Correlation of Anxiety with Pregnancy Symptoms and Maternal-fetal Attachment

Solmaz Ghanbari-Homaie [iD][1], Sonia Hasani [iD][1] and Mojgan Mirghafourvand [2, *]

[1]Department of Midwifery, Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, Iran
[2]Social Determinants of Health Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

Corresponding author: Social Determinants of Health Research Center, Tabriz University of Medical Sciences, Tabriz, Iran. Email: mirghafourvand@gmail.com

Abstract

Background: Anxiety during pregnancy may affect maternal-fetal attachment (MFA) and the prevalence of pregnancy symptoms.
Objectives: The present study aimed to assess the correlation of anxiety with pregnancy symptoms and MFA.
Methods: This cross-sectional study was conducted on 220 pregnant women in the health centers of Tabriz, Iran, in 2020. Samples were selected by the cluster sampling method. Data were collected using the socio-demographic questionnaire, Pregnancy-related Anxiety Questionnaire-revised 2 (PRAQ-R2), MFA Scale (MFAS), and Pregnancy Symptoms Inventory (PSI), all of which were completed as self-administered in the second half of pregnancy. The Pearson's correlation coefficient and adjusted general linear model were used for data analysis.
Results: The results of Pearson's correlation showed no correlation between anxiety during pregnancy and MFA among nulliparous ($r = -0.003$, $P = 0.976$) and multiparous ($r = -0.003$, $P = 0.712$) pregnant women. However, anxiety and pregnancy symptoms were significantly correlated among nulliparous ($r = 0.424$, $P < 0.001$) and multiparous ($r = 0.227$, $P = 0.028$) pregnant women. According to the general linear model, after adjusting the socio-demographic variables, a significant correlation was observed between anxiety and pregnancy symptoms ($P < 0.001$), while no relationship was found between anxiety and MFA ($P = 0.705$).
Conclusions: Given the significant correlation between anxiety and pregnancy symptoms, pregnant women with anxiety symptoms need to be screened and treated by an expert psychological team if their disorder is confirmed.

Keywords: Anxiety, Maternal-fetal Attachment, Pregnancy Symptoms

1. Background

Pregnancy is one of the most important events in women's lives and can lead to maternal mood changes during pregnancy, such as stress and anxiety (1). Pregnant women often express concern about labor, pain, fear of childbirth, the health of the baby, or physical changes (1). A feeling of anxiety is relatively common during pregnancy, with about 10 - 15% of women experiencing some levels of stress or anxiety in this period (2). The prevalence of anxiety among Iranian women with low-risk pregnancies was reported as about 26%, which is considered relatively high (3).

A high level of anxiety can lead to negative health consequences for both mother and baby, including prenatal outcomes (4), preterm labor, low birth weight, low Apgar score, depression, prolonged labor coupled with the use of anesthesia (1, 5, 6), poor maternal-fetal attachment (MFA) (7), and developmental delay in the child (8). Moreover, anxiety during pregnancy may affect MFA and the prevalence of pregnancy symptoms. For example, anxious women are more likely to experience nausea and vomit during pregnancy and more often see a doctor to alleviate their pregnancy symptoms (7). Such signs include a wide range of physical symptoms, such as backache, headache, varicose veins, and frequent urination to psychological symptoms, namely forgetfulness, poor sleep, and depression (9). However, in most studies, the role of anxiety during pregnancy has been investigated in a limited number of symptoms, such as nausea and vomiting (10, 11).

MFA is a process that begins in the late first trimester and increases in the second and third trimesters of pregnancy, and plays an important role in the adaptation of the mother to pregnancy (8). MFA refers to a unique enduring relationship between mother and fetus (12) characterized by the positive feelings of mother and affection for the child (13). This relationship ensures the physical and emotional health of neonates and prepares them for social, cognitive, and emotional development in the future

(14, 15). Furthermore, attachment affects the mental health of the mother (16) and child development after childbirth (14, 15). Poor maternal attachment to the fetus can be associated with high levels of anxiety and depression during pregnancy (17, 18).

Some studies showed that a higher level of anxiety is associated with a lower level of MFA (6, 19). However, some other investigations demonstrated that anxiety during pregnancy had a significant albeit small effect on MFA (20). Further studies are needed as a meta-analysis found that individual effect size on prenatal anxiety and MFA differ noticeably (21). To the best of the authors' knowledge, no study has evaluated the relationship of pregnancy symptoms, either physical or psychological, with anxiety. In this regard, it is assumed that women with more anxiety would have a weaker attachment to their fetus and would experience more severe pregnancy symptoms.

