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Typology of Pregnant Women's Bonding Emotions towards Their Foetus: A Study of Japanese Women in the First Trimester

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Abstract

Background: Maternal emotions towards the foetus are an essential part of maternal-foetal bonding, and predict its quality and quantity. It is necessary to identify a cluster of pregnant women with maternal-foetal bonding difficulty. **Objectives:** To identify a cluster of pregnant women with maternal-foetal bonding difficulty and describe the character of the cluster. **Methods:** An online questionnaire survey was conducted to investigate psychological issues among pregnant women at 12 - 15 weeks' gestational age. Maternal-foetal bonding emotions, demographic and obstetric variables, attitudes towards the current pregnancy, emesis, adult attachment, depression, fear of childbirth, obsessive-compulsive symptoms, borderline personality traits, substance use, avoiding taking part in childcare, and consideration of pregnancy termination were measured. A two-step cluster analysis was performed to classify participating women according to maternal-foetal bonding subscale scores. Emerging clusters were compared in terms of the variables used in this study. **Results:** Two clusters emerged, one of which was the Foetal Bonding Disorder Cluster, characterised by significantly lower scores ($p < 0.001$) in Happiness, Alpha Pride, and Beta Pride, and significantly ($p < 0.001$) higher scores in Anger, Fear, Sadness, Disgust, Shame, and Guilt. Individuals in this

cluster were also characterised by unhappiness with and not wanting the current pregnancy, depression, tokophobia, obsessive-compulsive symptoms, and borderline personality traits. They were more likely to avoid caring for the baby after childbirth and consider termination of the pregnancy during the study period. **Limitations:** Our study did not follow the participants up to childbirth. Further research should clarify confounders or mediators associated with maternal-foetal bonding disorder. **Conclusion:** Our findings suggest that some pregnant women suffered from potentially pathological maternal-foetal bonding emotions, and this was linked to many mental health problems.

Keywords

Maternal-Foetal Bonding[1] Disorder, Cluster Analysis, Psychiatric Symptoms

1. Introduction

Women's perception of the foetus as an individual starts early in pregnancy. Although the degree of foetal development was grossly underestimated in the first trimester, a minority of pregnant women were found to establish a psychological relationship with the fetus by 8 - 12 weeks of gestation (Lumley, 1982). Maternal emotions towards the foetus are an essential part of maternal-foetal bonding, and predict its quality and quantity after childbirth (Ohara et al., 2017; Ohashi et al., 2016; Usui et al., 2019). Poor maternal-neonatal bonding may lead to abusive parenting (Ohashi et al., 2016) and mental health difficulties. Maternal-foetal bonding is, therefore, an important health issue in perinatal mental health.

Several measures of maternal-foetal bonding (also known as maternal-foetal attachment) have been developed (Condon, 1993; Cranley, 1981; Müller, 1993), and their factor structures were reported (e.g. Fujita & Otsuki, 2021; Usui et al., 2019). Maternal-foetal bonding is known to be a multi-faceted phenomenon. However, there has been little research on whether expectant women can be clustered in terms of maternal-foetal bonding characteristics. Identification of a cluster of pregnant women with maternal-foetal difficulty is necessary in order for perinatal health professionals to diagnose and plan a therapeutic intervention in this group.

The aim of this study, which was based on our previously reported data about women in the first trimester (Hada et al., 2023; Kitamura et al., 2022; Ohashi et al., 2023; Saito et al., 2022; Usui et al., 2023), was to identify a cluster of women with problematic maternal-foetal bonding and clarify their clinical characteristics.

2. Methods

2.1. Study Procedure and Participants

Pregnant women at 12 - 15 weeks' gestational age were recruited for an internet

[1]Typology of maternal-foetal bonding.

survey over a 2-week period, from 7 to 21, December, 2020, via an Internet application called Luna Luna Baby (MTI, Tokyo, Japan). The number of participants in this study was 696. Both nulliparae and multiparae at 12 - 15 weeks' gestation were included. Our only exclusion criterion was lack of command of Japanese reading. Participation was anonymous and voluntary. As an incentive to participate, women were given digital credits usable for Amazon shopping.

