Mediating role of prenatal depression in attachment and maternal-fetal attachment in primigravida in late pregnancy

Ling Zhang
School of Mental Health and Psychological Sciences, Anhui Medical University, Hefei 238000, China

Lei Wang
School of Mental Health and Psychological Sciences, Anhui Medical University, Hefei 238000, China

Qiuyu Yuan
School of Mental Health and Psychological Sciences, Anhui Medical University, Hefei 238000, China

Cui Huang
School of Mental Health and Psychological Sciences, Anhui Medical University, Hefei 238000, China

Shu Cui
School of Mental Health and Psychological Sciences, Anhui Medical University, Hefei 238000, China

Kai Zhang
Chaohu Hospital, Anhui Medical University, Hefei 238000, China

Xiaoqin Zhou (✉ Zhouxqlulu@126.com)
Chaohu Hospital, Anhui Medical University, Hefei 238000, China

Research Article

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Abstract

Background: Prenatal depression and attachment are factors that affect the establishment of an intimate relationship between a mother and fetus. The study explored differences in prenatal depression and maternal-fetal attachment (MFA) scores between different type of attachment as well as the effects of maternal depression scores and attachment dimensions on maternal intimacy with fetus.

Methods: The Edinburgh Postnatal Depression Scale (EPDS), Experience of Close Relationship (ECR) scale, Maternal Antenatal Attachment Scale (MAAS) and a general data scale were used to investigate 260 primigravida. Exploratory analysis was performed to analyze the effects of depression score and attachment on MFA.

Results: The results showed that pregnant women with insecure attachment exhibited an increased prevalence of prenatal depression, lower total score of MFA and lower MFA quality compared with those women with secure attachment. Explorative analysis showed that depression score mediated the relationship between attachment avoidance and MFA quality.

Conclusions: Primigravida who had insecure attachment exhibited an increased prevalence of prenatal depression and lower MFA. Maternal depression and attachment may affect the emotional bond between a mother and fetus. This finding should be taken seriously, and early intervention needs to take personality traits into consideration.

Background

Pregnancy is a significant and arduous process that can be extremely challenging for a woman physiologically and psychologically. According to a review of 101 studies, the prevalence of perinatal depression was 11.9%[1]. A systematic review including 48904 persons from 20 low-income middle-income countries reported that the prevalence of depression was 25.3% prenatally[2]. Prenatal depression not only affects the mood of the pregnant women, such as increasing the risk of suicide and the prevalence of postpartum depression[3, 4], but also affects the development of the fetus[5, 6], and even increases the risk of mental health issues in the child[7]. Moreover, prenatal depression can significantly predict the degree of attachment from pregnant women to the fetus[8, 9] and even affect the intimate bond with children after pregnancy[10].

Maternal-fetal attachment (MFA) is the mother’s emotional connection to the fetus and is an important indication of whether the pregnant mother can adapt to changes in pregnancy and assume maternal responsibility[11]. MFA increases with gestational age[12]. In addition, MFA can predict the postpartum mental status of mothers, such as the presence of anxiety and depression, and affect postpartum mother-infant attachment quality[13]. Pregnant women with weak MFA are less likely to engage in health promotion activities and more likely to have an unhealthy newborn compared with those with strong MFA[7]. Moreover, a significant positive correlation is noted between MFA and neonatal outcome during pregnancy[14]. In addition, the level of MFA can predict children's development of early behavioral and emotional ability[15]. In addition to prenatal depression, many factors are predictors of MFA, such as gestational age, social support and prenatal examination depression[16]. Personality characteristics of pregnant women, such as adult attachment, can also affect MFA.

Attachment is defined as an emotional connection between an individual and their primary caregiver in the earliest stage of life[17]. Attachment behavior forms an internal working model during individual development, and when people encounter difficulties or significant changes in life, such as pregnancy[18], the internal working model is activated and manifested in different ways, eliciting emotional and behavioral responses. Attachment has an acknowledged role in maternal mental health[19]. Catherine's quality-stress model showed that relationship templates dominated by fear or lack of security, such as insecure attachment, may become a personality trait, making women more vulnerable to perinatal depression than those without this trait[20]. The level of prenatal attachment affects maternal-infant attachment after delivery[21]. In a recent study by Huang and colleagues, women with greater attachment anxiety and avoidance exhibited more symptoms of depression[22].
Taken together, prenatal depression, MFA and attachment all are related. A previous study indicated that depression partially mediated the connection between insecure attachment and mother-infant attachment after birth[23]. Additionally, the regulatory role of postpartum depression symptoms in the relationship between different attachment types and postpartum bonding was also confirmed[24]. However, the role of maternal depression and two dimensions of attachment (avoidance and anxiety) for MFA during pregnancy are not currently known. The purpose of this article was to explore the difference between prenatal depression and MFA in pregnant women with different attachment style as well as the role of maternal depression and attachment on MFA. More specifically, we predicted that maternal depression will mediate the relationship between the two dimensions of attachment and MFA.