2. Objectives

(1) To determine the correlation of anxiety with MFA.

(2) To determine the correlation of anxiety with pregnancy symptoms.

3. Methods

3.1. Research Questions

(1) Is there a correlation between anxiety and MFA?

(2) Is there a correlation between anxiety and pregnancy symptoms?

3.2. Study Design and Participants

The participants of this cross-sectional study were 220 women (with a 73% response rate) with normal pregnancy who were referred to the health centers of Tabriz, Iran, during January 2020 - September 2020. Inclusion criteria were being pregnant with a minimum gestational age of 20 weeks and willingness to participate in the study. The exclusion criteria entailed experiencing high-risk pregnancies, such as diabetes and hypertension, being affected with mental illness reported by the participants, major fetal abnormalities confirmed by ultrasound, and stillbirth. The sample size was calculated using the G*Power software based on the study of Hopkins et al. (6) and the correlation coefficient between MFA and anxiety (r = -0.24) considering two-sided α of 0.05 and power of 95% equal to 215. In the present study, a total of 220 women were evaluated.

3.3. Sampling

Sampling was performed through the cluster sampling method. First, a quarter of all public health centers (87 centers) in Tabriz were randomly selected using the website www.random.org. The list of pregnant women was then prepared based on health records in each center. Next, the required number of samples was randomly selected from the prepared list. One of the researchers telephoned the pregnant women and after giving the necessary explanations about the research, invited them to participate in the study. Following the acceptance of individuals the link of the research questionnaires, which was designed online due to the coronavirus pandemic available in here was sent to participants requesting them to complete the questionnaire.

3.4. Data Collection

Data collection tools in this study were a socio-demographic questionnaire, the Pregnancy-related Anxiety Questionnaire-Revised 2 (PRAQ-R2), MFA Scale (MFAS), and Pregnancy Symptom Inventory (PSI). The socio-demographic questionnaire used in this study was designed by the researcher and included questions about maternal age, marital status, the level of education, occupation, the sufficiency of monthly income for living expenses, and wanted pregnancy.

The PRAQ-R2 is a standard tool for measuring anxiety among nulliparous and multiparous women. The original version was designed in 1990 by van den Bergh and contained 34 items (22). The edited version was designed by Huizink et al. in 2016 based on an evaluation of 1144 women (2). The shortened version entails 11 questions, and answers to questions vary from not relevant at all (score 1) to very relevant (score 5). Questionnaire items are grouped in three subscales, including the fear of childbirth (questions 1, 2, 6, and 8), concern about giving birth to a child with physical or mental disability (questions 4, 9, 10, and 11), and concern about self-appearance (questions 3, 5 and 7). Scores range was 11 - 55 and 10 - 50 for nulliparous and multiparous individuals, respectively. Item 8 did not apply to multiparous women. Higher scores indicated a higher level of anxiety, and there is no cut-off point. No items in the questionnaire are inverted. Cronbach's alpha had the ranges of 0.71 - 0.85 and 0.75 - 0.84 for multiparous and primiparous women, respectively. The face and content validity of the PRAQ-R2 in Iran had already been assessed and confirmed for 30 pregnant women. Content validity index (CVI) and content validity ratio (CVR) scores were 0.97 and 0.98, respectively (23).

The MFAS contains 24 questions under the five following subscales: (1) Interaction with the fetus, (2) Distinc-

tion between self and fetus, (3) Acceptance of the maternal role, (4) Attribution of certain characteristics to the fetus, and (5) Self-sacrifice. The answers were graded based on a 5-point Likert scale as definitely yes, yes, not sure, no, and definitely no. Question 20 was scored reversely. A higher score demonstrated more attachment. The reliability of the questionnaire has been investigated by its developer using internal consistency, and $\alpha = 0.85$ has been reported (24). The validity and reliability of the MFAS in Iran have been confirmed. The face and content validity of the MFAS has been assessed and confirmed by collecting the opinions of 15 obstetricians, midwives, and gynecologists. Cronbach's alpha and test-retest reliability coefficient have been reported as 0.83 and 0.9, respectively (25, 26).

