both the case and control groups who were thought to need counseling were referred to a specialist for psychological support.

Results

Table 1 shows the sociodemographic and obstetric characteristics of the participants. There was no significant difference between the women in the case and control groups in terms of age, whether they had an income-generating job, income status, place of residence, parity, number of living children, status of having a planned pregnancy, and smoking status ($p > 0.05$). It was determined that the participants in the case group had significantly lower education levels than those in the control group ($p < 0.001$). Moreover, the number of pregnancies ($p = 0.036$) and the number of abortions ($p = 0.012$) in the case group were found significantly higher than those in the control group. These results supported the hypothesis that some sociodemographic and obstetric characteristics of women are associated with high-risk pregnancies.

According to the Kolmogorov-Smirnov test results, the total APSI and NUPDQ scores of the participants were not normally distributed ($p < 0.001$). Table 2 shows the stress levels of the participants compared based on their scale scores. The total APSI ($p < 0.001$, Cohen's d = 0.388) and total NUPDQ ($p = 0.002$, Cohen's d = 0.272) scores of the participants in the case group were significantly higher than those of the participants in the control group. The APSI Psychosocial Changes during Pregnancy ($p < 0.001$, Cohen's d = 0.473) and Prospect of Childbirth ($p < 0.001$, Cohen's d = 0.314) dimension scores of the participants in the case group were also significantly higher than those of the participants in the control group. These results supported the hypothesis that prenatal stress levels are higher in high-risk pregnancies than in healthy pregnancies.

Table 2 Stress levels of pregnant women

	Healthy Pregnant Women ($n=245$)	High-Risk Pregnant Women ($n=121$)	%95 CI		p*	Effect Size
	Mean ± SD Median/Mean Rank	Mean ± SD Median /Mean Rank				
NUPDQ Total Scores	7.98 ± 5.68 6/171.73	9.47 ± 5.24 8/207.33	−2.69	−0.27	**0.002**	**0.272**
APSI Total Scores	20.53 ± 6.81 19/169.10	23.27 ± 7.28 22/212.65	−4.26	−1.21	**< 0.001**	**0.388**
APSI Sub-Dimensions						
The medical and obstetric risks / Fetal health	5.08 ± 2.22 5/179.49	5.35 ± 2.31 5/191.62	−0.77	−0.22	0.292	
The psychosocial changes during pregnancy	7.81 ± 2.74 7/168.20	9.28 ± 3.43 8/214.47	−2.13	−0.83	**< 0.001**	**0.473**
The prospect of childbirth	7.64 ± 3.26 7/169.67	8.62 ± 2.96 8/211.50	−1.65	−0.31	**< 0.001**	**0.314**

The bold values represents as $p < 0.05$

CI Confidence Interval, *APSI* Antenatal Perceived Stress Inventory, *NUPDQ* Revised Prenatal Distress Questionnaire

*Mann Whitney U Test

Table 3 shows the stress levels of the participants with different diagnoses in the case group. In terms of risky pregnancies, the most frequently observed diagnoses were the threat of preterm labor in 37.2% of the participants in the case group, vaginal bleeding/placenta previa in 20.7%, and gestational diabetes mellitus in 10.7%. No statistically significant correlation was found between the diagnoses of the participants in the case group and their total APSI or NUPDQ scores ($p > 0.05$). This result did not support the hypothesis that there is a difference in prenatal stress levels based on differences in high-risk pregnancy diagnoses.

In the linear regression analysis, Model 1 included APSI on education, gravidity, number of abortions, and high-risk pregnancy, and it was determined that there was a significant relationship between APSI and high-risk pregnancies, where the former explained 4.3% of the total variance in the latter ($R^2 = 0.043$) ($p < 0.001$). Model 2 included NUPDQ on education, gravidity, number of abortions, and high-risk pregnancy, and it was determined that there was a significant relationship between NUPDQ and high-risk pregnancies, where the former explained 3.3% of the total variance in the latter ($R^2 = 0.033$) ($p = 0.009$). Model 3 included

