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Research Article

The factors Related to Maternal-Fetal Attachment: Examining the Effect of Mindfulness, Stress and Symptoms during Pregnancy

Abstract

Background: The development of a successful relationship between a mother and her developing fetus to foster maternal behavior attainment. Diverse factors such as psychophysiological elements influence the maternal-fetal relationship. Mindfulness, a psychological process, increasingly apples to the research of pregnant women's wellbeing. However, most studies focus solely on physiological outcomes; few consider the maternal-fetal bonding.

Purpose: This research aims to investigate whether factors of stress, symptoms during pregnancy and mindfulness systematically related to maternal-fetal attachment.

Methods: Data were collected from 339 pregnant women, which were recruited from two hospitals in Taiwan, using the following questionnaires: the mindfulness scale, the symptom scale, the pregnancy stress scale during pregnancy, and the maternal fetal attachment scale. A path analysis approach was used to test the relationship.

Results: Pregnancy stress is the most robust factor of maternal-fetal attachment. The mindfulness and stress during pregnancy both have significant direct effects on maternal-fetal attachment, ß = .46, and ß = 22, all $p < 0.00$, respectively. The mindfulness has a significant inverse, direct effect (ß = -.13, $p < 0.05$) on stress during pregnancy. But the variable of symptoms during pregnancy is no significant effect on maternal-fetal attachment. The model proposed in this study accounts for 22.5% ($R2$) variance in the relational model of maternal-fetal attachment.

Conclusions: Given that the maternal mindfulness direct and indirect effect through stress variable on mother developing a closer connection with her babies, screenings of the relational elements should be incorporated into prenatal education programs.

Introduction

Maternal health and newborn health are closely linked. Prompt pregnant women and their baby's wellbeing must continually improve the quality of prenatal care [1-3]. The relationship between pregnant woman and her fetus help mothers experienced a pleasant motherhood, and also further impact maternal identity being either enriched or encumbered [4]. A study acknowledged that maternal-fetal attachment is especially critical for mother-infant relationships among 100 primiparous women [5]. Such attachment relationship refers to the extent to which the mothers engage in behaviors that represent affiliation and interaction with their unborn child; it creates a pervasive feeling of safety [6,7]. The human attachment relationship originated from the work of John Bowlby who presented a report behalf of World Health Organization. Bowlby indicated that "the infant and young child should experience a warm, intimate, and continuous relationship with his mother in which both find satisfaction and enjoyment". Lack of the attachment relationship may result in irreversible health consequences for mothers and their babies [8,9]. Although the theory existed for years, what critical factors associated with the attachment relationship are still being studied. The factors such as mindful personality, stress perception, and symptom during pregnancy are the focus of this study.

The mind-body concept can be a crucial point to contribute pregnant women's health. Changing people's psychological status would bring different and healthier outcomes, thus

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many studies have initiated psychological activities such as mindfulness interventions to reduce health problems during pregnancy [10,11]. It is wondering whether the mindfulness is obtained by training or naturally present without effort.

The concept of mindful personality is multi-faceted and includes present-centered situation, mindful attention, diminished self-talk, nonjudgment, non-doing, and a particular set of philosophical, ethical, or therapeutic beliefs. Each component contributes to the effect of mindfulness on emotion and behavior [12,13]. The individuals having different mindfulness characteristics were reported in a study [14]. The mindfulness can also occur in meditation and yoga exercises [15]. Braeken *et al.* [10] demonstrated that mindfulness is associated with autonomic nervous system function during pregnancy and with less negative social-emotional behavior. Some studies proved that mindful yoga practiced by pregnant women may alter stress appraisal and improve the ability to cope with stressful events [16].

