



RESEARCH ARTICLE

Prenatal attachment in the COVID-19 pandemic: A cluster analysis

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ABSTRACT

Objective: This study examined the relationship between coronavirus 2019 (COVID-19) pandemic-related psychiatric symptoms and prenatal attachment in pregnant women, a group particularly vulnerable to the psychological, social, and economic effects of the pandemic.

Method: The study group consisted of 68 pregnant women with a healthy pregnancy with no reported psychiatric or other illness. The participants were grouped as those who were pregnant with low COVID-19 anxiety and obsession (Cluster 1) and those who were pregnant with high COVID-19 anxiety and obsession (Cluster 2) based on online scale scores.

Results: The prenatal attachment scores of Cluster 1 were significantly higher than those of Cluster 2. The parameter of financial difficulties due to COVID-19 circumstances was significantly different between the groups.

Conclusion: The results of this study indicated that anxiety, obsessions, and financial difficulties due to the pandemic might have negatively affected mothers' attachment to the child. Due to the possible effects of weak maternal attachment on the child's mental health, prenatal attachment may be a point for exploration of the psychological effects of the pandemic on future generations.

Keywords: COVID-19, COVID-19 anxiety, COVID-19 obsession, prenatal attachment, perinatal mental health

INTRODUCTION

The coronavirus 2019 (COVID-19) pandemic has had a broad effect across the globe in social, psychological, economic, and medical terms (1). It has been observed that the frequency of psychopathology increased in the general population as a result of conditions associated with the pandemic, including fear of a new and potentially deadly virus, quarantine measures, and disruption of daily life (2). Studies have also shown that pregnant women, a group that is already

vulnerable in terms of psychiatric symptoms, experienced greater distress than usual during the pandemic (3). Expectant mothers face a number of new worries about themselves and their unborn children (4,5). Pregnant women are now experiencing many challenges, including concerns about contracting the virus, difficulties accessing the health system, financial difficulties, and reduced social support. The resulting psychiatric symptoms that may occur not only make life difficult for pregnant women, but may also affect mother-baby attachment.

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The term "attachment"(6) refers to the relationship that the child develops with a caregiver, the bond that provides intimacy and a sense of security that enables exploration of the world and, if necessary, a safe retreat under stress or a dangerous situation (7). The attachment process begins before birth and includes the parents' feelings, thoughts, and behaviors related to the fetus. It contributes to the internal working models that the child will use in the future, including the mental images of the self, others, and relationships (8,9). Attachment contributes to creating affect regulation strategies (10). Studies have shown that prenatal attachment may also be directly related to the future mother-child relationship (11). The early relationship between parent and child affects the child's cognitive, social, and emotional development (12). A secure attachment is essential to establishing healthy relationships in adult life and reducing the risk of psychopathology (13).

It is important to determine the level of mother-fetus attachment in order to be able to treat women at risk of weak attachment with appropriate interventions and provide education and motivation to women who have an indifferent attitude or have no knowledge of attachment (14, 15). Various studies have shown that stress and psychiatric symptoms experienced by a woman during pregnancy can have negative effects on mother-infant attachment and infant behavior and development (16-18). An increase in anxiety and depressive symptoms among pregnant women has been reported during the COVID-19 pandemic. Social isolation and lack of social support has exacerbated or made existing psychiatric symptoms more difficult to manage, and made it difficult for individuals to cope with emerging psychiatric symptoms (4, 19).

While there are a limited number of studies in the literature addressing this important problem, to our knowledge, there is no available published research investigating the relationship between psychological symptoms associated with COVID-19 and prenatal attachment. The aim of this study was to explore how mothers' concerns about COVID-19 and psychiatric symptoms affected attachment to their unborn child. It was hypothesized that psychiatric symptoms and other stress factors caused by the pandemic, such as the occurrence of COVID-19 infection in the mother-to-be or a family member, inadequate social support, and financial problems as a result of pandemic measures, would have a negative effect on prenatal mother-fetus attachment.