2.2. Measurements

Maternal-foetal bonding emotions: We measured the participants' emotions towards the foetus using the abridged version of the Scale of the Parent to Baby Emotion (SPBE-20: Hada et al., 2023). Emotions include six basic and four self-conscious emotions, each rated using two items graded with 7-point scales. The basic emotions are Happiness, Anger, Fear, Sadness, Disgust, and Surprise (Ekman, 1994; Ekman et al., 1983), whereas the self-conscious emotions are Shame, Guilt, Alpha Pride, and Beta Pride (Tangney, 1990, 1991).

Demographic and obstetric variables: The questionnaire tapped each participant's 1) age, 2) number of past pregnancies, 3) number of past deliveries, 4) infertility treatment, and 5) marital status (single/married).

Attitudes towards the current pregnancy: Two ad hoc questions tapped Unwanted Pregnancy and Unhappiness towards Pregnancy, using 5-point scales. The question regarding the former was "*Did you want to be pregnant*?" (*I did not want be pregnant* = 0, *I wanted to but it was bit earlier than planned* = 1, *I left pregnancy to course* = 2, *I wanted it* = 3, and *I wanted and tried to have a baby* = 4). The question addressing the latter was "*How did you feel when you learned that you were pregnant*?" (*very displeased* = 0, *relatively displeased* = 1, *neither pleased nor displeased* = 2, *relatively pleased* = 3, and *very pleased* = 4).

Emesis: We used the Japanese version (Hada et al., 2021) of the 24-hour Pregnancy-unique Quantification of Emesis and Nausea (PUQE-24) (Ebrahimi et al., 2009), a three-item self-measure rating used widely in clinical and research settings. It measures: 1) nausea (the duration of nausea in hours over the last 24 hours), 2) vomiting (number of vomiting episodes over the last 24 hours), and 3) retching (the number of retching episodes over the last 24 hours), each with a 5-point scale. Higher scores indicate more severe emesis. The severe end of the emesis spectrum has serious clinical implications as it necessitates immediate interventions. The PUQE-24 is able to identify and predict the occurrence of hyperemesis gravidarum (Koot et al., 2020; Koren & Cohen, 2021). The PUQE-24 was translated into Japanese with permission from the original authors, and the resultant questionnaire was back-translated and compared with the original English to verify wording.

Adult attachment: We used the Japanese version (Matsuoka et al., 2006) of the Relationship Questionnaire (RQ) (Bartholomew & Horowitz, 1991). The RQ assesses adult attachment styles. It consists of four items that describe different styles of adult attachment (i.e. attachment to a partner): Secure, Fearful, Preoc-

cupied, and Dismissing. Each item was rated on a 7-point scale (*Does not apply to me at all* = 0 to *Applies to me very much* = 6). The total score was calculated by adding the scores of Fearful, Preoccupied, and Dismissing, and then subtracting the score of Secure. A higher score indicates a more insecure attachment style.

Depression: Depression was assessed on the basis of two questions addressing the first two symptoms of Major Depressive Episode (MDE)—depressed mood and lack of interest—each rated on a 4-point scale: 0 = *none*, 1 = *a few days a week*, 2 = *more than half a week*, and 3 = *almost every day*. This is because research showed that only these two questions predicted MDE reasonably well (Bowling, 2005; Chochinov et al., 1997; Cutler et al., 2007; de Boer et al., 2004; Mitchell, 2008; Mishina et al., 2009; Mitchell & Coyne, 2007; Richardson et al., 2010). The two aforementioned symptoms were identified as core symptons of antenatal depression (Kitamura et al., 2023). MDE was defined if either or both of the two symptoms were rated as present almost every day over the past 2 weeks.