**Methods**

**Participants**

Data were collected at the antenatal clinic of Chaohu Hospital of Anhui Medical University from September to December 2019. The hospital is a comprehensive tertiary hospital, providing medical services to approximately one million people. The inclusion criteria were as follows: 1) participants were primigravida; 2) pregnant women aged 18-45 years; 3) women with a gestational age of 28-40 weeks; and 4) women with singleton gestation. The exclusion criteria were as follows: 1) women with a previous history of mental illness; 2) women with a high-risk pregnancy (gestational diabetes, hypertension and preeclampsia); 3) women have a history of miscarriage. We administered 280 questionnaires and finally analyzed 260 questionnaires after excluding incomplete and invalid questionnaires. The sample recovery rate was 92.86%.

**Procedures**

The ethics committee of Chaohu Hospital of Anhui Medical University approved the study protocol. The procedures used in this study adhered to the principles of the Declaration of Helsinki. All the women signed informed consent forms. The evaluation and screening of all scales were completed by two nurses and three uniformly trained graduate students, and standardized instructions were given to all participants before the start of the research.

**Measures**

**Demographic characteristics**

We used a self-designed questionnaire to collect demographic characteristic data, including age, gestational age, education level, planned pregnancy, prenatal education, working status, exercise, and marital satisfaction of pregnant women enrolled in our study.

**Prenatal depression**

The Edinburgh Postpartum Depression Scale (EPDS)[25] was chosen to assess the participants’ severity of depression. The EPDS can be used to screen for postpartum depression as well as depression during pregnancy. The EPDS contains a total of 10 items. The total score ranges from 0 to 30, and the higher the score is, the more serious the degree of depression. The content validity ratio is 0.93. The α coefficient is 0.76. We regarded a total EPDS score ≥12 as being indicative of diagnosing maternal depression. This scale has been verified in different cultures[26-28]. Furthermore, this scale has been proved and practiced frequently in China[29, 30].

**Attachment**

Attachment in all pregnant women was assessed with the Experience of Close Relationship (ECR) scale[31], which demonstrated high measurement accuracy[32]. The scale consists of 36 items, each ranging from 0 "strongly disagree" to 7 "strongly agree". The scale has two dimensions: anxiety and avoidance. The avoidance subscale includes 18 items, indicating the avoidance of intimacy and interdependence. The anxiety subscale also includes 18 items and indicates concerns about
exclusion and abandonment. According to the score of the two dimensions, attachment can be divided into secure and insecure attachment, in which there are three types in insecure styles (attentive, indifferent and phobic).

**MAAS**

The Maternal Antenatal Attachment Scale (MAAS) [33] was used to assess the MFA of the participants. The MAAS is a self-reported scale that includes 19 questions with a 5-point scoring system, and the total score of MFA ranges from 5 to 95, with higher score signifying higher MFA[34]. The scale includes two sub-dimensions: “MFA quality” (items 3, 6, 9, 10, 11, 12, 13, 15, 16, and 19) and “MFA intensity” (items 1, 2, 4, 5, 8, 14, 17, and 18). The item 7 is only included in the total score and does not affect any of these two dimensions. MFA quality indicates the emotional experience with regard to the fetus, and MFA intensity indicates the time and energy devoted to the fetus by the pregnant women.

**Data analysis**

We used the Statistical Package for Social Sciences (IBM SPSS 22.0) for all analyses conducted in this study. The continuous variables were tested by t-test or Mann-Whitney U test according to whether they obeyed the normal distribution, and the chi-square test was used to classify the variables. Before the mediation analysis, Spearman's correlation was calculated to determine the correlations between attachment anxiety or avoidance, the maternal depression score, and MFA. Finally, we found pairwise correlations between anxiety/avoidance, the depression score, and MFA quality. Subsequently, model 4 of Hayes's (2013) PROCESS macro and Bootstrap were used to analyze the mediating effect. The model estimates the direct effect of anxiety/avoidance on maternal depression and maternal depression on MFA, the indirect effect of attachment anxiety/avoidance on MFA mediated by maternal depression as well as the direct effect of on MFA. A p-value of 0.05 was considered to be statistically significant.

