

Behavioral brain systems activation with postpartum blue: According revised reinforcement sensitivity theory

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Abstract

Context: Mood disorders such as postpartum blue are very prevalent in the postnatal period, while the underlying mechanism of postpartum blue is not well known.

Aim: This research aimed to investigate the role of brain-behavioral systems activation in postpartum blue according to revised reinforcement sensitivity theory in mothers referring to Mashhad health-care centers.

Settings and Design: This correlational study has been conducted during February–March 2018, on 172 cases who diagnosed with postpartum blue were chosen through the purposive sampling method.

Materials and Methods: Participants completed demographic questionnaire, Jackson five-factor questionnaire, and the Edinburgh depression scale.

Statistical Analysis Used: The normality of data distribution examined using the Kolmogorov–Smirnov test. After, data were analyzed using descriptive methods (mean and standard deviation), Pearson correlation, and stepwise regression method.

Results: The results showed that brain-behavioral systems, including behavioral inhibition system (BIS) ($P < 0.001$; $R = 0.31$) and behavioral activation system (BAS), had a significant correlation with postpartum blue ($P < 0.05$; $R = 0.39$), while there was no significant relationship between fight-flight systems with postpartum blue. BAS ($R^2 = 0.15$, $P < 0.05$) and BIS ($R^2 = 0.08$, $P < 0.001$), the predictive potential of BIS and BAS was equal to 21% of variance of postpartum blue.

Conclusion: The findings suggest that behavioral-brain systems play a role in mothers' "postpartum psychological disorders such as postpartum blue and in the conception of mothers" distress after maternal delivery, the effects of these systems can be used in short-term interventions.

Keywords: Behavioral-brain systems activation, Postpartum blue, Revised reinforcement sensitivity theory

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INTRODUCTION

Mothers face many challenges during pregnancy and postpartum. Although the majority of mothers overcome the challenges in these stages, some mothers experience problem and could not pass postpartum normally

situations.^[1] Postpartum blue after childbirth is one of the complications that may affect mothers in postpartum period.^[2] Higher degree of postpartum blue with clinical signs called postpartum depression.^[3] The following can be pointed out about possible causes: feeling disappointed,

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fear and early birth discomfort, fatigue due to lack of sleep during labor and pregnancy, anxiety about the inability to care of the baby, and fear of reducing postpartum charm, as well as the involvement of hormonal agents such as endorphin, estrogen, and progesterone levels have also been reported.^[4,5] Although these hormonal changes are fast, transient, and only observed in the first few days after childbirth,^[6] in some cases, grief in this period is the beginning of postpartum depression.^[7] Emotions such as depression have biological, social, and psychological dimensions.^[8,9] According to a reinforcement sensitivity theory, behavioral-brain systems play a key role in creating emotions.^[10,11] Reinforcement sensitivity theory is one of the most widely accepted theories in terms of biological models in psychology, which has been proposed by Gray *et al.* in 1970. According to this model, Gray hypothesized brain-behavioral included two systems of behavioral inhibition system (BIS) and the behavioral activation system (BAS). These systems control the behavioral activity.^[12] The BIS is thought to be related to sensitivity to punishment as well as avoidance motivation, while the BAS is thought to be related to sensitivity to reward as well as approach motivation. This theory supported animal studies.^[13] The BIS, as proposed by Gray, is a neuropsychological system that predicts an individual's response to anxiety-relevant cues in a given environment. This system is activated in times of punishment, boring things, or negative events.^[14]

The BAS, in contrast to the BIS, is based on a model of appetitive motivation in anxiety validation. The BAS is aroused when it receives cues corresponding to rewards and controls actions that are not related to punishment, rather actions regulating behaviors.^[14] According to Gray's theory, the BAS is sensitive to conditioned attractive stimuli and is associated with impulsivity.^[15] Gray and McNaughton (2002) made some changes and presented revised reinforcement theory. Accordingly, fight/flight/freeze system (FFFS) added, which in this revised theory, freezing refers to the response to real threats that are not avoidable.^[11] The sensitivity of this system is to respond to all unpleasant stimuli (whether conditional, nonconditional, or internal), and the consequence of avoidable behaviors and escape from immediate threats and fears, including fear and hat but not anxiety.^[16,17]

The theory of sensitivity to reinforcement, as a biological basis personality, is a basis for explaining mood disorders such as depression.^[18-22] However, no investigation was found regarding the relationship between postdelivery blue and brain-behavioral systems. Therefore, this study was conducted to investigate the role of brain-behavioral

systems activation in postpartum blue according to revised reinforcement sensitivity theory in mothers.