Table 3 Stress levels of high-risk pregnant women

Diagnoses of Pregnant Women	n (%)	APSI Total Scores	NUPDQ Total Scores
		Mean ± SD Median/Mean Rank	Mean ± SD Median/Mean Rank
Preeclampsia	11 (9.1)	25.09 ± 6.51 24/71.45	10.45 ± 4.88 12/68.45
Gestational Diabetes Mellitus	13 (10.7)	21.61 ± 7.21 20/51.38	7.00 ± 4.47 6/45.81
Threatened Preterm Labor	45 (37.2)	23.13 ± 7.36 21/60.61	10.08 ± 5.42 9/64.78
Vaginal Bleeding/Placenta Previa	25 (20.7)	22.48 ± 5.50 23/59.74	9.08 ± 4.71 8/58.82
Oligo/Polyhydramnios	8 (6.6)	23.37 ± 9.56 21/57.19	8.75 ± 5.94 8.5/67.38
Fetal Distress	7 (5.8)	23.14 ± 3.93 23/65.64	8.85 ± 4.84 8/57.00
IUGR	6 (4.9)	26.16 ± 12.71 27/67.67	11.83 ± 7.41 10/72.83
Urinary Tract Infection	4 (3.3)	26.75 ± 12.06 24.5/68.88	10.50 ± 7.23 9.5/64.63
Rh Sensitization	2 (1.7)	21.50 ± 6.36 21.5/53.75	7.00 ± 1.41 7/46.75
p*		0.951	0.778

APSI Antenatal Perceived Stress Inventory, *NUPDQ* Revised Prenatal Distress Questionnaire

*Kruskal Wallis Test

Table 4 Evaluation of high-risk pregnancy affecting prenatal stress and prenatal distress by linear regression analysis

	β	t	*p*	%95 CI		Collinearity statistics	
Model 1						Tolerance	VIF
Education	*0.310*	*0.670*	*0.503*	*-0.599*	*1.219*	0.887	1.128
Gravidity	*-0.628*	*-1.239*	*0.216*	*-1.625*	*0.369*	0.420	2.382
Number of Abortions	*0.194*	*0.234*	*0.815*	*-1.433*	*1.820*	0.435	2.299
High-Risk Pregnancy	*2.995*	*3.735*	***< 0.001***	*1.418*	*4.573*	0.931	1.074
F = 4.067 R = 0.208	R^2 = 0.043	df1 = 4	***df2 = 361***	Durbin-Watson = 2.093 (*p* = 0.003)			
Model 2							
Education	*0.127*	*0.346*	*0.729*	*-0.593*	*0.847*	0.887	1.128
Gravidity	*– 0.0805*	*-2.004*	*0.046*	*-1.595*	-0.015	0.420	2.382
Number of Abortions	*0.453*	*0.691*	*0.490*	*-0.836*	1.741	0.435	2.299
High-Risk Pregnancy	*1.665*	*2.620*	***0.009***	*0.415*	2.914	0.931	1.074
F = 3.054 R = 0.181	R^2 = 0.033	df1 = 4	df2 = 361	Durbin-Watson = 2.012 (*p* = 0.017)			
Model 3							
The medical and obstetric risks / Fetal health	-0.017	-1.308	0.192	-0.042	0.008	0.694	1.140
The psychosocial changes during pregnancy	0.037	3.699	**< 0.001**	0.017	0.057	0.612	1.633
The prospect of childbirth	0.006	0.651	0.515	-0.013	0.026	0.592	1.690
F = 7.258 R = 0.238	R^2 = 0.057	df1 = 3	df2 = 362	Durbin-Watson = 0.515 (*p* < 0.0001)			

B Regression Coefficient, *df* degrees of freedom

The bold values represents as $p < 0.05$

Model 1: The effect of APSI on education, gravidity, number of abortions, and high-risk pregnancy

Model 2: The effect of NUPDQ on education, gravidity, number of abortions, and high-risk pregnancy

Model 2: The effect of NUPDQ on education, gravidity, number of abortions, and high-risk pregnancy

Table 5 One-way manova analysis results according to the high-risk pregnancy variable

	Variables	Sum of Squares	df	Mean of Squares	F	*p*	Partial Eta Squared
Intercept	APSI Total Scores	155441.059	1	155441.059	3198.637	< 0.001	0.898
	NUPDQ Total Scores	24677.294	1	24677.294	803.585	< 0.001	0.688
High-Risk Pregnancy	APSI Total Scores	607.222	1	607.222	12.495	**< 0.001**	0.033
	NUPDQ Total Scores	179.195	1	179.195	5.835	**0.016**	0.016
	Wilks' Lambda = 0.967	*F = 6.231*	*df = 2.000-363.000*	*p = 0.002*			
Intercept	The medical and obstetric risks / Fetal health	8823.119	1	8823.119	1734.053	< 0.001	0.827
	The psychosocial changes during pregnancy	23665.960	1	23665.960	2651.018	< 0.001	0.879
	The prospect of childbirth	21459.683	1	21459.683	2133.031	< 0.001	0.854
High-Risk Pregnancy	The medical and obstetric risks / Fetal health	6.069	1	6.069	1.193	0.275	0.003
	The psychosocial changes during pregnancy	178.659	1	178.659	20.013	**< 0.001**	0.052
	The prospect of childbirth	77.650	1	77.650	7.718	**0.006**	0.021
	Pillai's Trace = 0.057	F = 7.258	df = 3.000-362.000	*p* < 0.001			

APSI dimensions, and it was determined that there was a significant relationship between psychosocial changes during pregnancy and high-risk pregnancy, where the former explained 5.7% of the total variance in the latter ($R = 0.057$) ($p < 0.001$) (Table 4).