The PSI is a comprehensive tool for assessing the frequency of some symptoms, such as back pain, headache, vaginal discharge, nausea, reflux, forgetfulness, poor sleep, the feeling of depression, anxiety, and fatigue. Moreover, the effect of each symptom, if any, on daily activity restrictions is investigated. The PSI has been designed by Foxcroft et al. in Australia (27). The tool encompasses 41 questions with Likert answers (0 = "never", 1 = "rarely", 2 = "sometimes", and 3 = "often"). The face and content validity of PSI in Iran have been assessed by the authors of the present study and will be published in another paper. All items were reported simply and transparently. In addition, CVI and CVR were desirable for all items (0.8 - 1). The reliability of the items had a range of 0.51 - 1 with 0.7 and > 0.7 for most questions.

To determine the validity of the socio-demographic questionnaire, face and content validity were used. Moreover, a test-retest for 20 pregnant women two weeks apart was used to confirm the reliability of tools in terms of two aspects of repeatability intra-class correlation coefficient (ICC) and internal consistency (Cronbach's alpha coefficient). Cronbach's alpha was 0.74, 0.87, and 0.95 for PRAQ-R2, MFAS, and PSI, respectively. Furthermore, ICC was found as 0.97 for PRAQ-R2, 0.99 for MFAS, and 0.94 for PSI.

3.5. Ethical Consideration

The current study was approved by the Ethics Committee of Tabriz University of Medical Sciences (code number: IR.TBZMED.REC.1398.227). The objectives of the study were explained to research centers and participants. In addition, the individuals were reassured about the confidentiality of the data obtained in the questionnaires. All participants completed the informed written consent and were free to leave the study at any time.

3.6. Statistical Analysis

Data were analyzed using the SPSS for Windows version 24 (SPSS Inc., Chicago, IL., USA). Descriptive statistics consisting of frequency, percentage, mean, and standard deviation (SD) were used to describe the socio-demographic characteristics. The Pearson's correlation coefficient was used to evaluate the correlation of anxiety during pregnancy with MFA and pregnancy symptoms. To assess the latter correlation with controlling the socio-demographic variables as probable confounders, first, the unadjusted univariate general linear model was used to determine the relationship of MFA and pregnancy symptoms with the socio-demographic variables. Next, the socio-demographic variables which had a significant relationship with MFA and pregnancy symptoms (P < 0.05) based on the unadjusted general linear model together with the anxiety variable were entered into an adjusted univariate general linear model as independent variables.

4. Results

The mean $\pm$ SD of the age of women and their husbands and their marriage age was 28.23 $\pm$ 5.64, 33.87 $\pm$ 5.26, and 21.15 $\pm$ 4.3 years, respectively. Almost half of the women (42.3%) and 45% of men had a university degree. More than three-quarters of participants (81.4%) had insurance. Most women and their husbands were housekeepers (87.7%) and employees (97.3%), respectively. The income of approximately two-thirds of the participants (64.5%) was relatively adequate. It was observed that 60% of these pregnant women had a fear of childbirth, and 8.6% of them experienced violence during pregnancy. The mean $\pm$ SD of gestational age was 29.24 $\pm$ 4.88 weeks, and 93.2% of all of the pregnancies were wanted by women and their husbands. Nearly half of women (44.5%) were doing exercise during pregnancy, and the most common type of exercise was jogging (86.7%). We found that 75% of women received help from their husbands during pregnancy (Table 1).

The mean $\pm$ SD of anxiety during pregnancy in nulliparous (achievable score = 11 - 55) and multiparous (achievable score = 10 - 50) individuals was 28.63 $\pm$ 9.92 and 22.4 $\pm$ 9.28, respectively. Furthermore, the mean $\pm$ SD of MFA (achievable score = 24-120) and pregnancy symptoms (0 - 123) was 82.43 $\pm$ 16.86 and 53.7 $\pm$ 16.86, respectively. The results of Pearson's correlation coefficient showed no correlation between anxiety during pregnancy and MFA among nulliparous (r = -0.003, P = 0.976) and multiparous (r = -0.003, P = 0.712) pregnant women, while anxiety and pregnancy symptoms were significantly correlated in nulliparous (r = 0.424, P < 0.001) and multiparous (r = 0.227, P = 0.028) pregnant women (Table 2).

According to the unadjusted univariate general linear model, MFA significantly correlated with age (P = 0.046), attending prenatal classes (P = 0.039), exercising during pregnancy (P = 0.027), and spouse education (P = 0.022).