The stress level can influence prenatal attachment relationship. Significant associations have been found between psychical attributes and physical health during pregnancy. Researchers found that emotional status during pregnancy can directly affect neonatal outcomes such as birth weight, gestational age, higher admission rate to the neonatal care unit, and reduced dopamine levels in mothers [17]. Women during pregnancy undergo unavoidable, significant psychological distress and physical changes such as hormone system readjustment. Mental distress during pregnancy can adversely affect both mother and infant in the short- or long-term [18]. Maternal stress also can simultaneously affect outcomes of the child by altering the functions of the maternal and fetus, leading to sleep disorder, increased risk of inflammatory disease such as asthma [11,19]. These stressful events are closely related to psychological health, maternal-fetal relationship, and infant outcomes [20,21].

The symptoms during pregnancy can be palliative by mindfulness practice. The pregnant women with higher mindfulness also adapted better and had less emotional distress both during and after pregnancy [10]. A study designed a 10-week mindfulness yoga class for 18 primiparous participants who were 12 to 26 weeks pregnant and has mild symptom of depression [22]. This research found that symptoms of depression had a significant reduction and increased maternal-fetal attachment. Another study examined a 7-week mindfulness-based yoga intervention on pregnant women and found that mindful yoga practicing in their second trimester improved their back pain [16]. Undoubtedly, the literature reveals a potential mechanism that mindfulness related to stress reduction. It also raises different issues about how the two key elements work in conjunction with the prenatal attachment relationship.

One could hypothesize that if pregnant women worry about their baby's health, thus they may narrowly focus toward those aspects of bad future outcomes. How can they keep mindful attention and awareness of their surroundings? And physical discomfort apparently limits their ability of mindfulness just like disease can impede the ability of self-care. A few studies indicate various predisposing factors of mindfulness [23].

Regarding the attachment model, more evidence is needed to identify potential psychosocial and physiological mechanisms that may link to the maternal-fetal attachment. Although some psychologists proposed that a child "turns out" is not placed only on the parents and disagreed with the attachment model [24]. Such model is still useful to explain how attachment behaviors developed. While there is some evidence of individual differences in the level of attachment [25,26]. There is still a need to clarify the factors that may help to explain this variation.

Identifying the crucial factors of developing maternal-fetal attachment may make healthcare professionals become more aware and reminiscent of how the relationship appears between mothers with her babies. This study will propose an initial integrated framework that considers the linkages between psychic and physical components of pregnant women as a mean for enlarge our understanding of the complexity of prenatal attachment.

Methods

Sampling and Setting

This study was a cross-sectional design and conducted at 2 hospitals in Taiwan (one tertiary care teaching hospital and one obstetric and pediatric clinic). The inclusion criteria were pregnant women who were (a) more than 20 years old, (b) at least in the 12th week of pregnancy, (c) able to read Chinese, and (d) willingness to participate in research and sign consent forms. Exclusion criteria based on the contradiction of the American Congress of Obstetricians and Gynecologists (ACOG) [27]. They were selected on the basis of the purpose and by sample size determination with an error of 5%, confidence of 95%, a power of 80%, and the effect size of 0.3. Finally, the sample size was 310.

Procedure

Following institutional ethics approval, the participants was instructed the research purpose by one on one, consent was obtained prior to commencing the survey. As an incentive to participate, all participants were entered in a draw to win one of three prizes of equal value.

Measurements

There are five sets of questionnaires in the survey: demographic items, the pregnancy symptoms, the pregnancy stress, the mindfulness scale as the independent variables, and the maternal-fetal attachment as dependent variables. The demographic items included age, education, gravida with para, gestational weeks, and perceived healthy.

1. Symptoms during pregnancy: This was measured by the Pregnant Psychosomatic symptoms [28], which consisted of 38 statements, graded by 4-point Likert scale: *often* exist (3), sometimes exist (2), rare experience (1), and no symptom experience at all (0), was used. Symptom items addressed both

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the frequencies of symptoms. A higher total score indicates more frequencies and increased types of symptoms. The Cronbach's alpha was assessed to be 0.92 in this study.