**Results**

**Demographic characteristics of the participants**

Two hundred and sixty pregnant women were enrolled in our study. The mean age of the pregnant women was 26.52 (SD = 3.18) years, and the mean gestational age was 35.37 (SD = 2.57) weeks. Among all participants, 54.23% of the pregnant women had secure attachment. The majority had a high school or junior college diploma (51.39%), and those with a junior high school or lower and bachelor's degree or higher accounted for 16.15% and 31.92% of the total, respectively. Moreover, 71.15% of participants had a planned pregnancy, and 64.23% had prenatal education during pregnancy. In addition, 59.62% of the pregnant women were employed. When asked whether they exercised during the pregnancy period, 71.15% of pregnant women said yes. Additionally, 84.23% of the participants reported that they were satisfied with their marriage. Our results also showed that a total 18.85% of the pregnant women had a score of 12 or greater, indicating prenatal depression. The mean total score of MFA was 74.12 (SD = 7.32), and the mean MFA intensity and the MFA quality were 28.21 (SD = 4.62) and 42.14 (SD = 4.57) respectively.

**Differences in the demographic characteristics, prenatal depression and MFA between the secure and insecure groups**

As shown in Table 1, compared with the secure group, the prevalence of depression was increased in the insecure group (61.22% vs 38.78%, p = 0.016). The EPDS score was also higher in the insecure group (8.64±4.47 vs 6.99±4.24, p = 0.003). In addition, the results suggested that the total score of MFA and MFA quality were both lower in the insecure group compared with the secure group (72.87±7.14 vs 75.17±7.33, p < 0.001; 41.34±4.48 vs 42.82±4.54, p = 0.003). Moreover, no differences in the demographic characteristics and MFA intensity were noted between the two groups (all p > 0.05).

Table 1. Demographic characteristics, prenatal depression and MFA between the secure and insecure groups
| All participants (n=260) | Secure (n=141;54.23%) | Insecure (n=119;45.77%) | t/Z/X | P |
|--------------------------|------------------------|--------------------------|------|---|
| **Age (years)**          | 26.52±3.18             | 26.66±3.03               | 26.34±3.37 | -1.020 | 0.308 |
| **Gestational weeks**    | 35.57±2.57             | 35.37±2.73               | 35.81±2.35 | -0.1056 | 0.291 |
| **Education**            |                        |                          |      |    |
| High school or lower     | 42(16.15%)             | 19(45.24%)               | 23(54.76%) | 4.893 | 0.087 |
| High school or junior college | 135(51.93%)     | 82(60.74%)               | 53(39.26%) |      |      |
| Bachelor degree or higher | 83(31.92%)       | 40(48.19%)               | 43(51.81%) |      |      |
| **Planned pregnancy**    | Yes 185(71.15%)        | 98(52.97%)               | 87(47.03%) | 4.893 | 0.087 |
| **Prenatal education**   | Yes 167(64.23%)        | 95(56.89%)               | 72(43.11%) | 1.326 | 0.249 |
| **Employed**             | Yes 155(59.62%)        | 57(36.77%)               | 98(63.23%) | <0.001 | 0.988 |
| **Exercise**             | Yes 185(71.15%)        | 82(60.74%)               | 43(51.81%) | 0.409 | 0.523 |
| **Marital satisfaction** | Yes 123(46.16%)        | 40(48.19%)               | 43(51.81%) | 0.291 | 0.523 |
| **Prenatal depression**  | Yes 19(38.78%)         | 30(61.22%)               | 5.811 | 0.016 |
| **EPDS score**           | 7.75±4.14              | 6.99±4.24                | 8.64±4.47 | -2.922 | 0.003 |
| **Total score of MFA**   | 74.12±7.32             | 75.17±7.33               | 72.87±7.14 | 2.548 | <0.001 |
| **MFA intensity**        | 28.21±4.62             | 28.49±4.39               | 27.87±4.87 | -1.533 | 0.125 |
| **MFA quality**          | 42.14±4.57             | 42.82±4.54               | 41.34±4.48 | -2.992 | 0.003 |