Table 2. Correlation of Anxiety During Pregnancy with Maternal-fetal Attachment and Pregnancy Symptoms (N = 220)

Variables	Mean (SD)	Maternal-fetal Attachment, r (P-Value)	Pregnancy Symptoms, r (P-Value)
Nulliparous anxiety during pregnancy (n = 127) [a]	28.63 (9.92)	-0.003 (0.976)	0.424 (< 0.001)
Multiparous anxiety during pregnancy (n = 93) [b]	22.4 (9.28)	-0.039 (0.712)	0.227 (0.028)
Concerns about their appearance (n = 220)	7.38 (3.73)	-0.041 (0.543)	0.253 (< 0.001)
Worries of bearing a child with physical or mental disability (n = 220)	8.33 (4.61)	0.028 (0.683)	0.267 (< 0.001)
Nulliparous fear of giving birth (n = 127)	12.49 (4.56)	0.014 (0.879)	0.309 (< 0.001)
Multipara fear of giving birth (n = 93)	7.28 (3.39)	-0.090 (0.39)	0.219 (0.035)
Maternal-fetal attachment [c]	82.43 (16.86)	-	-
Pregnancy symptoms [d]	53.70 (16.86)	-	-

[a] Total score range: 11 - 55
[b] Total score range: 10 - 50
[c] Total score range: 12 - 24
[d] Total score range: 0 - 123

The unadjusted univariate general linear model showed that none of the variables were significantly associated with pregnancy symptoms (P = 0.008). However, the adjusted univariate general linear model revealed that after adjusting the effects of age, prenatal classes, spouse education, and exercising during pregnancy, no correlation was observed between anxiety during pregnancy and MFA (P = 0.705). Following adjusting the effect of childbirth fear, anxiety during pregnancy significantly correlated with pregnancy symptoms (P < 0.001) (Table 3).

Table 3. Relationship of Anxiety During Pregnancy with Maternal-fetal Attachment and Pregnancy Symptoms Based on Adjusted General Linear Model (N = 220)

Variables	β (95% CI) [a]	P-Value
Maternal-fetal attachment		
Anxiety during pregnancy	0.04 (-0.17 - 0.25)	0.705
Attending prenatal classes (ref: no)		
Yes	-11.34 (-18.44 - -4.24)	0.002
Doing exercise during pregnancy (ref: no)		
Yes	6.10 (1.67 - 10.53)	0.007
Husband education (ref: university)		
High school or lower	-6.80 (-12.27 - -1.32)	0.015
Diploma	0.67 (-4.45 - 5.8)	0.796
Pregnancy symptoms		
Anxiety during pregnancy	0.86 (0.53 - 1.19)	< 0.001

[a] 95% Confidence Interval

5. Discussion

The present study aimed to evaluate the correlation of anxiety during pregnancy with MFA and pregnancy symptoms. The findings revealed a significant correlation between anxiety during pregnancy and symptoms, while no significant correlation was observed between anxiety and MFA.

According to our results, there was no significant correlation between anxiety during pregnancy and MFA. In a systematic meta-analysis review, 10 low-effect factors were introduced for MFA, one of which was anxiety (r = 0.17 - 0.21) [21]. In a study conducted by McFarland et al. in the United States, 161 low-risk pregnant women were enrolled at 23 - 36 weeks of gestation, and 65 of them met the criteria for depression. In this study, although depression was significantly associated with MFA, no relationship was observed between anxiety during pregnancy and MFA [28].

Hopkins et al. reported a significant correlation between trait anxiety and MFA, while state anxiety had no relationship with MFA. In this research, 94 pregnant women on 15 - 28 weeks of gestation expressed their anxiety through completing the Spielberger State-Trait Anxiety Inventory (STAI) [6]. The STAI is a self-report form for announcing state and trait anxiety symptoms. The state section of the questionnaire measures the cognitive and physical symptoms of state anxiety and is devoted to stressful situations, such as arguments, the loss of social status, as well as threats to human safety and health. On the other hand, trait anxiety is related to individual differences in response to stressful situations in general [29]. In another study on 360 low-risk pregnant women on weeks, 20 - 40 of gestation using the mentioned questionnaire in Kerman, Iran, a significant correlation was found between anxiety

and MFA ([30](#)).