Fear of childbirth: To measure fear of forthcoming childbirth, we used the Japanese version (Takegata et al., 2013) of the Wijma Delivery Expectancy/Experience Questionnaire (WDEQ) (Wijma et al., 1998). This scale consists of 33 items, each rated with a 5-point scale. Higher scores indicate more severe fear of forthcoming childbirth. Item 31 of the original WDEQ was erroneously deleted in the present study.

Obsessive-compulsive symptoms: To rate obsessive and compulsive symptoms, we used the Japanese version (Koike et al., 2020) of the Obsessive-Compulsive Inventory-Revised (OCI-R) (Foa et al., 2002). This scale consists of 18 items, each rated with a 5-point scale, with six subscales: Washing, Checking, Ordering, Obsessing, Hoarding, and Neutralising. We changed the grading from 5 point to 7 point in the present study.

Borderline personality traits: We used the Personality Organisation Inventory (IPO) (Kernberg & Clarkin, 1995), short version (IPO-SV) (Yamada et al., 2022). This scale consists of nine items rated with a 7-point scale, with three subscales: Primitive Defence, Identity Diffusion, and Reality Testing Disturbance.

Substance use: Two simple ad hoc questions, using a dichotomous scale (*no* = 1; *yes* = 2), addressed whether participants smoked tobacco and whether they drank alcohol before pregnancy.

Avoiding taking part in childcare: To assess participants' willingness to actively take part in childcare after childbirth, we created an ad hoc question asking "*Do you plan to look after your baby after childbirth?*" It was rated with a 7-point reversed Likert-type scale from 6 = *not at all* to 0 = *very much so*.

Consideration of Termination of Pregnancy (TOP): To assess participants' plans regarding possible termination of the current pregnancy, we created an ad hoc question asking "*Are you considering terminating your pregnancy*?" It was

rated with a 7-point Likert-type scale, from 6 = not at all to 0 = very much so. Higher scores indicated a desire for TOP.

2.3. Data Analysis

After examining the mean, Standard Deviation (SD), skewness, and kurtosis of all the maternal-foetal bonding subscale scores, we grouped participants according to two-step cluster analysis. Cluster analysis classifies cases (members) into groups that are homogenous within themselves and heterogenous between each other in terms of any relevant characteristics, in this case maternal-foetal bonding emotions (Borgen & Barnett, 1987). The groups thus classified comprise the clusters. Several methods are used in cluster analysis. In contrast to other cluster techniques such as k-mean and hierarchical cluster analyses, two-step cluster analysis is advantageous for creating clusters based on both categorical and continuous variables (Satish & Bharadhwaj, 2010), as well as for selecting the number of clusters automatically. Determination of the best cluster model was made on the basis of the highest distance increase measured by Schwarz's Bayesian Criterion between the two closest cluster models during each stage of the hierarchical clustering (Sarstedt & Mooi, 2014; SPSS, 2001). Clusters that emerged were compared in terms of the variables used in this study. Because of multiple comparisons, we set the alpha level (possibility of Type I error) at $p < 0.001$.

2.4. Ethical Considerations

This study was approved by the Institutional Review Board of the Kitamura Institute of Mental Health Tokyo (No. 2020101501). Study participation was anonymous. Hence, all participants provided electronic informed consent after they understood the study rationale and procedure. The authors assert that all procedures contributing to this study comply with the ethical standards of the National and Institutional Committees on Human Experimentation and with the Helsinki Declaration of 1975 as revised in 2008.