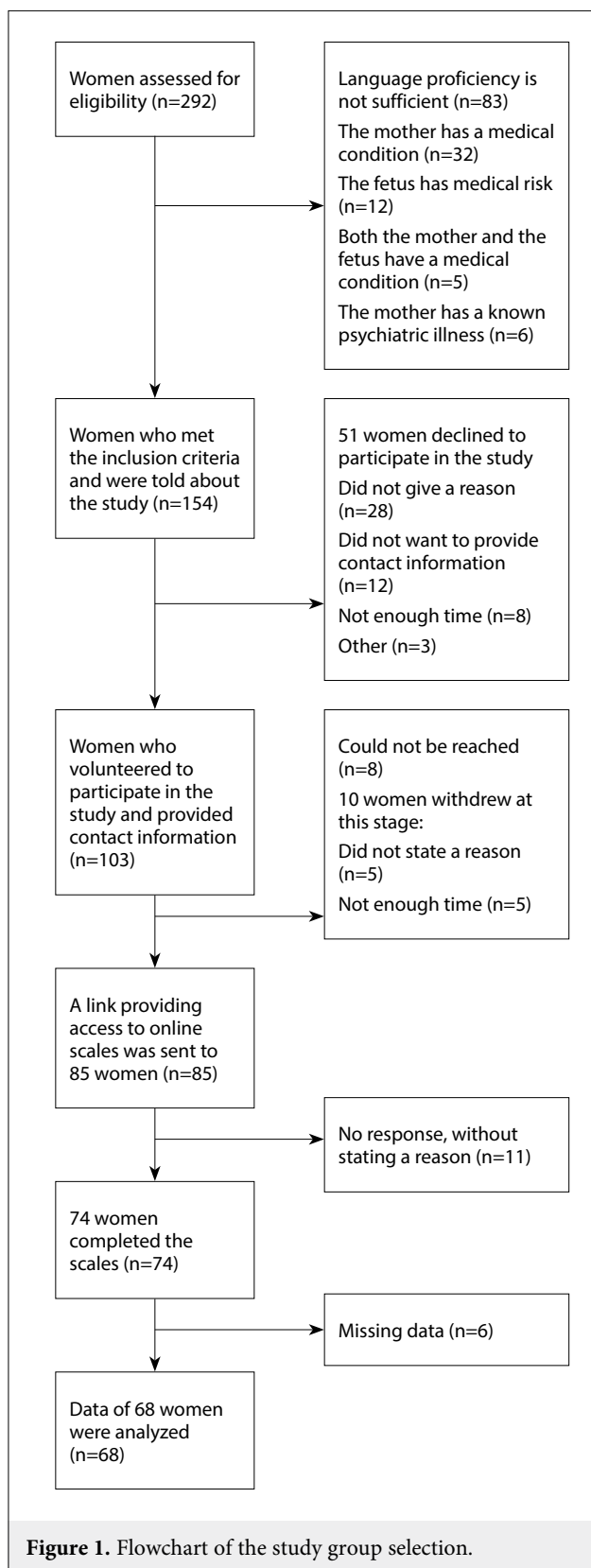
METHOD

The study protocol was approved by the Van Research and Training Hospital Institutional Review Board (IRB Date and No: 10.12.2020 - 2020/26). Informed consent was obtained from all of the patients. The study data were collected from pregnant women who came to the gynecology and obstetrics outpatient clinic for routine check-ups. Women who were examined by obstetricians and found to have a medically normal pregnancy constituted the sample group. Pregnant women with serious medical risks to themselves or the fetus were not included in the study, since this could itself be an additional stressor affecting the attachment process (20). Another exclusion criterion was a psychiatric presentation or psychiatric treatment within the previous 6 months. Existing psychiatric symptoms requiring treatment might have impaired the homogeneity of the sample. Finally, individuals considered to have an insufficient language proficiency, mental capacity, or literacy level to read and understand the questions were excluded from the study. The number of gestational weeks was not used as an exclusion criterion.