| Primigravida(n=260) | Multigravida (n=172) | t/Z/X | P |
|---------------------|-----------------------|------|---|
| **Age (years)**     | 26.52±3.19            | 31.44±4.26 | -11.89 | <0.001 |
| **Gestational weeks** | 35.57±2.60          | 35.58±2.64 | -0.126 | 0.900 |
| **Education**       |                        |      |    |
| Less than high school | 97                    | 55 | 19.878 | <0.001 |
| High school or junior college | 222               | 87 |      |    |
| Bachelor degree or higher | 113              | 30 |      |    |
| **Body shape change** | Yes 343               | 146 | 5.257 | 0.022 |
| No 89               | 26 |      |    |
| **Prenatal education** | Yes 273              | 106 | 0.302 | 0.583 |
| No 159              | 66 |      |    |
| **Employed**        | Yes 177               | 72 | 0.093 | 0.760 |
| No 255              | 100 |      |    |
| **Exercise**        | Yes 302               | 117 | 0.482 | 0.487 |
| No 130              | 55 |      |    |
| **Marital satisfaction** | Yes 355             | 136 | 1.882 | 0.170 |
| No 77               | 36 |      |    |
| **Avoidance**       | 2.86±0.79             | 2.91±0.79 | -0.948 | 0.343 |
| **Anxiety**         | 2.92±0.79             | 2.91±0.83 | -0.151 | 0.880 |
| **EPDS score**      | 7.36±4.42             | 6.77±4.37 | -2.380 | 0.017 |
| **Prenatal depression** | Yes 113             | 37 | 3.193 | 0.074 |
| No 319              | 135 |      |    |
| **Total score of MAAS** | 73.63±7.50          | 72.90±7.73 | 1.664 | 0.097 |
| MAAS intensity      |                      |      |    |

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Explorative analysis

To determine the relationship among the variables of the EPDS score, two dimensions of attachment (avoidance and anxiety) and MFA, Spearman’s correlation analyses were performed (Table 2). As noted in Table 2, both avoidance and anxiety were correlated with the EPDS score and the MFA quality (all p < 0.05), and the EPDS score was also correlated with the MFA quality. However, there was only a significant indirect effect of avoidance on MFA quality through depression (b = -0.2474, SE = 0.1175, 95% CI=[-0.5438–-0.0691]). Figure 1 shows the coefficients of the relationships among the independent, mediating, and outcome variables.

| Variable          | EPDS score | Avoidance | Anxiety | Total score of MFA | MFA intensity | MFA quality |
|-------------------|------------|-----------|---------|-------------------|---------------|-------------|
| EPDS score        | 1.000      |           |         |                   |               |             |
| Avoidance         | 0.171**    | 1.000     |         |                   |               |             |
| Anxiety           | 0.330**    | 0.245**   | 1.000   |                   |               |             |
| Total score of MFA| -0.044     | -0.192**  | -0.023  | 1.000             |               |             |
| MFA intensity     | 0.101      | -0.143    | 0.059   | 0.835**           | 1.000         |             |
| MFA quality       | 0.235**    | -0.194**  | -0.144* | 0.794**           | 0.410**       | 1.000       |

Legend: *p < 0.05, **p < 0.01

Discussion

To the best of our knowledge, this is the first study on the effects of attachment and EPDS score on MFA in primigravida. These results are helpful for understanding the influence of attachment and depression on MFA.

In our study, a total of 18.85% of the participants suffered from prenatal depression, which is similar to a previous study[35], but lower than that in another study of Chinese primipara in late pregnancy[36]. One possible explanation is the difference in the prenatal depression screening scale used, and another possible explanation might be the difference in demographic data.

We found that women with secure attachment had a lower prevalence of prenatal depression. A pregnant woman’s attachment patterns continue to affect her experience of the fact of pregnancy, increasing the risk of mood disorders during pregnancy[20]. Individuals with secure attachment would seek social support to regulate negative emotions when needed[37]. Moreover, pregnant women with secure attachment reported high total score of MFA and MFA quality. A study of 165 pregnant women in Poland also found that maternal attachment affects her image as a mother and her connection with fetus[38], and people with secure attachment are more likely to assume the role of parents[18]. Therefore, prenatal intervention can be performed in terms of the personality structure of pregnant women, such as attachment. A previous study also noted that it is necessary to screen for attachment styles and provide tailored care during pregnancy[39].