2. Pregnancy Stress Rating Scale: The stress in pregnancy period was measured by Pregnancy Stress Rating Scale which was adopted from Chen's measurement [29]. The 30-item scale consisted of five sources of stress, (a) stress from seeking safe passage for mother and child through pregnancy, labor, and delivery; (b) stress from baby care and changing family relationships; (c) stress from maternal role identification; (d) stress from seeking social support; and (e) stress from altered physical appearance and function. The score was 5-point Likert scale, *always* (4), *often* (3), sometimes (2), rarely (1), and never (0). The higher score of total items indicates higher perceived stress during pregnancy. The Cronbach's alpha was tested to be 0.937 in this study.

3. The Five Facet Mindfulness Questionnaire (FFMQ): Mindfulness instrument was originally reported by Baer [12] and the Chinese version was translated by Chang, Lin, & Huang [30]. There are five dimensions: Observing (paying attention to stimuli), Describing (labeling the sensation of stimuli), Acting with awareness (purposefully attending to stimuli), Non-Judging (not criticizing one's inner experience), and Non-Reactivity (allowing thoughts and emotions to come and go, without reaction). The instrument included thirty-nine items, scores ranging from 39 to 195 with higher scores reflecting greater mindfulness; the items were graded by a five-point scale 'very fit' (5) to 'not very fit' (1). The FFMQ has shown good internal consistencies [30], and Cronbach's alpha was 0.902 in this study.

4. Maternal-fetal attachment: The attachment instrument was agreed to use by Hsu & Chen [19], which translated from Muller'squestionnaire [7]. This questionnaire consisted of 39 statements, graded by 5-point Likert scale: always so (5), often so (4), sometimes so (3), rarely so (2), and never so (1). The minimum and maximum scores were 39 and 195, respectively, and higher scores showed stronger attachment. The Cronbach's alpha was high reliability [19] and Cronbach's alpha was 0.955 in this study.

Data Analysis

Data was analyzed using SPSS statistical software package (v22.0 for Windows). Data analysis included descriptive and exploratory statistical analyses. One-way analyses of variance and t tests are used to examine the differences among or between groups. Pearson correlations evaluated the relations between independent variables and mindfulness scores. Model selection was based on statistical significance and use a path analysis approach to explore the critical factors of maternal-fetal attachment, which was carried out by conducting multiple regression analyses.

Ethical considerations

The study was conducted after the Institutional Review Board approval (reference number CGH-OP103001). The written informed consent forms were obtained from all participants. Participants were given instruction about the study purpose and the questionnaires.

Results

Of the 352 pregnant women, 339 were enrolled the study, response rate was 96.3%; 13 excluded due to incomplete questionnaires. Participants' ages ranged from 20 to 43 years (M = 32.02 years, SD = 4.03 years). Most participants were married (n = 332, 97.9%), 240 (70.8%) had a university degree, 253 (74.6%) were employed, 182 (54.3%) were multigravida, 244 (71.9%) were second trimester, and 253 (74.6%) perceived healthy (Table 1).

The analytic results revealed differences in mindfulness by demographic characteristics, age and education, with age ≥ 36 years participants reporting significantly higher mindfulness than others (F = 3.76, p < .05; F = 5.48, p < .01). Pearson's moment product correlation was used to examine the relevance between variables (Table 2). The FFMQ score was negatively associated with both symptoms during pregnancy (r = −0.231, p < .01) and pregnancy stress (r = −0.197, p < .01), indicating that higher frequencies of symptoms and higher stress levels during pregnancy were associated with lower mindfulness score. In contrast, the mindfulness score was positively associated with maternal-fetal attachment (r = 0.135, p < .05), indicating that higher levels of mindfulness were associated with higher levels of maternal-fetal attachment.

Table 1: Comparison of Mindfulness and Characteristics (N = 339).

