[Environmental Health and Preventive Medicine 11, 199–205, July 2006]

Original Article

Relationship between Sense of Coherence in Final Stage of Pregnancy and Postpartum Stress Reactions

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Abstract

Objective: In this study, we evaluated postpartum stress using a postpartum depression scale and by measuring the level of a stress-related substance, to clarify the relationship between the stress-coping capabilities of women in the final stage of pregnancy and their postpartum stress reactions.

Methods: Between April 2004 and October 2004, 54 women participated in a questionnaire survey and the measurement of their secretory immunoglobulin A (s-IgA) level as a stress-related substance two times in the final stage of their pregnancy (prepartum) and in their early puerperium (postpartum) was carried out. The questionnaire used in the prepartum stage included the following parameters: "basic features", "Sense of Coherence (SOC)" and "Japanese version of the self-assessment depression scale" of Zung. The questionnaire employed in the postpartum stage included the following parameters: "course of delivery", "Self-evaluation of delivery experience", and "Postpartum depression scale".

Results: The depression score was higher and the s-IgA level was lower in the low-SOC score group than in the high-SOC score group, indicating that stress reactions were more intense in the low-SOC score group.

Conclusion: It was revealed that stress reactions were more intense for women with a low SOC score. Moreover, the finding of a relationship between the low SOC score in the prepartum stage and depressive tendency suggests that women who are likely to develop depressive tendency can be predicted in the prepartum stage, and the significance of measuring SOC in the prepartum stage is thus suggested.

Key words: sense of coherence, stress-coping capabilities, stress reactions, secretory immunoglobulin A, depressive tendency

Introduction

Various studies have revealed that the experience of giving birth has a large impact on the postpartum mental health of women (1–4). As for the effects of delivery on mental health, a researcher reported that women less satisfied with their delivery were more likely to show postpartum depressive tendency (5). For women, delivery is one of the most stressful events both physically and psychosocially among the various events in their lives. Postpartum depressive tendency may be viewed as a kind of postpartum stress reaction.

Stress can be generally classified into the following three categories: physicochemical stress, physiological stress and psychosocial stress. In psychosocial stress, the field of "Psychoneuroendocrinoimmunology" has recently drawn much attention (6). Studies in this field have been conducted primarily within the framework of psychosomatic diseases. These studies are based on the theory that the physiological changes observed in the three systems of the living body (i.e., nerve, endocrine and immune systems) in response to stress (e.g., excitation of the autonomic nerve system, stimulation of hormone secretion from the endocrine system and reduction in the activity of immunocompetent cells) are not independent but a result of the interaction of these systems. From this theory, it has been thought that the cognitive function and stress-coping capabilities of an individual determine the body's response to psychosocial stress (6, 7). This means that psychosocial stress is

Received Nov. 11, 2005/Accepted Apr. 27, 2006
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subjective in nature because it is affected by the cognitive function and stress-coping capabilities of an individual. Reactions to stress therefore can vary depending on how the individual recognizes stress and to what extent the individual can handle stress. For this reason, subjective stress evaluation such as the use of questionnaires has limitations.

Therefore, if the relationship between the aforementioned "satisfaction with delivery" and "postpartum depressive tendency" is discussed on the basis of the theory of stress recognition and evaluation proposed by Lazarus (7), the degree of satisfaction with delivery corresponds to how an individual recognizes (or recognized) her experience of delivery, and postpartum depressive tendency can be regarded as a postpartum stress reaction. Furthermore, we anticipate that stress-coping capabilities associated with delivery can also affect stress reactions.

From this background, this study was undertaken to evaluate postpartum stress reactions using a postpartum depression scale (i.e., a subjective indicator) and by measuring the level of a stress-related substance (i.e., an objective indicator). We previously reported the relationship between the degree of satisfaction with delivery and stress reactions (8), thus, in this study, we focused on the relationship between stress-coping capabilities and stress reactions.

Methods

Subjects

Four obstetric facilities in a selected district that consented to the objectives and methods of this study and in which the percentage of low-risk pregnant women was relatively high were selected by the expedient sampling method. Women satisfying all of the following requirements were enrolled in the study: 1) women receiving periodic ambulatory health checkups for pregnant women and who are scheduled to undergo delivery in the same facility as that for pregnancy management, 2) women without medical complications, 3) pregnant women who intend to have transvaginal delivery and 4) puerpera after term delivery.

This study was approved by the Ethical Committee for Human Studies in Kanazawa University School of Medicine in 2003.

Investigation and tests

A questionnaire survey and the measurement of the level of a stress-related substance were performed simultaneously.

1. Design of questionnaires

1) Questionnaire used in final stage of pregnancy (prepartum)

The questionnaire used in the prepartum stage was designed to include the following items, with reference to those used in the studies reported by Tokiwa (5, 9, 10) or Tateoka (11): "basic features" that is, age, with or without medication, smoking, and drinking, "Sense of Coherence (SOC)" and the "Japanese version of the self-assessment depression scale" of Zung (12).