3. Results

3.1. Clusters of Maternal-Foetal Bonding

First, we calculated the mean, SD, skewness, and kurtosis of all the maternal-foetal bonding items. Skewness < 2.0 and kurtosis < 4.0 were observed for all items except for Happiness (kurtosis = 3.2) and Anger (skewness = 3.3 and kurtosis = 13.5). We assumed normality of the data (**Table 1**). Two-step cluster analysis yielded two clusters, with a silhouette coefficient of 0.50 (**Table 2**). Cluster 2 was a minority cluster ($n = 165$, 24%) that scored significantly ($p < 0.001$) lower in Happiness, Alpha Pride, and Beta Pride, and significantly ($p < 0.001$) higher in Anger, Fear, Sadness, Disgust, Shame, and Guilt. Thus we interpreted Cluster 1 as the Healthy Cluster and Cluster 2 as the Foetal Bonding Disorder Cluster.

Table 1. Mean, SD, skewness and kurtosis of the maternal-foetal bonding items (n = 696).

Items	Mean	SD	skewness
Happiness	10.05	1.93	−1.4
Anger	0.64	1.57	3.3
Fear	4.80	2.83	0.1
Sadness	1.36	2.24	1.8
Disgust	1.53	2.49	1.7
Shame	1.73	2.37	1.4
Guilt	1.38	2.36	1.9
Alpha Pride	4.43	2.56	−0.2
Beta Pride	9.00	2.67	−0.9

Table 2. Two-step cluster analysis of the maternal-foetal bonding items.

Items	Clusters		F
	Cluster 1 Positive Bonding (n = 531)	Cluster 2 Bonding Disorder (n = 165)	
Happiness	10.58 (1.43)	8.33 (2.30)	225.846***
Anger	0.12 (0.47)	2.47 (2.28)	359.176***
Fear	3.97 (2.44)	7.48 (2.28)	267.788***
Sadness	0.47 (1.06)	4.18 (2.67)	671.575***
Disgust	0.58 (1.29)	4.55 (2.98)	584.433***
Shame	0.74 (1.26)	4.91 (2.29)	893.363***
Guilt	0.56 (1.25)	4.01 (3.04)	444.638***
Alpha Pride	4.82 (2.54)	3.20 (2.25)	54.111***
Beta Pride	9.69 (2.27)	6.76 (2.67)	194.728***

Note: ***$p < 0.001$.

3.2. Characteristics of the Bonding Disorder Cluster

The two clusters did not differ significantly in terms of demographic or obstetric variables. Compared to the women in Cluster 1, those in Cluster 2 were characterised by unwanted pregnancy, unhappy pregnancy, depression, tokophobia, obsessive-compulsive symptoms, and all three subscales of the IPO (Table 3). They were significantly more likely to avoid caring for the baby after childbirth and to consider TOP during the study period. No differences were found between the two clusters in terms of adult attachment or substance use.

Table 3. Demographic, obstetric, and psychological characteristics of clusters.

Variables	Cluster 1 ($n = 531$)	Cluster 2 ($n = 165$)	χ^2
	n	*n*	
Living with Partner	498	150	0.204*NS*
	Mean (SD)	**Mean (SD)**	***F***
Age	31.98 (4.46)	30.99(4.70)	5.940*
Gestation Week	13.34 (1.13)	13.44 (1.15)	0.999*NS*
Number of Past Pregnancies	0.76 (1.06)	0.69 (1.17)	0.551*NS*
Number of Past Deliveries	0.39 (0.70)	0.33 (0.79)	0.994*NS*
Number of Past TOP	0.11 (0.39)	0.19 (0.54)	3.254*NS*
(Un)Happiness about Pregnancy	0.17 (0.46)	0.61 (0.87)	71.531***
(Un)Intendedness of Pregnancy	1.02 (1.13)	1.56 (1.26)	26.543***
PUQE-24	2.74 (2.52)	3.60 (2.86)	13.839***
RQ: Self-model	3.78 (2.95)	2.16 (3.72)	10.906**
RQ: Other-model	4.04 (2.80)	2.90 (3.13)	6.364*
Depression	0.88 (1.20)	2.09 (1.78)	99.049***
Tokophobia: WDEQ	55.67 (18.17)	80.07 (18.85)	222.860***
Obsessive-compulsive Symptoms	25.66 (15.98)	34.99 (16.65)	42.196***
IPO Primary Defence	4.13 (3.47)	6.82 (3.99)	70.415***
IPO Identity Diffusion	6.63 (4.52)	9.73 (4.01)	62.227***
IPO Reality Testing Disturbance	1.71 (2.78)	3.44 (3.65)	41.502***
Smoking	1.89 (0.32)	1.79 (0.41)	10.625**
Alcohol	1.42 (0.49)	1.38 (0.49)	0.755*NS*
Avoiding Caring for the Baby after Childbirth	0.68 (1.13)	1.26 (1.58)	26.713***
Considering TOP	0.04 (0.27)	0.85 (1.39)	163.351***