The inconsistency of the aforementioned results with the findings of the current study could be mainly attributed to the type of questionnaire. In the present study, a pregnancy-specific anxiety questionnaire was used, in which state and trait anxiety are not discussed, and only the concerns of mothers about pregnancy are considered. It seems that it is better to use specialized tools to measure anxiety during pregnancy, and it has even been shown that these tools predict the consequences of childbirth better than general anxiety tools ([31](#)). However, the Spielberger Questionnaire is also advantageous due to distinguishing between state and trait anxiety. Moreover, grouping women based on different trimesters can cause inconsistencies in the results because the anxiety of pregnant women and MFA vary in distinct trimesters.

We found a significant correlation between anxiety and pregnancy symptoms. To the best of the authors' knowledge, there is no study on the relationship of all pregnancy symptoms with anxiety. Most investigations have evaluated the relationship of a few symptoms, such as nausea and vomiting, with anxiety. A descriptive study conducted in Iran on 220 women at 6 - 16 pregnancy weeks demonstrated that anxiety during pregnancy had a significant direct correlation with vomiting and nausea ([7](#)).

Moreover, a study by Kelly et al. in the United States showed that pregnant women with anxiety or depression were more likely to report physical and psychosomatic symptoms, including nausea, digestive problems, abdominal pain, headache, palpitations, and dizziness ([32](#)). In the latter study, Patient Health Questionnaire, which includes 13 symptoms, was used to assess pregnancy symptoms. Another study by Gurkan et al. ([33](#)). examined the correlation between the violence of sexual partner and pregnancy symptoms. This study also used the comprehensive tool of PSI to assess pregnancy symptoms. According to the latter research, the incidence of pregnancy symptoms was significantly higher in women who experienced verbal, economic, physical, and sexual violence during pregnancy. Women who were abused showed very high levels of anxiety and experienced more pregnancy symptoms, which was in line with our results.

Highly anxious pregnant women may show pregnancy symptoms as poor self-care and usually suffer from malnutrition. Furthermore, such women are less likely to seek prenatal care and do not follow medical and prenatal guidelines well. The consumption of anxiolytics and tobacco in this group is higher, which in turn can affect their health during pregnancy leading to symptoms. Medical conditions associated with anxiety also intensify in these women ([34](#)).

The current research clearly shows a relationship between anxiety and pregnancy symptoms. Therefore, women with the signs of anxiety during pregnancy must be screened and treated by an expert psychological team if their disorder is confirmed. Pregnant women are less often screened by experts for pregnancy-related psychological disorders, such as the fear of pregnancy or childbirth, anxiety, and depression, during pregnancy in the Iranian medical system. Consequently, specialized teams are recommended in maternity care centers as some pregnancy symptoms for which repeated treatment is provided by a midwife or gynecologist may have a psychological origin, especially with the high prevalence of anxiety in Iranian pregnant women. It is suggested that in addition to anxiety, nutritional status, the existence of concomitant medical diseases, the quality of family relationships, and prenatal care be examined for pregnant women to investigate the possible interfering effect of these factors. Further research is also recommended to identify the relationship of other pregnancy disorders with pregnancy symptoms.

5.1. Strengths and Limitations

Concerning the strengths and limitations of the current study, one of the merits of this study was the examination of all pregnancy symptoms using an accurate and valid instrument. Although the application of specific tools for measuring anxiety during pregnancy was one of the strengths of the study, the lack of distinction between current (state) and general (trait) anxiety was a limitation. Moreover, not including the pregnant women in the first half of pregnancy was another limitation, which makes the results ungeneralizable for this group. In spite of the development of internet networks in Iran, some women were not able to participate in the study as they did not have access to a smartphone or internet, which can be considered as another limitation.

5.2. Conclusions

Given the significant correlation between anxiety and pregnancy symptom, some effective interventions to decrease the anxiety of pregnant women and, therefore, relieve their pregnancy symptoms, are recommended.

Acknowledgments

Footnotes

Authors' Contribution: SH & SGH: conceptualization and design, data acquisition, manuscript preparation; MM: conceptualization and design, data acquisition, blinded data analysis, data interpretation, and manuscript preparation. All authors read and approved the final manuscript to be published.

Conflict of Interests: The authors declare that they have no competing interests.

Ethical Approval: The current study was approved by the Ethics Committee of Tabriz University of Medical Sciences (code: IR.TBZMED.REC.1398.227).

Funding/Support: This research was supported by Tabriz University of Medical Sciences (Code: 61986). The funding source had no involvement in the design of the study, data collection, and data analysis.