Of the 292 pregnant women who presented at an outpatient clinic for a routine examination, 154 met the study criteria and were referred for inclusion in the study. In all, 103 women volunteered to participate and were contacted by phone. Detailed information about the research was given to the 95 women who were reached. Ten women did not participate for various reasons, and the remaining 85 women were sent a prepared Google Forms link (Google LLC, Mountain View, CA, USA). A total of 74 pregnant women completed the form, and 6 were removed as a result of insufficient data. The data analysis was performed using the information of 68 pregnant women who completed the scales and provided consent (Fig. 1).

A data form was prepared to gather sociodemographic characteristics of the pregnant women and changes they had experienced related to COVID-19. The Coronavirus Anxiety Scale (CAS) and the Obsession with COVID-19 Scale (OCS) were administered to assess symptoms associated with the pandemic. In addition, the Brief Symptom Inventory (BSI) was used to assess general psychiatric condition and the Prenatal Attachment Inventory (PAI) was used to evaluate prenatal attachment.

Although the study participants had presented at the hospital, it was recommended that they complete the questionnaires online to minimize possible COVID-19



risk due to extended presence in the hospital. The participants were encouraged to complete the form at home and contact the researchers by phone with

questions. The women also provided an e-mail address for possible follow-up studies as part of the questionnaire.

Sociodemographic Data Form and COVID-19-Related Questions

A form was created that requested details of the participants' age, education, profession, financial status, mental health history, general health history, date of last menstrual period, details of previous pregnancies and any method of conception used, as well as questions related to the pandemic period, such as whether she or any of her close relatives had contracted COVID-19, experienced any loss of family member, financial difficulties, or a decrease in social support.

Coronavirus Anxiety Scale

The CAS is a 5-item scale developed by Lee et al. (21). Study results indicate that the CAS is an effective and valid tool for clinical research and practice ($\alpha=.93$). A cut-off score of 9 was used in the first validity and reliability study (90% sensitivity and 85% specificity). In a subsequent study, the cut-off score was reduced to 5 and it was still found to be acceptable for diagnostic screening ($\alpha=.92$; 71% sensitivity and 74% specificity) (21). A validity and reliability of a Turkish version of the scale was conducted by Evren et al. (22) with 1023 people whose native language was Turkish. The internal consistency of the Turkish scale was 0.80 (22). In our study, the Cronbach alpha coefficient of the scale was 0.832.

Obsession with COVID-19 Scale

The OCS is a scale consisting of 4 items. Lee et al. (21) determined that the instrument was valid and reliable. A cut-off score of 9 was seen to distinguish non-functional COVID-19 thinking patterns (81% sensitivity and 93% specificity) from those without such patterns (73% sensitivity and 76% specificity). Other study results have supported the use of the OCS as an effective and valid tool for clinical research and practice ($\alpha=.71$) (21). The Turkish validity and reliability study of the CAS demonstrated a significant correlation between the CAS and the OCS (22). The internal consistency analysis of the OCS in this study yielded a result of $\alpha=0.784$. Factor structure analysis of the scale resulted in a single-factor structure that explained 51.5% of the variance. When the clinical validity of the scale was evaluated, it was observed that there was a statistically significant, positive correlation between the BSI total score and the OCS total score ($r=0.49$).