Note: IPO: Inventory of Personality Organization; RQ: Relationship Questionnaire; TOP: Termination of Pregnancy; WDEQ: Wijma Delivery Expectancy/Experience Questionnaire. *NS*: Not Significant; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

4. Discussion

Our study analysis grouped expectant women into healthy women and women with maternal-foetal bonding disorder. The latter consisted of a quarter of all participants. Matsunaga et al. (2017) studied a population of mothers with 1-month-old infants using the Mother-to-Infant Bonding Scale, and explored a cluster of women, comprising 12% of the total, who exhibited maternal-neonatal

bonding disorder. This means that quite a few perinatal women may have difficulty maintaining affectionate bonds with their children. The pregnant women in our study who were categorised as having Bonding Disorder had many mental health problems. These included depression, tokophobia, and obsessive-compulsive symptoms, all three of which were found to be substantially linked to each other during pregnancy (Usui et al., 2023). Our study added the possibility that maternal-foetal bonding disorder is linked to this triangle. The causal relationships between these symptoms await further longitudinal investigations.

In our study, women with Bonding Disorder were preceded by negative psychological reactions towards the current pregnancy: unwantedness and unhappiness. There have been many reports that unwanted (unintended) pregnancy is linked to a variety of mental health problems. Recent studies have demonstrated that such links are mediated by a lack of happiness towards the pregnancy (Ohashi et al., 2023).

Our study did not follow the participants up to childbirth. Nevertheless, the study suggests that pregnant women with maternal-foetal difficulty were less likely to be prepared to take care of the newborn and were more likely to consider termination of pregnancy. Few studies have reported a link between maternal-foetal bonding disorder and the wish to terminate pregnancy, whereas many investigators have reported that women with tokophobia wish to terminate their pregnancies. The latter may be confounded or mediated by maternal-foetal bonding disorder and thus awaits further clarification.

The clinical implications of this study merit comment. Thus far, little has been reported about possible therapeutic interventions. Exposure to foetal scanning has been reported to increase pregnant women's affectionate emotions towards the foetus. However, most of these reports did not precisely measure maternal emotions regarding the foetus. There has been minimal research on the long-term effects of such exposure on these emotions. It is still unclear whether viewing foetal scans will improve maternal-foetal bonding emotions in both pregnant women in general and in those with Bonding Disorder.

Taking into consideration these drawbacks, the present study suggested that a proportion of pregnant women suffered from possibly pathological maternal-foetal bonding emotions and that this was linked to many mental health problems.

5. Conclusion

Our findings suggested that some pregnant women suffered from potentially pathological maternal-foetal bonding emotions, and this was linked to many mental health problems. These features imply the necessity for early clinical intervention.

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Ethical Approval

This study was approved by the Institutional Review Board of the Kitamura Institute of Mental Health, Tokyo (No. 2020101501).

Authors' Contributions

TK and ST designed the study. AH, YU, and YO analysed the data and wrote the first draft. TK rewrote the manuscript. All the authors read and approved the final draft.

Data Availability

Data used in this analysis will be available upon reasonable request to the first author.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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