Informed Consent: The informed written consent was obtained from all participants.

References

1. van Bussel JC, Spitz B, Demyttenaere K. Anxiety in pregnant and postpartum women. An exploratory study of the role of maternal orientations. *J Affect Disord*. 2009;**114**(1-3):232–42. doi: 10.1016/j.jad.2008.07.018. [PubMed: 18793805].

2. Huizink AC, Delforterie MJ, Scheinin NM, Tolvanen M, Karlsson L, Karlsson H. Adaption of pregnancy anxiety questionnaire-revised for all pregnant women regardless of parity: PRAQ-R2. *Arch Womens Ment Health*. 2016;**19**(1):125–32. doi: 10.1007/s00737-015-0531-2. [PubMed: 25971851]. [PubMed Central: PMC4728175].

3. Faramarzi M, Kheirkhah F, Barat S, Cuijpers P, O'Connor E, Ghadimi R, et al. Prevalence and factors related to psychiatric symptoms in low risk pregnancy. *Caspian J Intern Med*. 2020;**11**(2):211.

4. Goodman JH, Guarino A, Chenausky K, Klein L, Prager J, Petersen R, et al. CALM Pregnancy: results of a pilot study of mindfulness-based cognitive therapy for perinatal anxiety. *Arch Womens Ment Health*. 2014;**17**(5):373–87. doi: 10.1007/s00737-013-0402-7. [PubMed: 24449191]. [PubMed Central: PMC4107206].

5. Dunkel Schetter C, Tanner L. Anxiety, depression and stress in pregnancy: implications for mothers, children, research, and practice. *Curr Opin Psychiatry*. 2012;**25**(2):141–8. doi: 10.1097/YCO.0b013e3283503680. [PubMed: 22262028]. [PubMed Central: PMC4447112].

6. Hopkins J, Miller JL, Butler K, Gibson L, Hedrick L, Boyle DA. The relation between social support, anxiety and distress symptoms and maternal fetal attachment. *J Reprod Infant Psychol*. 2018;**36**(4):381–92. doi: 10.1080/02646838.2018.1466385. [PubMed: 29727202].

7. Nikibakhsh A, Neisani samani L, Keshavarz M, Hoseini F. Incidence and Severity of Nausea and Vomiting during Pregnancy and its Association with Anxiety and Depression in Pregnant Women. *Iran J Nurs*. 2016;**29**(101):1–11. doi: 10.29252/ijn.29.101.1.

8. Kuo PC, Bowers B, Chen YC, Chen CH, Tzeng YL, Lee MS. Maternal-foetal attachment during early pregnancy in Taiwanese women pregnant by in vitro fertilization. *J Adv Nurs*. 2013;**69**(11):2502–13. doi: 10.1111/jan.12135. [PubMed: 24099514].

9. Oviedo-Caro MA, Bueno-Antequera J, Munguia-Izquierdo D. Spanish version of Pregnancy Symptoms Inventory: transcultural adaptation and reliability. *J Matern Fetal Neonatal Med*. 2017;**30**(18):2185–92. doi: 10.1080/14767058.2016.1242125. [PubMed: 27677822].

10. Koken G, Yilmazer M, Cosar E, Sahin FK, Cevrioglu S, Gecici O. Nausea and vomiting in early pregnancy: relationship with anxiety and depression. *J Psychosom Obstet Gynaecol*. 2008;**29**(2):91–5. doi: 10.1080/01674820701733697. [PubMed: 18655256].

11. Jahangiri F, Hirshfeld-Cytron J, Goldman K, Pavone ME, Gerber S, Klock SC. Correlation between depression, anxiety, and nausea and vomiting during pregnancy in an in vitro fertilization population: a pilot study. *J Psychosom Obstet Gynaecol*. 2011;**32**(3):113–8. doi: 10.3109/0167482X.2011.576790. [PubMed: 21591978].

12. Olivier L. *Maternal fetal attachment during teenage pregnancy*. Stellenbosch: Stellenbosch University; 2016.

13. Tietz A, Zietlow AL, Reck C. Maternal bonding in mothers with postpartum anxiety disorder: the crucial role of subclinical depressive symptoms and maternal avoidance behaviour. *Arch Womens Ment Health*. 2014;**17**(5):433–42. doi: 10.1007/s00737-014-0423-x. [PubMed: 24687168].