Table 1: Sociodemographic characteristics

		Total sample (n=68)		Cluster 1 Low COVID-19 anxiety and obsession (n=44)		Cluster 2 High COVID-19 anxiety and obsession (n=24)		p
		n	%	n	%	n	%	
Mean age (years)		29.1±5.7		28.3±5.7		30.75±5.8		0.107
Trimester	1 st	5	7.4	3	6.8	2	8.3	0.655
	2 nd	15	22.1	10	22.7	5	20.8	
	3 rd	48	70.6	31	70.5	17	70.8	
Education	Pre-high school	18	26.5	11	25.0	7	29.1	0.798
	High school	17	25.0	12	27.3	5	20.8	
	University or higher	33	48.5	21	47.7	12	50.0	
Employment	Unemployed/ housewife	41	60.3	26	59.1	15	62.5	0.784
	Employed	27	39.7	18	40.9	9	37.5	
Family income	Low	13	19.1	6	13.6	7	29.2	0.074
	Average	40	58.8	25	56.8	15	62.5	
	High	15	22.1	13	29.5	2	8.3	
Number of pregnancies	1	31	45.6	24	54.5	7	29.2	0.232
	2	23	33.8	12	27.3	11	45.8	
	≥3	14	20.6	8	18.2	6	25.0	
Miscarriages	0	56	82.4	37	84.1	19	79.2	0.348
	1	9	13.2	4	9.1	5	20.8	
	≥2	3	4.4	3	6.8	0	0.0	
Pregnancy method	Natural fertilization	67	98.5	44	100.0	23	95.8	0.173
	<i>In-vitro</i> fertilization	1	1.5	0	0.0	1	4.2	

Brief Symptom Inventory

The BSI was created by Derogatis (23) as shorter version of the Symptom Check List (SCL-90). The BSI was adapted for use with Turkish adolescents by Şahin et al. (24). The scale consists of 53 items and uses a 5-point Likert scale to evaluate 5 subscales (anxiety, depression, negative self, somatization, and hostility). The internal consistency of the complete Turkish version of the scale was high ($\alpha=0.94$), as well as the subscales ($\alpha=0.71-0.85$).

Prenatal Attachment Inventory

The PAI, developed by Muller et al. (25) in 1993, was designed to measure the relationship between a pregnant woman and her unborn child. A validity and reliability study of a Turkish version resulted in an internal consistency finding of $\alpha=0.84$ and the instrument was found to be an appropriate tool to be used in clinical research (26).

Statistical Analysis

The psychometric properties of the study data were

analyzed using IBM SPSS Statistics for Windows, Version 26.0 software (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean±SD and categorical variables were presented as number (percentage). Categorical changes (stressor factors related to COVID-19) were evaluated using a chi-squared test. Non-parametric data (sociodemographic characteristics) were analyzed with the Mann-Whitney U test. The differences between continuous variables (CAS, OCS, PAI, BSI scores) were compared using the Student t-test.

Cluster analysis was performed to better understand the feelings and thoughts of pregnant women about their experience during the COVID-19 pandemic. As suggested in the literature, hierarchical and non-hierarchical clustering methods were used (27). The clustering method was based on 2 variables: COVID-19 anxiety and COVID-19 obsessions. The correlation between descriptive statistics and variables of interest was evaluated to understand the nature of the resulting cluster. The elbow method was used to

Table 2: Stressors related to COVID-19

		Total		Cluster 1 Low COVID-19 anxiety and obsession (n=44)		Cluster 2 High COVID-19 anxiety and obsession (n=24)		p
		n	%	n	%	n	%	
		A COVID-19 diagnosis (self)	Yes	3	4.5	1	2.2	
	No	65	95.5	43	97.8	22	91.7	
A positive COVID-19 test result in a relative or close acquaintance	Yes	11	16.2	6	13.6	5	20.8	0.329
	No	57	83.8	38	86.4	19	79.2	
Death of a relative or close acquaintance due to COVID-19	Yes	3	4.4	2	4.5	1	4.2	0.717
	No	65	95.6	42	95.5	23	95.8	
Financial difficulties due to pandemic	Yes	45	66.2	25	56.8	20	83.3	0.024
	No	23	33.8	19	43.2	4	16.7	
Perceived social support	Sufficient	52	76.5	34	77.3	18	75	0.529
	Insufficient	16	23.5	10	22.7	6	25	

Table 3: COVID-19-related symptoms related to anxiety and obsession, prenatal attachment, and mental health