As a result of the MANOVA, it was determined that having a high-risk or a pregnancy was associated with significant differences in the combined set of dependent variables (APSI and NUPDQ total scores), F = 6.231, $p = 0.002$, Wilk's Lambda = 0.967. There were significant differences between the case and control groups in terms of their APSI psychosocial changes during pregnancy and prospect of childbirth dimension scores, F = 7.258, $p < 0.001$, Pillai's Trace = 0.057. (Table 5).

Discussion

This study determined the stress levels of pregnant women with high-risk and healthy pregnancies. Stress experienced in high-risk pregnancies can have negative effects in terms of the pregnancy process and maternal and fetal health (Atasever & Çelik, 2018; Gözüyeşil & Düzgün, 2021; Riggin, 2020; Traylor et al., 2020; Yüksel et al., 2011). Therefore,

it is thought that the results of this study will contribute to the literature.

It was determined in this study that the education levels of the high-risk pregnant women, who constituted the case group, were lower compared to the healthy pregnant women in the control group. Other studies in the literature have shown that risk factors in pregnancy are at higher rates in women with low educational levels (Annagür et al., 2014; Soğukpınar et al., 2018; Topalahmetoğlu et al., 2017; Türkmen, 2019). It is thought that as education levels increase, the knowledge levels of pregnant women about the management of risk factors in pregnancy increase, and these situations are intervened with in the early period. Moreover, high education levels can also prevent factors that may cause a high-risk pregnancy such as malnutrition, ill-advised exercise practices, and lack of antenatal care. For this reason, considering the results of our study, it is recommended that health professionals provide education to pregnant women with low education levels about prenatal care, proper nutrition, exercise, and antenatal follow-ups.

The numbers of pregnancies and abortions among the participants in the case group in this study were significantly higher compared to those in the control group. In the study by Orbay et al. (2017), the number of pregnancies among pregnant women with GDM was lower than the number of pregnancies among those without GDM. Cincioğlu et al. (2020) found the mean number of abortions among pregnant women with risky pregnancies to be 1.31 ± 0.71. As the number of pregnancies increases, the potential risks of pregnancy also increase. More frequent monitoring of pregnant women with a high number of abortions by health professionals and providing information about family planning methods to women with a high number of pregnancies will prevent high-risk pregnancies.

High-risk pregnancies consist of many obstetric pathologies including maternal chronic diseases. Every pathologic condition experienced during pregnancy can affect the women's stress levels (Sinaci et al., 2020). In this study, two different scales were used to measure the stress levels of the participants, and the stress levels of the participants in the case group were found to be higher than the stress levels of those in the control group. Gözübebek and Düzgün (2021) stated that 63.5% of pregnant women diagnosed with risky pregnancies experienced distress. Üzar-Özçetin and Erkan (2019) reported high perceived stress levels in high-risk pregnant women. In their meta-analysis study, Amiri and Behnezhad (2019) revealed that diabetes during pregnancy was a risk factor for anxiety symptoms, and diabetes increased the risk of anxiety by up to 48%. Other studies in the literature have shown that high-risk pregnant women also have high anxiety levels (Byatt et al., 2014; Denis et al., 2012; Gourounti et al., 2015a, b; McDonald et al., 2021; Orbay et al., 2017; Sinaci et al., 2020; Hung et al., 2021).

It was reported that low education levels, having a history of abortion, and a high number of pregnancies may cause prenatal stress (Atasever & Çelik, 2018). In this study, lower education levels and higher numbers of pregnancies and abortions were found in the case group than in the healthy control group. Since low education levels and high numbers of pregnancies and abortions were thought to be potential confounding factors in terms of prenatal stress, further analyses tests were performed, and it was determined that these factors did not affect stress levels to a significant extent. The research in this field may benefit from a more in-depth exploration of potential implications and confounding factors related to education.

In the studies performed by Üzar-Özçetin and Erkan (2019) and Yüksel et al. (2013), it was found that the stress levels of pregnant women who had experienced hospitalization due to any risk during pregnancy were high. It is considered that diagnosis methods, treatment methods, symptoms, complications, and their effects on the fetus for high-risk pregnancies cause great stress in pregnant women, and the fact that some pregnant women spend this process in the hospital increases their stress levels even further. For this reason, considering the results of our study, it is recommended that healthcare professionals inform the pregnant woman about her diagnosis and symptoms and explain each procedure to be performed, and that healthcare institutions provide more comfortable hospital rooms.