14. Reck C, Zietlow AL, Muller M, Dubber S. Perceived parenting stress in the course of postpartum depression: the buffering effect of maternal bonding. *Arch Womens Ment Health*. 2016;**19**(3):473–82. doi: 10.1007/s00737-015-0590-4. [PubMed: 26592705].

15. Rossen L, Hutchinson D, Wilson J, Burns L, A. Olsson C, Allsop S, et al. Predictors of postnatal mother-infant bonding: the role of antenatal bonding, maternal substance use and mental health. *Arch Womens Ment Health*. 2016;**19**(4):609–22. doi: 10.1007/s00737-016-0602-z. [PubMed: 26867547].

16. Delavari M, Mohammad-Alizadeh-Charandabi S, Mirghafourvand M. The Relationship of Maternal-Fetal Attachment and Postpartum Depression: A Longitudinal Study. *Arch Psychiatr Nurs*. 2018;**32**(2):263–7. doi: 10.1016/j.apnu.2017.11.013. [PubMed: 29579522].

17. Rolle L, Giordano M, Santoniccolo F, Trombetta T. Prenatal Attachment and Perinatal Depression: A Systematic Review. *Int J Environ Res Public Health*. 2020;**17**(8). doi: 10.3390/ijerph17082644. [PubMed: 32290590]. [PubMed Central: PMC7216181].

18. Allison SJ, Stafford J, Anumba DO. The effect of stress and anxiety associated with maternal prenatal diagnosis on feto-maternal attachment. *BMC Womens Health*. 2011;**11**:33. doi: 10.1186/1472-6874-11-33. [PubMed: 21749702]. [PubMed Central: PMC3148201].

19. Hart R, McMahon CA. Mood state and psychological adjustment to pregnancy. *Arch Womens Ment Health*. 2006;**9**(6):329–37. doi: 10.1007/s00737-006-0141-0. [PubMed: 16830068].

20. Yarcheski A, Mahon NE, Yarcheski TJ, Hanks MM, Cannella BL. A meta-analytic study of predictors of maternal-fetal attachment. *Int J Nurs Stud*. 2009;**46**(5):708–15. doi: 10.1016/j.ijnurstu.2008.10.013. [PubMed: 19081091].

21. Mullen B, Muellerleile P, Bryant B. Cumulative Meta-Analysis: A Consideration of Indicators of Sufficiency and Stability. *Pers Soc Psychol Bull*. 2016;**27**(11):1450–62. doi: 10.1177/01461672012711006.

22. van den Bergh B. The influence of maternal emotions during pregnancy on fetal and neonatal behavior. *J Prenat Perinat Psychol Health*. 1990;**5**(2):119.

23. Bayrampour N, Nourizadeh R, Mirghafourvand M, Mehrabi E, Mousavi S. Psychometric properties of the pregnancy-related anxiety questionnaire-revised2 among Iranian women. *Crescent J Med Biological Sci*. 2019;**8**:23–5.

24. Muller ME. Development of the Prenatal Attachment Inventory. *West J Nurs Res*. 1993;**15**(2):199–211. discussion 211-5. doi: 10.1177/019394599301500205. [PubMed: 8470375].

25. Hasanabadi H, Esmaili H, Tafazzoli M, Abbasi E. The effect of training maternal-fetal attachment behavior on primipara maternal mental health in the third trimester of pregnancy. *J Sabzevar Univ Med Sci*. 1970;**15**(2):104–9.

26. Mehran P, Simbar M, Shams J, Ramezani-Tehrani F, Nasiri N. History of perinatal loss and maternal-fetal attachment behaviors. *Women Birth*. 2013;**26**(3):185–9. doi: 10.1016/j.wombi.2013.04.005. [PubMed: 23721683].

27. Foxcroft KF, Callaway LK, Byrne NM, Webster J. Development and validation of a pregnancy symptoms inventory. *BMC Pregnancy Childbirth.* 2013;**13**:3. doi: 10.1186/1471-2393-13-3. [PubMed: 23324494]. [PubMed Central: PMC3599678].

28. McFarland J, Salisbury AL, Battle CL, Hawes K, Halloran K, Lester BM. Major depressive disorder during pregnancy and emotional attachment to the fetus. *Arch Womens Ment Health.* 2011;**14**(5):425–34. doi: 10.1007/s00737-011-0237-z. [PubMed: 21938509]. [PubMed Central: PMC3248759].