MATERIALS AND METHODS

This cross-sectional correlational study has been conducted during February–March 2018. The study included all selected main health center services of Mashhad city (1-2-3-5 and Samen). Accordingly, researcher asked from staffs to screen referred mothers during February–March 2018 through Edinburg scale and introduce to researcher if they were willing to participate in the study. Finally, 172 cases were selected using the purposive method. The inclusion criteria were as follows: Iranian, residence of Mashhad, educated at least up to high school, earning a score between 10 and 15 in the Edinburg depression scale,^[23] lack of psychiatric drugs, nonsmoking, nonalcohol and drugs, no medical or mental condition (according self-report of participants), no history of postpartum depression in previous births, and lack of experience of stressful events during pregnancy such as the death of loved ones or divorce. They have excluded if they do not like to cooperate in any stage, history of suicide, and uncompleted questionnaire. In order to collect data, in addition to demographic information, the following tools were used.

Edinburgh Depression Scale

These 10-item self-report measures symptoms of emotional distress were during pregnancy and the postnatal period. Each item offers four options to selection. When scores are between 1 and 9 may indicate the presence of some symptoms of distress that may be short lived and not serious. Scores between 10 and 15 are considered as postpartum blue and more than 15 scores are considered as postpartum depression.^[24] Mosallanejad and Sobhanian reported sensitivity of scale (75.6) and reliability for the Iranian population of 65.8. The positive predictive value of the test was 62.2 and the negative predictive value of the test was 2.79, and the accuracy of the correct diagnosis of the test was 6.72 and the confidence limits for the test were 0.062.^[25]

Jackson's Five-Factor Questionnaire

This 30-item scale is designed by Jackson (2009); the items equally distributed across five scales to each six items as follows: BAS, BIS, fight, flight, and freezing. The answer format is a 5-point Likert type scale (1 = completely disagree; 5 = completely agree). Higher score in each subscale indicated domination of that trait.^[26] An Iranian study showed Cronbach's alphas range (0.72–0.88), test-retest coefficients (0.64–0.78), and test-retest

correlations (0.28–0.68) suggested good reliability of the Persian version of Jackson's five-factor questionnaire. Confirmatory and explanatory factor analysis supported the original five-factor model of the questionnaire. The internal relationships between the subscales were appropriate (0.11–0.53).^[27]

Ethical considerations

Written consent form signed by participants. The aims declared before giving questionnaire and they informed there is no obligation to leave the study at any stage. The research project approved the research committee of the Azad University of Neishabur with ethical code number of IR.IAU.NEYSHABUR.REC.1396.10.

The collected data were analyzed using SPSS-20 software (SPSS 20, IBM, Armonk, NY, United States of America) after omitting invalid questionnaires. Mean and standard deviation used to describe data. Meanwhile, frequency and percentage employed for describing characters of participants. The Pearson statistical tests and multiple regressions used to find the correlation of variables. Durbin–Watson and inflation variance index were used to check the assumptions. Initially, the normal distribution of data was investigated using the Kolmogorov–Smirnov statistical method. A statistically significant level of 0.05 was considered.

RESULTS

Demographic characters of the participants reported as following [Table 1].

The mean and standard deviation of brain-behavioral systems and postpartum blue as well as the correlation between these systems were presented [Table 2]. The results indicated a statistically significant correlation between BIS ($r = 0.38$, $P < 0.001$) and BAS with postpartum blue ($r = -0.33$, $P < 0.05$), while there was no significant relationship between FFFS components with postpartum blue.

The multivariate regression analysis was used to determine the role of brain-behavioral systems in postpartum blue. For this purpose, the basic assumptions of this test such as natural distribution, elimination of irregular data, linearity, homogeneity of variances, and the absence of multiple parallelism by the Durbin–Watson test and coefficients of variance inflation factor were investigated. As shown in Table 3, the BAS ($F = 29.93$, $P < 0.05$, $R^2 = 15$) and BIS ($F = 26.15$, $P < 0.001$, $R^2 = 0.08$) and totally they could predict 23% of variance of postpartum blues.