	Cluster 1 Low COVID-19 anxiety and obsession		Cluster 2 High COVID-19 anxiety and obsession		p
	M	SD	M	SD	
Coronavirus Anxiety Scale	0.41	0.69	5.04	4.4	< 0.001
Obsession with COVID-19 Scale	1.3	1.24	6.88	3.49	< 0.001
Prenatal Attachment Inventory	63.67	6.79	59.50	8.36	0.030
Anxiety	7.59	6.80	14.63	8.64	< 0.001
Depression	9.20	8.65	16.42	10.56	0.003
Negative self-concept	7.16	9.05	11.46	7.63	0.043
Hostility	4.41	2.94	8.67	4.76	< 0.001
Somatization	6.70	5.47	12.71	7.19	< 0.001
Total	35.07	30.31	63.88	34.64	0.001

determine the appropriate size of the clusters using a dendrogram. In the second stage of the cluster analysis, the K-means algorithm was used to optimize the classification. The reliability and stability of the final clusters were tested using a random subsample (50%) of the total sample, and the analyses were repeated for this sample. Agreement of the total sample and subsample clusters was accepted with a kappa value of .85.

As a result of the clustering analysis, the pregnant women were divided into 2 groups: Cluster 1, defined as a low level of COVID-19 anxiety and obsession (n=44; 28.3±5.7), and Cluster 2 with high COVID-19 anxiety and obsession (n=24; 30.75±5.8). The total CAS and OCS scores of the pregnant women who demonstrated

low COVID-19 anxiety and obsessions were 0.4 and 1.3, respectively. The total CAS and OCS scores of the pregnant women who had a high level of anxiety and obsessions about COVID-19 were 5.0 and 6.9, respectively. There were significant differences between the groups in the BSI total and the subscores. The difference in terms of psychopathology between clusters may support the validity of these 2 clusters.

Finally, the scale scores of the clusters were compared using the Student t-test. The sociodemographic characteristics and COVID-19 related stressors were compared to characterize the clusters that emerged in the cluster analysis. A p level of <0.05 was considered statistically significant in all of the analyses.

RESULTS

Descriptive Analysis

The characteristics of all of the samples and groups are shown in Table 1. Most of the participants (70.6%) were in the third trimester of pregnancy. The average age was 29.1 years (29.1±5.7 years) and 73.5% of participants had an education level of high school or more. This was the first pregnancy for 45.6% of the group and 82.4% stated that they had not had a previous miscarriage. Most of the sample (98.5%) stated that the pregnancy was natural.

Evaluation of pandemic-related stressor factors revealed that 3 of the participants had contracted COVID-19 infection, 11 of the pregnant women had a COVID-19 infection in their close neighbors, and 3 pregnant women had lost an immediate family member due to COVID-19. Many of the women described their level of social support as good during this period, however, 66.2% of the participants reported that they had experienced financial difficulties (Table 2).

Cluster analysis was used to compare the sociodemographic data of groups grouped according to high and low COVID-19 anxiety and obsession. Data that did not demonstrate a normal distribution were compared using the Mann-Whitney U test and revealed no statistically significant difference between the groups (Table 1).

A chi-squared test was used to compare the stressor factors related to COVID-19 between the groups. No significant difference was seen in the variables of a participant having had a COVID-19 diagnosis, a positive COVID-19 test in a relative or close acquaintance, a death in a relative or close acquaintance due to COVID-19, or the level of perceived social support. Notably, 83.3% of the group with a high level of COVID-19 anxiety and obsession reported financial difficulties, while 56.8% of the group with a low level of COVID-19 anxiety and obsessions reported financial difficulties (Table 2).

Other than financial difficulty, there was no statistically significant difference between COVID-19-related stressors of pregnant women in the low COVID-19 anxiety and obsession group and the high COVID-19 anxiety and obsession group. Pregnant women who had a high level of COVID-19 anxiety and obsession reported that they experienced more financial difficulties ($p=0.024$).