29. Speilberger CD, Gorsuch RL, Lushene PR, Vagg PR, Jacobs GA. *State-trait anxiety for adults (STAIS-AD) manual. Palo Alto.* CA: Consulting Psychologists Press; 1983.

30. Abazari F, Pouraboli B, Tavakoli P, Aflatoonian M, Kohan M. Anxiety and Its Relationship with Maternal Fetal Attachment in Pregnant Women in Southeast of Iran. *I-managers J Nurs.* 2017;**7**(3). doi: 10.26634/jnur.7.3.13788.

31. Huizink AC, Menting B, Oosterman M, Verhage ML, Kunseler FC, Schuengel C. The interrelationship between pregnancy-specific anxiety and general anxiety across pregnancy: a longitudinal study. *J Psychosom Obstet Gynaecol.* 2014;**35**(3):92–100. doi: 10.3109/0167482X.2014.944498. [PubMed: 25093467].

32. Kelly RH, Russo J, Katon W. Somatic complaints among pregnant women cared for in obstetrics: normal pregnancy or depressive and anxiety symptom amplification revisited? *General Hospital Psychiatry.* 2001;**23**(3):107–13.

33. Gurkan OC, Eksi Z, Deniz D, Circir H. The Influence of Intimate Partner Violence on Pregnancy Symptoms. *J Interpers Violence.* 2020;**35**(3-4):523–41. doi: 10.1177/0886260518789902. [PubMed: 30049233].

34. Fishell A. Depression and anxiety in pregnancy. *J Popul Ther Clin Pharmacol.* 2010;**17**(3):e363–9. [PubMed: 21041870].

Table 1. Socio-demographic and Obstetric Characteristics of Participants (N = 220)

Characteristics	No. (%)
Age (y) [a]	28.23 (5.64)
Husband age (y) [a]	33.87 (5.26)
Marriage age (y) [a]	21.15 (4.3)
Nationality	
Azeri	213 (96.8)
Persian	7 (3.2)
Marital status	
Live with husband	220 (100)
Education	
High school or lower	49 (22.2)
Diploma	78 (35.5)
College	93 (42.3)
Husband education	
High school or lower	54 (24.5)
Diploma	67 (55)
University	99 (45)
Passive smoker	
Yes	60 (27.3)
No	160 (72.7)
Insurance	
Yes	179 (81.4)
No	41 (18.6)
Job	
Housekeeper	193 (87.7)
Employee	27 (12.3)
Husband job	
Unemployed	6 (2.7)
Employee	213 (97.3)
Residential type	
Personal house	122 (55.5)
Rental house	80 (36.4)
Relative's house	18 (8.2)
Income adequacy	
Completely adequate	33 (15)
Relatively adequate	142 (64.5)
Non-adequate	
Fear of childbirth	
Yes	132 (60)
No	88 (40)

Violence during pregnancy	
Yes	19 (8.6)
No	201 (91.4)
Kind of delivery in multiparous women	
Vaginal	51 (29.3)
Cesarean section	123 (70.7)
Fetus gender favorite	
No	6 (2.8)
Yes	212 (97.2)
Gestational age (weeks) [a]	29.24 (4.88)
Gravidity	
1	99 (45)
2	77 (35)
≥ 3	44 (20.1)
Abortion history	
Yes	48 (21.9)
No	172 (78.2)
Parity	
0	127 (57.7)
1	74 (33.6)
≥ 2	19 (8.6)
Wanted pregnancy	
No	15 (6.8)
Yes	205 (93.2)
Attending in prenatal class	
Yes	24 (10.9)
No	196 (89.1)
Prenatal class number (session)	
1 - 3	17 (70.8)
4 - 8	7 (29.2)
Doing exercise during pregnancy	
Yes	98 (44.5)
No	122 (55.5)
Exercise number (per week)	
1 - 2	35 (36.5)
3 - 4	37 (38.5)
5 - 7	24 (25)
Duration of exercise (min)	
5 - 10	14 (14.6)
15 - 30	76 (79.2)
> 30	6 (6.1)
Kind of exercise	
Jogging	85 (86.7)

Others [b]	13 (13.3)
Receiving help during pregnancy	
Husband	165 (75)
Father/mother	50 (22.7)
Relatives/friends	5 (2.3)
Fetus gender	
Female	100 (45.5)
Male	116 (52.7)
Unknown	4 (1.8)

[a] Data are reported as Mean (standard deviation)
[b] Aerobic exercise and yoga