In this study, it was seen that the prenatal stress levels of the participants were high in terms of psychosocial changes during pregnancy. Intense stress can cause a sense of helplessness and hopelessness by depleting the energy of individuals, as well as negatively affecting their physical and mental health (Sharma & Rush, 2014). For this reason, healthcare professionals have an important role in the care of pregnant women with high-risk pregnancies. They should take an active role in the early diagnosis of at-risk pregnant women through qualified home visits and by initiating and continuing treatment. Advanced clinical guidelines and case management models should be developed for women having high-risk pregnancies.

In the study by Pinar et al. (2022), women with high-risk pregnancies were given training on stress management. After the training program, it was determined that 51.4% of the women in the intervention group and 75.7% in the control group experienced stress. Based on these results, it is recommended that healthcare professionals provide training, to ensure the active participation of the pregnant woman and her partner, on stress management to reduce the perceived stress, anxiety, and hopelessness levels of women in high-risk pregnancy cases. Additionally, these

pregnant women should be provided with methods to cope with stress such as breathing exercises, relaxation exercises, appropriate physical exercises, visualization/yoga, massage therapy, music therapy, explanations about social support factors, and practices strengthening their spirituality (Ölçer & Oskay, 2015).

In this study, no significant difference was found in the prenatal stress levels of the participants in the case group based on their obstetric diagnoses of high-risk pregnancy. In the study by Byatt et al. (2014), no significant difference was identified between obstetric diagnoses in terms of anxiety levels in pregnant women. A high-risk pregnancy causes high stress levels in pregnant women due to similar diagnostic tests, treatment methods, hospitalization, complications, and fetal outcomes (Kent et al., 2015).

It is thought that high stress levels are not associated with obstetric diagnoses, and similar stress levels are experienced by all pregnant women aware of any risky situation during their pregnancies. Nevertheless, an increase in stress levels in risky pregnancies such as cases of preeclampsia may cause a further aggravation in the clinical status of women. Healthcare professionals should be aware of the higher stress levels of these pregnant women, they should help the pregnant woman express her feelings and thoughts by providing a reassuring communication environment, and plan appropriate consultancy, intervention, and care routines to help reduce their stress levels. These professionals can also coach high-risk pregnant women in terms of stress reduction and coping mechanisms. Pregnant women with high stress levels should be referred to a specialist for psychological support and therapy.

Strengths and limitations

The strength of this study was its prospective design with a control group. In this study, the use of two similar scales in terms of measuring the stress levels of pregnant women provided rigor and transparency compared to data obtained in previous studies. Since these scales were included in studies in Turkey only in the context of testing their validity and reliability in Turkish, it was decided to use them in the study as they measure stress levels in the prenatal period. A limitation of the study was that the pre-pregnancy stress levels of the participants, which would affect their present condition, were not measured in the study. Women with high stress levels before pregnancy have a higher risk of high-risk pregnancy. In other words, instead of high-risk pregnancy increasing stress levels, high stress levels may have affected the high-risk pregnancy statuses of the women. The results of the study also revealed a significant difference in education levels between the case and control groups. However, as a result of further analyses, it was determined that education did not affect prenatal stress levels.

Conclusion

In this study, it was determined that high-risk pregnancy affected prenatal stress. Moreover, it was found that the participants in the case group who had high-risk pregnancies had lower education levels and higher numbers of pregnancies and abortions compared to the participants in the control group with healthy pregnancies. This is why healthcare professionals are recommended to bear in mind that pregnant women with low education levels and a high number of pregnancies and abortions are at risk of high-risk pregnancies and monitor these pregnant women more frequently and carefully.

It is of great importance for the course of a pregnancy that healthcare professionals assess the stress levels of pregnant women in the high-risk pregnancy category, provide psychological support to pregnant women who have high stress levels or are hospitalized, offer them counseling and training opportunities (e.g., relaxation exercises, breathing exercises, practices strengthening their spirituality, music therapy), take appropriate precautions, and refer these pregnant women to specialists if needed. Moreover, since the stress levels of these pregnant women will increase even more during childbirth, alternative methods to reduce the fear of childbirth and childbirth pain should be explained.

It is recommended to organize educational programs such as trainings, seminars, and conferences on stress management during pregnancy for health professionals working in family health centers, community health centers, and gynecology departments.

Consequently, more studies with larger sample sizes are needed to compare diagnostic stress levels in high-risk pregnancies. In addition to prenatal stress and childbirth fear levels, future studies should also determine the stress levels of women before pregnancy for similar comparisons between high-risk and healthy pregnancies.

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Data availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical considerations For the study to be carried out, approval was obtained from the Clinical Research Ethics Committee of the Faculty of Medicine of the University, and written permission was obtained from the institution where the study would be conducted (2019/123).

Conflict of interest No potential conflict of interest is reported by the authors.

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