Differences in Psychopathology and Prenatal Attachment

Additional psychopathologies in pregnant women were evaluated using the BSI. The Student t-test was used to

compare the BSI scores of the groups. In addition to evaluating psychopathology, the scale was used to assess the characteristics of the groups in cluster analysis and evaluate the convergent validity of the COVID-19 scales. Pregnant women with COVID-19 related anxiety and obsessions had a significantly higher total BSI score ($p<0.001$). The anxiety ($p<0.001$), depression ($p=0.003$), negative self-concept ($p=0.043$), hostility ($p<0.001$), and somatization ($p<0.001$) subscale scores were statistically significantly higher. The prenatal attachment scores of the groups were compared using the Student t-test. The pregnant women with anxiety and obsessions about COVID-19 had a lower mean PAI score ($p=0.030$, Table 3).

DISCUSSION

Due to emotional instability and susceptibility to stress due to hormonal fluctuations and other concerns, pregnancy is a risk factor for heightened adverse effects of the current COVID-19 outbreak. Given the possible risks to both themselves and their children, pregnant women represent a particularly vulnerable group (28). In a study examining the psychopathological consequences of the epidemic, a greater increase in depression, anxiety, and negative affect was observed in pregnant women than non-pregnant women. Further, the positive affect of pregnant women decreased significantly (29). In a study of 19,515 pregnant women in China who were evaluated with an online cross-sectional survey, 44.6% of the participants reported possible depression, 29.2%, possible anxiety, and 7.4%, suicidal ideation (30). Another study conducted during the pandemic period by Yassa et al. (31) found that 61.6% of pregnant women had high obsessive symptom scores associated with the COVID-19 pandemic.

In its latest guideline on prenatal care, the World Health Organization emphasized the importance of awareness of prenatal psychological and psychosocial variables and intervening to ensure the well-being of the mother and baby (32, 33). Prenatal attachment is part of an important psychological process. It has been demonstrated in various studies that maternal anxiety and obsession experienced during pregnancy negatively affected prenatal attachment (17, 34, 35).

Studies of anxiety and obsession caused by the COVID-19 virus continue, and new instruments and data are being developed (21). We used some of these new measurement tools to see whether prenatal attachment was associated with symptoms directly

related to the COVID-19 pandemic. Pregnant women with high and low CAS scores were clustered into 2 groups. These groups also correlated with the subscale scores of the BSI in terms of additional psychopathologies. The OCS scores also clustered similarly. The prenatal attachment scores between these 2 groups showed a statistically significant difference consistent with our hypothesis. To our knowledge, there is no published study on prenatal attachment related to the COVID-19 pandemic. However, our results were consistent with the literature, indicating that greater symptoms of anxiety and obsession as a result of the pandemic may negatively affect maternal fetus attachment (17, 34, 35). There are several potential reasons prenatal anxiety and obsession symptoms may have a negative effect on prenatal attachment. It has been established that attachment to the fetus may decrease when the mother has concerns about her own health or the health of her baby (17). The mother's feelings about her competency as a mother and concerns about whether she will be able to adequately protect her child's psychological and physical health also play a role in attachment. The uncertainty brought by the pandemic in this respect may have led to maladaptive cognitions in some expectant mothers (35). Studies have shown that the stress and anxiety of the mother during pregnancy affects attachment and the development of the infant through prenatal cortisol exposure, changes in hypothalamic-pituitary-adrenal axis, and cytokine release (18, 36, 37). Studies examining the relationship between a mother's obsessions and attachment have suggested that a mother's increased mental preoccupation reduced her focus on the baby and the relationship (38). It has been observed that intrusive thoughts and neutralization strategies can cause a decrease in maternal responsiveness. Maladaptive behaviors employed to reduce the stress of the mother may lead to avoidance of the infant (38-40).