Variables	n	%	Mean	SD	Statistic
Age (years)					F = 3.76*
≤30	118	34.8	124.85	12.32	
31-35	162	47.8	127.62	12.82	
≥36	59	17.4	129.93	12.87	
Marital Status					t = -0.89
Married	332	97.9	126.97	12.26	
Others	7	2.1	131.14	13.68	
Education[a]					F = 5.48**
≦ senior high school	50	14.7	124.20	10.404	
university	240	70.8	126.75	12.24	
master degree	40	11.8	132.48	13.20	
Employment Status[b]					t = 0.32
Housewife	84	24.8	127.10	12.18	
Employed	253	74.6	126.61	12.39	
Gravidity[c]					t = -1.46
Primigravida	153	45.7	125.96	12.21	
Multigravida	182	54.3	127.92	12.23	
Gestation					t = 0.60
2nd trimester	244	71.9	127.18	12.79	
3rd trimester	95	28.0	127.73	11.92	
Perceived healthy					t = -1.35
No	86	25.4	125.51	12.33	
Yes	253	74.6	127.58	12.24	

[a]n=330; [b]n=337; [c]n=335; *p < .05 ** p <.01

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The study found that symptoms during pregnancy contributed to three dimensions of mindfulness, including ''describing'' (D2), ''acting with awareness'' (D3), and mindfulness from "non-Judging" (D4). Furthermore, the study found that pregnancy stress contributed to four dimensions of mindfulness, which are ''observing'' (D1), ''acting with awareness'' (D3), ''non-Judging'' (D4), and "non-Reactivity'' (D5).

The mediating effect among the constructs was examined for understanding whether the constructs of symptoms had any effect on attachment through stress, after age and education variables were adjusted. The result of Sobel test revealed a significant mediating effect on the relationship between symptoms and mindfulness (Figure 1). Furthermore, to examine the direct and indirect effects of symptoms, stress, and mindfulness on maternal-fetal attachment, the path diagram was used to present a relational model by conducted multiple regression analysis. The symptoms during pregnancy have a significant, direct effect ($ß$ = .27, p < 0.00) and indirect effect ($ß$ = .0325, p < 0.00) on stress, and inverse direct effect on mindfulness ($ß$ = -.25, p < 0.00). The mindfulness has a significant inverse, direct effect ($ß$ = -.13, p < 0.05) on stress during pregnancy (Table 3). The mindfulness and stress during pregnancy both have significant direct effects on maternal-fetal attachment, $ß$ = .46, and $ß$ = 22, all p < 0.00, respectively. But the symptoms during pregnancy is no significant effect on maternal-fetal attachment. (Table 4) presented the final model, the explanation of variance in maternal-fetal attachment was 22.5% (R^2). The calculations of path coefficients were graphically shown in figure 2.

Discussion

This study confirmed a relational model of maternal-fetal attachment using the factors of symptoms, stress during pregnancy, and mindfulness. The rational model was explored in a clinical sample of pregnant women in their 2nd and 3rd trimester. In our study, *mindfulness* is a significant contributing factor to *maternal-fetal attachment*. Mohamadirizi and Kordi's [31], research echoes the findings of our study which found a positive correlation between mindfulness and maternal-fetal attachment. Higher levels of mindfulness were associated with higher levels of maternal-fetal attachment [31]. Mindfulness-based interventions can enhance maternal-fetal attachment and physiological psychology status [22]. However, pregnancy stress is the most robust factor of maternal-fetal attachment. The relational effect of pregnancy stress is expected but surprising its positive effect on maternal-fetal attachment. A review provided evidence that the mood state of pregnant women influencs attachment levels [32].

Table 2: Correlation between in-dependable variables and dependable variable.