Further analysis revealed that maternal attachment avoidance and anxiety were negatively related to MFA quality, which was consistent with previous research results[40]. Self-reported romantic attachment predicts high avoidance scores on the parental role scale in pregnant women, and they may face difficulties in developing their maternal identity[38]. Those who attached great importance to attachment avoidance felt uncomfortable with intimacy and invalidated the attachment system[41]. Thus, we can infer that in the third trimester, pregnant women with high avoidance may not respond to fetal movement, and as a result, the emotional experience with regard to the fetus may be relatively low. In addition, people with high attachment anxiety were afraid of rejection, so they may think they do not have the ability to cultivate intimate
relationships and pay more attention to their own distress and attachment needs\[42, 43\]. In addition, there was also a negative correlation between depression during pregnancy and MFA quality. Previous research also revealed that pregnant women with depression were less sensitive to the fetus\[44\], and depression during pregnancy was also a risk factor for poor MFA\[11\].

The exploratory mediation analysis revealed that low maternal attachment avoidance directly and indirectly reduced the MFA quality score through the prenatal depression score. The results suggested that an avoidance attitude toward the attachment subjects rendered them susceptible to the interference of depression symptoms, reducing emotional investment in the fetus. The possible mechanism is that the internal working model of attachment has an important impact on an individual’s cognition, emotion, and behavior with regard to interpersonal communication, and the avoidance attachment model formed in childhood leads to a sense of mistrust of others in pregnant women. This internal working model is triggered by stressful events, such as pregnancy, and leads to depression during pregnancy, further reducing the emotional investment and energy devoted to the fetus, that is, poor MFA. Condon indicated that parental psychological variables could affect MFA quality. Moreover, attachment avoidance-related deactivation strategies are associated with depression maintenance\[13\]. In fact, when perceiving positive emotional information, people with high attachment avoidance are unable to experience positive emotions; to avoid the activation of the attachment system, they tend to deactivate their emotional channels and hide their feelings\[45\]. People with a high level of avoidance are less willing to be parents and feel more pressure to raise children\[46\]. It seems that attachment avoidance and the prenatal depression score both affect the mother’s intimate connection to the unborn fetus. However, no mediating role of the prenatal depression score was observed in attachment anxiety and MFA quality, and a previous study demonstrated that caregivers with a higher degree of avoidance are less responsive than those with a lower degree of avoidance\[47\]. MFA quality is related to the mental health of mothers, whereas MFA intensity is not associated with mental health\[48\]. Existing research has also revealed that the focus of future research should also be on the dimension of MFA\[49\].

Our results revealed the relationship between attachment avoidance and the prenatal depression score and their effects on the degree of emotional communication and interaction between the mother and the fetus, further providing a basis for understanding the development of maternal-fetal relationships. In prenatal screening, the timely detection of low-quality MFA and the application of effective interventions on the basis of the prenatal depression score or attachment can help pregnant women adapt to their changing role in a timely manner. This can prevent incidents, such as domestic child violence, and allow women to better care for their newborn to ensure healthy and balanced development\[50\].

There are some limitations in our study. First, this study was restricted by its cross-sectional design, and we did not track postpartum depression and mother-infant attachment, which should be evaluated in the next steps of our work. Moreover, given that all the data were evaluated at a measurement point, directional and causal conclusions could not be drawn directly in this design. In addition, data collection was based on a convenience sampling, so our participants may not represent the general pregnant population.

Despite these limitations of our research, our findings provide new insights into understanding the mother-fetal relationship before childbirth and might be effective in giving guidance for prenatal psychological education and individualized interventions.

**Abbreviations**

**EPDS:** Edinburgh Postpartum Depression Scale  
**ECR:** Experience of Close Relationship  
**MAAS:** Maternal Antenatal Attachment Scale  
**MFA:** Maternal-fetal attachment  
**CI:** Confidence interval
Declarations

Ethics approval and consent to participate

The ethics committee of Chaohu Hospital of Anhui Medical University approved the study protocol. All participating pregnant women signed an informed consent form.

Consent for publication

All participants agreed to record and publish anonymous data.

Availability of data and materials

All the data supporting our findings have been presented in the manuscript; the datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The author did not report potential conflicts of interest.

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Authors’ contributions

The manuscript was designed by written by authors LZ and KZ. Data were collected by LZ and LW; analyzed by LZ, QY, SC, and CH; and verified by XZ. All authors read and approved the final manuscript.

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