The "SOC" scale was developed by Antonovsky (13) on the basis of the salutogenetic model. Its Japanese version, prepared by Yamazaki et al. (14) was employed in this study. According to Yamazaki, the SOC scale is an advanced form of the concept of stress-coping capabilities and thus we used SOC as the scale of stress-coping capabilities.

The salutogenetic model of Antonovsky is composed of two theoretical models. One model is based on the theory which states that stress can work both favorably and unfavorably on health and that the nature of its influence on health is determined by the degree of the individual's SOC developed through various experiences. The other model pertains to the theory which states that SOC is developed through good experiences in one's life and is reinforced by experiencing success in dealing with tension (13, 15). In this study, the former theory was adopted and SOC in the prepartum stage was investigated, while maintaining SOC as an independent variable, with the goal of examining how stress-coping capabilities developed during one's life would relate to postpartum stress reactions.

The SOC scale is composed of 29 elements. The responses to each question are rated on a seven-point scale (scores 1 to 7) and the total score is calculated. A higher total score indicates that the individual is less likely to develop stress even when facing various stressful stimuli.

2) Questionnaire used in early stage of puerperium (postpartum)

The questionnaire used in the postpartum stage was designed to include the following items, with reference to those used in the studies reported by Tokiwa (5, 9, 10) or Tateoka (11): "course of delivery" (i.e., time required for delivery, gestational weeks, with or without measures used during delivery, amount of blood lost during delivery, and birth weight), "Self-evaluation of delivery experience", and "postpartum depression scale". "Self-evaluation of delivery experience", prepared by Tokiwa (9, 10), was used for the evaluation of the degree of satisfaction with delivery. With this scale, the degree of satisfaction of the mother regarding her delivery is rated on a five-grade scale (much satisfied to quite unsatisfied). This scale is composed of 18 questions and the total score ranges from 18 to 90. A higher total score indicates a higher degree of satisfaction with delivery.

Previous studies revealed that depressive tendency during pregnancy is associated with postpartum depressive tendency (16). In view of this finding, we used the "Japanese version of the self-assessment depression scale" of Zung in the prepartum stage and the "Postpartum depression scale" of Ikemoto et al. (17) in the postpartum stage. The latter scale was prepared by combining the 20 questions from the Zung's scale with 5 questions pertaining to postpartum physical symptoms (total of 25 questions). Responses to each question are rated on a Likert's four-grade scale (unconscious to always conscious). A higher total score indicates a higher likelihood for developing depressive tendency.

2. Blood sampling

1) Parameter

Blood was sampled and checked for the presence of secretory immunoglobulin A (s-IgA), which is a stress-related substance. Blood was used as a specimen for detecting s-IgA for the following reasons: although large interindividual vari-

ances in physiological parameters are known, interindividual variance is particularly large for saliva; and because the composition of secretions has been reported to vary among different sites of secretion, blood which allows relative quantification was selected.

2) Blood sampling protocol

Blood was collected from the median vein of the brachium. The sampling site was disinfected with cotton containing alcohol and punctured using a 22 gauge needle. Considering the circadian variation in the parameter to be tested, blood was sampled between 9:00 and 11:00 in the morning. Five milliliters of blood was collected into an Insepac vacuum plastic tube made by Sekisui Medical and the blood sample was treated with a serum separating agent and a coagulation promoting agent. Each blood sample was centrifuged on the same day and stored at −80°C within the same laboratory until use for the assay, so that the stability of the parameter to be tested could be maintained.

3) Principle of measurement procedure

A s-IgA kit made by MBL was used for the enzyme immunoassay (EIA) of s-IgA. S-IgA measurement was performed by an experienced laboratory technologist, and performed in duplicate using the same lot. After confirming the coefficient of variation (CV), the parameter to be tested was finally quantified.

Data collection

1. Survey period

The survey period was from April 2004 to the end of October 2004. For each subject, the survey was conducted at two points, that is, in the prepartum stage (approximately 36 weeks of pregnancy) and in the postpartum stage (3–5 days after delivery).

2. Procedure

1) Informed consent from responsible persons at each obstetric facility

The physician and chief nurse of the Department of Obstetrics and Gynecology of each obstetric facility were informed of the design, objectives and methods of the study, and their approval of the conduct of the study was confirmed.

2) Selection of subjects

In the order of arrival, the enrollment of pregnant women who satisfied the above-mentioned requirements was performed by the nurses of each facility.

3) Distribution and collection of questionnaires

The questionnaires were distributed by the researcher or a nurse to the pregnant women who had consented to the study. The answered questionnaires were collected directly or sent through a self-addressed envelope after the completion of answers.

4) Blood sampling

Blood was sampled by a nurse or a medical technologist of each facility.

Methods of analysis

All data were inputted into a computer to prepare data tables. Statistical analysis software SPSS13.0 for Windows was used for the processing and analysis of collected data. The equalities of variance test and t-test were employed to test two independent samples. Paired t-test was used to test two related samples. Either Pearson's or Spearman's correlation coefficient was calculated. Two-way analysis of variance and multiple comparison were used for the comparison of averages among related multiple samples. In all tests, $p<0.05$ was regarded as statistically significant.