	Mean (SD)	Reliability	1	2	3
1.Symptoms	79.65 (17.81)	0.924			
2.Pregnancy Stress	97.81 (23.61)	0.937	0.320**		
3.Mindfulness	127.06 (26.02)	0.902	-0.231**	-0.197**	
4.Maternal-fetal attachment	134.08 (26.02)	0.955	0.120	0.298**	0.135*

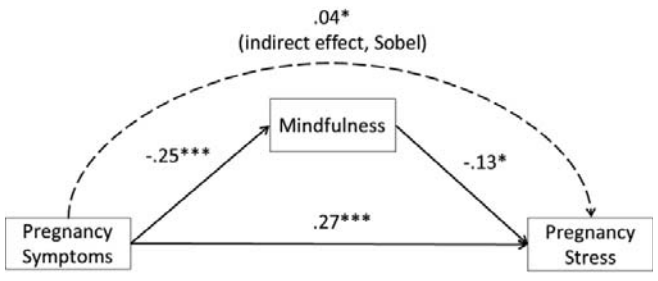

Figure 1: Examination of Mediating Effect*
*Note: to examine the effect between independent variable and a dependent variable via the inclusion of a third hypothetical variable "mediating variable of *Mindfulness"*

Table 3: Direct, Indirect, and Total Effects of Symptoms during Pregnancy, Pregnancy Stress, Mindfulness on Maternal-fetal Attachment (N = 339).

Variables	Mindfulness			Pregnancy stress			Maternal-fetal attachment		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Symptoms	-.25***	-	-.25	.27***	.0325***	.31	.02	0.0842***	.1042
Mindfulness	-	-	-	-.13*	-	-.13	.22***	-.0598	.1602
Stress	-	-	-	-	-	-	.46***	-	.46

Note: Significant level at p < .05,** p <.01, *** p <.001; The total effect indicates the sum of the direct and indirect effect.

Table 4: Path Analysis of Independent Variables and Maternal-fetal Attachment (N = 339).

Variable	Model 1	Model 2	Model 3
	Mindfulness (β)	Stress (β)	Maternal-fetal attachment (β)
Independent			
Symptoms	-.25***	-.27***	.02
Stress	---	--	.46***
Mindfulness	---	-.13*	.22***
Model			
R^2 (Final)	.06	.11	.225
Adjust R^2	.06	.10	.218
F (Final)	22.72***	20.14***	32.33***
df	1,337	2,336	335

Note: * p < .05, ** p < .01, *** p < .001; statistical analysis utilized multiple regression.

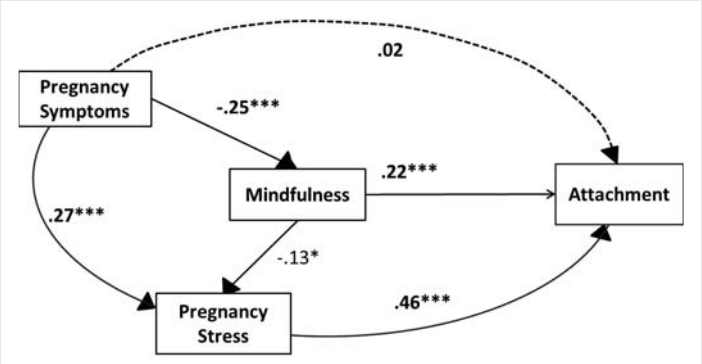

Figure 2: The Path Model on the Effects of Symptoms, Stress, and Mindfulness on Maternal-fetal Attachment.

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While identifying related to mindfulness variable, symptoms during pregnancy were the most significant factor related to prenatal mindfulness in this study compared with other variables (stress). Moreover, symptoms and stress during pregnancy had a strong, inverse relation with two aspects of mindfulness subscales including 'acting with awareness (D3)' and 'non-judging (D4)'. Our study found symptoms during pregnancy was negatively associated with mindfulness and positively associated with pregnancy stress. Mindfulness has significant direct effects on both pregnancy stress and maternal-fetal attachment.

Mental and physical discomfort may disrupt or even alter an individual's ability of awareness and nonjudgment [11,33]. Braeken *et al*. reported pregnant women with lower emotional disorders have higher mindfulness during prenatal and postpartum periods [10].