Table 1: Demographic characters of participants

Variable	Frequency (%)
Number of birth	
First	106 (61.6)
Second	42 (24.4)
Third	24 (14)
Education	
Guidance school	40 (23.3)
Diploma	66 (38.4)
Undergraduate	58 (33.1)
Graduate	34 (19.8)
PhD and doctor	8 (4.7)
Age	
19-29	94 (54.7)
30-41	78 (45.3)

Table 2: Mean, standard deviation, and correlation of brain-behavior systems and postpartum blue

Variable	Mean	SD	Pearson correlation with PB*
PB	14.39	5.6	1
BAS	10.41	5.2	-0.33*
BIS	12.79	3.3	0.38*
Fight	9.65	4.4	-0.03
Flight	10.68	4.6	-0.11
Freeze	12.44	1.71	-0.06

* $P < 0.005$. PB: Postpartum blue, BAS: Behavioral activation system, BIS: Behavioral inhibition system, SD: Standard deviation

Table 3: Statistical indexes of stepwise regression brain-behavior systems and postpartum blue

Step	Variable	R	R ²	F	B	β	t	Tolerance	VIF
1	BAS	-0.38	0.15	29.93*	0.18	0.35	5.31*	1.000	1.02
2	BIS	0.48	0.23	26.15*	-0.9	0.26	4.37*	0.95	1.02

* $P < 0.001$. BAS: Behavioral activation system, BIS: Behavioral inhibition system, VIF: Variance inflation factor

DISCUSSION

The results showed that the BIS/BAS had the potential for predicting mothers' postpartum blue. This result is in harmony with findings of other study which showed that depressed patients have a high level of BAS in comparison with normal people.^[28] Previous findings acknowledged that neurotic depression and anxiety are the results of higher activity of BIS, while psychoactive depression arises from the low activity of the BAS.^[11] Meanwhile, researchers found that the high scores of BAS predict lifelong depression and anxiety disorders.^[29] However, high scores in BAS are positively correlated with a positive emotional experience such as optimism, psychological well-being, and conversely correlated with depression.^[14]

The results of this study revealed that participants suffering from postpartum blue have higher BIS, and their BAS is limited. According to the theory of reinforcement sensitivity, the participants are more sensitive to the reward. It has been expected as BIS is the basis of neurotic depression.^[5,21] The findings of the research are also

consistent with other results which indicated high activation and sensitivity of BAS is related to negative mood.^[30] It is suggested that, regardless of the nature of the anxiety, the sensitivity of the BAS is associated to unpleasant emotions. People with high levels of BAS, in general, regardless of the situation, experience more unpleasant emotions and exhibit higher unpleasant emotions in distressed situations.^[31-33]

As a cross-sectional study, this study has been subjected to some limitations. Since the present study has been conducted in the mothers with postpartum blue in a single city and limited participants, its generalizability should be taken with caution and it is suggested that a similar study be conducted among the clinical population of mothers suffering from postpartum blue. There is a need for further neurological research to understand the underlying mechanism of BIS/BAS and its relationship with postpartum blue. Regarding disease history, we were limited with self-report tools and could not conduct deep intervention or laboratory tests. Therefore, it is recommended that laboratory evaluations also included in future studies. On the other hand, this study is limited to single variable, while postpartum blue is associated with several factors. Future research should look at the role of these components, and especially their differences in postpartum depression and blue as a mood disorder, in correction with BIS/BAS. The responsibilities, father cooperation, social capital, and support suggested to be compared in future researches.

CONCLUSION

According to the findings of this study, research evidence suggests that the inherent tendencies of BIS and BAS that manifest themselves in their emotional styles are an important risk factor for emotional disturbances. In addition, the abnormal sensitivity of these systems is indicative of potential for different types of psychopathology,^[9] so that the BIS/BAS can explain a wide range of disorders. As studies showed that BIS/BAS is relevant to treatment outcome.^[34] It would be useful for future studies to utilize the measurement of BIS/BAS in treatment settings to design personal and effective protocols for the treatment of postpartum blue in mothers.

Conflicts of interest

There are no conflicts of interest.

Author contribution

All authors contributed to this research.

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