When other factors were examined, the only variable that resulted in a significant difference was financial difficulties caused by the pandemic. It has been reported in the literature that financial difficulties may increase the risk of psychopathology (19, 41). Therefore, it may also affect prenatal attachment. There are studies where low-income groups scored lower in terms of prenatal attachment (42, 43). In the present study, similar to the earlier studies of Mermer et al. (44) and Aksoy et al. (45), no significant difference was found between low, middle, and high-income groups, however, the specific circumstances related to a sudden financial problem

as a result of the pandemic were found to be significant. This suggests that the uncertainty and anxiety caused by unforeseen financial problems could prevent healthy attachment between the mother and the fetus more than chronic financial problems. This information should be considered for future research.

Studies have also shown that insufficient social support can negatively affect prenatal attachment (46). In contrast to reports in the literature, we did not find a relationship between the feeling of having inadequate social support and prenatal attachment. This result may be due to the fact that the question we prepared to evaluate social support was formulated as sufficient or insufficient according to the perception of the individual, rather than using a scale. It may also be that the respondents found a reduced level of in-person support appropriate in order to avoid the risk of infection, given the circumstances.

Although studies have found differing relationships between sociodemographic characteristics and other pregnancy-related parameters and prenatal attachment, the general opinion is that a high education level, not having had a previous miscarriage, a first pregnancy, and achievement of the last trimester positively affect prenatal attachment (47). However, we found no significant difference in terms of these variables between the 2 clusters we compared. Although there are similar results in the literature (11, 47), we think the lack of difference in our study may be related to the small sample size.

To the best of our knowledge, this study is the first to examine prenatal attachment during the COVID-19 pandemic. The results represent an important addition to the literature. Nonetheless, our study does have some limitations. First, the participants were drawn from the obstetric outpatient clinic of a single hospital, and our sample size was relatively small. Second, the scales were completed online rather than in face-to-face interviews, and all of the data were self-reported. This is an important limitation, especially since a previous psychiatric diagnosis or symptoms were not confirmed by a physician. These women may have had pre-existing psychiatric disorders or predispositions that were not accounted for. Third, more objective criteria could have provided more insight into the social support and financial problem parameters perceived to be caused by the pandemic. Since we evaluated these variables using questions we prepared, these variables may have become partially subjective and, hence, less valuable. Finally, the gestational weeks of the pregnancy of the participants varied, which potentially decreased the

homogeneity of the data. However, we believe that the results of this study are valuable, since they provide initial data that have not yet been thoroughly studied. Furthermore, since the subject has the potential to provide a significant clinical benefit to many individuals, it should be prioritized in future research.

CONCLUSION

The objective of this study was to examine the psychological effects of the COVID-19 pandemic within the scope of prenatal attachment. We found that greater COVID-19 anxiety and obsessions among pregnant women may have had a negative effect on attachment. We also observed that pregnant women with a high level of COVID-19 anxieties and obsessions experienced more pandemic-related financial problems than the group with low COVID-19 anxiety and obsessions. This result provides us with some preliminary information about the future effects of the pandemic. The snapshot we have taken from this period and follow-up studies can serve as an introduction to further studies of how the psychological, social, and economic variables experienced during the COVID-19 period may affect future generations. Larger sample groups in future studies and evaluating the attachment and mental health after birth will shed further light on this issue. Given that prenatal attachment is important and can be improved with various intervention methods, we believe that additional studies of the effects and possible consequences of the pandemic are essential. The effects are likely to be significant.

Contribution Categories		Author Initials
Category 1	Concept/Design	Z.S.A., T.O.
	Data acquisition	E.B., G.B.U.
	Data analysis/Interpretation	S.C.
Category 2	Drafting manuscript	Z.S.A., S.C., T.O.
	Critical revision of manuscript	Z.S.A., S.C., E.B., T.O., G.B.U.
Category 3	Final approval and accountability	Z.S.A., S.C., E.B., T.O., G.B.U.
Other	Technical or material support	E.B., G.B.U.
	Supervision	Z.S.A., S.C., E.B., T.O., G.B.U.

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Conflict of Interest: The authors declare that there was no conflict of interest.

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