The finding of symptoms during pregnancy as the procursive factor of pregnancy stress and prenatal mindfulness is interesting and potentially significant. The pregnant women experiencing greater symptoms of discomfort may feel more difficult to cope with the demands of pregnancy than those who has less symptoms. But, this correlation between symptoms during pregnancy and mindfulness lacks a theoretical foundation and should be considered in further studies. The relational model could also serve as useful practical tools for professionals forecast the status of maternal-fetal attachment. Up-to-date, mindfulness is predominantly measured by means of self-assessment instruments which several scales have been published and validated. Conducting self-assessment at prenatal care visits can increase mindfulness insights will provide individualized feedback enhances self-awareness [34]. These individualized feedbacks can be a basis for quality improvement of prenatal care and thus help shape maternal-fetal relationship.

The study significantly enhances the literature regarding relationship of mindfulness and maternal-fetal attachment during pregnancy. A tendency towards mindfulness or perceived stressful is a crucial factor of developing maternal fetal attachment. Once health professionals care for pregnant women with low present-centered situation, they should infer the possibility of the mother's weak connection to her unborn babies. Furthermore, cultivating an open and non-judgemental attitude toward one's pregnancy stress is important in addressing relationship between the mother and her babies. The study results also suggest that health practitioners should be recognize mindfulness status of pregnant women during prenatal care. Stress and symptoms during pregnancy are susceptible to interventions during prenatal education programs. Be aware of pregnant women's characteristics with low mindfulness is needed in order to early intervention of treating maternal-fetal outcomes. The issue of maternal-fetal attachment is also recommended to be included within maternity care curricula at educational institutions.

Limitation

There are several limitations of this study. First, the study was conducted by the reliance on self-report questionnaires. The participant's self report provides subjective measure of the experience. Second, the participants were mostly healthy acording their reports and may not be representative of all pregnant women, especially high risk pregnant groups. Third, because of the cross-sectional nature of this study, the results cannot infer the cause-effect relationships change between these variables over time, such as better maternal-fetal attachment resulting from higher mindfulness. Finally, the low explained variance of the study provided limited generalizability to larger populations. In sum, mindfulness whether an intermediary link in a causal chain or associated with pregnant women's wellbeing over time is worthy of further investigation and evaluation.

Conclusion

Using the psychic-physical components and a series of path coefficient analyses, an integrated attachment model has been developed and tested. To the best of our knowledge, there is currently no mindfulness-added framework for maternal-fetal attachment forecast. The key findings underline the importance of further explorations in this area to determine whether mindfulness can be used to properly anticipate expectant mother's stress status and the development of feelings of attachment towards their children.

While attempting to increase maternal-fetal attachment in prenatal care, interventions maybe more successful while combining these considerations with mindfulness, symptoms during pregnancy and stress reduction. Increasing levels of mindfulness may assist women to approach motherhood more positively and improve their wellbeing as well; it may further reduce unnecessary birth interventions and improve postnatal mental health. Health care providers must be sensitive to psychological adaptation that facilitates the maternal role attainment process during pregnancy. Although, many researchers have stressed the importance of the relationship of the mother to her unborn fetus in attaining the maternal role. Maternal-fetal bonding remains a complex, and elusive, yet extremely important phenomenon. This is an initial model, which still requires further related studies before it can be finalized.

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Declarations

Ethics approval and consent to participate

The study approved by the Institutional Review Board of "Cathay General Hospital" (reference number CGH-OP103001) and followed the principles of the 1964 Declaration of Helsinki and subsequent amendments. Informed consent was obtained from all individual participants included in the study.

Consent to publish

All authors consent to publish the final version of the manuscript.

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Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to privacy restrictions, which were used under license for the current study, but are however available from the corresponding author on reasonable request and with permission of Cathay General Hospital.

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Authors' Contributions

SHMG and HHW contributed to study conception, and design the research; SHMG, CMT and HCH contributed to data acquisition; SHMG and HHW contributed to data analysis and interpretation, and writing of article; SHMG and HCH contributed to editing, reviewing and final approval of article.

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