Ethical consideration

Each candidate woman for this study was informed by the researcher or the staff of the facility concerned as to the design, objectives and methods of the study. When a candidate woman consented orally, she was then asked to sign a letter of consent.

To minimize stress associated with blood sampling, blood was sampled in time of the periodical health checkup for pregnant women or the routine postpartum check for anemia. When requesting each pregnant woman for a blood sample for testing, the pregnant woman was informed that the frequency of blood sampling will be the same as that of the regular blood sampling and that five milliliters of blood would be collected each time.

Results

Sample collection

Sixty women in the prepartum stage were invited to participate in the study, and all of them gave their written informed consent to the study. Of these pregnant women, six were not included for not satisfying all of the requirements of the study. These included two women who were referred to other facilities because of maternal or fetal abnormalities during pregnancy, one woman who decided to change the place for her delivery, one woman who had a premature delivery and two women who underwent cesarean section. As a result, 54 women (90%) were included in the analysis.

Features of subjects

Table 1 shows the summary of the features of the subjects. Twenty-four women (44.4%) were classified as primipara and thirty women (55.6%) were classified as para. The time required for delivery differed significantly depending on parity. Primipara women took more time for delivery ($p<0.01$). Table 2 shows the summary of the relationship between the s-IgA level/depression score in the prepartum stage and some variables. No variable was associated with the s-IgA level/depression score.

Score of some psychological scales and s-IgA level

The score of some psychological scales and the s-IgA level based on birth history are shown in Table 3. There was no significant difference in each score or the s-IgA level by birth history, thus, we analyzed data without the classification of birth history. The CV of the s-IgA level was in the range of 3.43–7.40% in terms of intra-assay variance and in the range of 6.97–10.9% in terms of interassay variance.

Table 1 Features of subjects (n=54)

	Birth history	mean±SD	min	max
Age (years)		28.9±3.8	23	38
Gestational week (weeks)		39.2±1.2	37	41
Time required for delivery (hours)	Primipara (n=24)	10.0±4.8]**	2.2	20.1
	Para (n=30)	6.1±4.7]**	1.2	27.8
Amount of blood lost during delivery (ml)	Primipara (n=24)	520±315	155	1310
	Para (n=30)	522±263	110	1155
Birth weight (g)		3140±309	2398	3808

** p<0.01.

Table 2 Relationship between s-IgA level/depression score in prepartum stage and some variables

	Variable	n	s-IgA (μg/ml)	p-value	depression scale (score)	p-value
Age (years)	<30	33	20.93±11.98	0.479	29.6±7.4	0.364
	30≤	21	23.40±12.99		27.8±6.4	
Medication	none	35	24.22±13.93	0.369	28.5±6.9	0.900
	ritodrine	10	17.71±7.99		29.4±8.4	
	ferric	5	21.03±8.24		30.0±8.2	
	cathartic	6	16.05±6.75		26.5±5.2	
Smoking	before smoking	16	23.71±15.44	0.515	30.9±9.7	0.172
	none	38	21.26±11.01		28.0±5.6	
Drinking	sometimes	19	23.26±14.86	0.849	26.6±4.0	0.157
	none	35	21.31±11.46		30.3±8.0	

t-test, Mann-Whitney U test, Kruskal-Wallis H test.

Table 3 Scores of some psycological scales and s-IgA level based on birth history

Period	Scale	range	Birth history	mean±SD	min	max
prepartum	Self-assessment depression scale	20–80	Primipara (n=24)	28.7±7.6	22	60
			Para (n=30)	29.0±6.6	21	48
	SOC	29–203	Primipara (n=24)	139.3±22.5	95	176
			Para (n=30)	139.5±24.6	92	197
	s-IgA	—	Primipara (n=24)	23.84±11.40	8.40	52.9
			Para (n=30)	20.30±12.89	7.30	61.5
postpartum	Self-evaluation of delivery experience	18–90	Primipara (n=24)	65.8±11.1	33	88
			Para (n=30)	70.2±9.2	49	83
	Postpartum depression scale	25–100	Primipara (n=24)	33.9±5.6	25	49
			Para (n=30)	34.1±7.3	27	58
	s-IgA	—	Primipara (n=24)	26.20±11.90	5.50	43.8
			Para (n=30)	26.90±13.90	6.70	69.6

Differences in depression score and s-IgA level between prepartum and postpartum stages

1. Depression score

There was no significant difference in the depression score between the prepartum and postpartum stages when comparing the same items of the depression scale, although the depression score in the postpartum stage tended to be higher than that in the prepartum stage.

2. S-IgA level

When the difference in s-IgA levels between the prepartum and postpartum stages was tested by the paired t-test, the s-IgA level was significantly higher in the postpartum stage (i.e., 26.6±13.0 μg/ml) than in the prepartum stage (i.e., 21.8±12.3 μg/ml) (p<0.01).

In addition, no factor (e.g., amount of blood lost during delivery, birth weight, etc.) that could affect the s-IgA level or depression score in the postpartum stage was associated with them (Table 4); thus, in the subsequent analyses of the s-IgA level or depression score or, these factors were not taken into consideration.

Relationship between SOC and stress reactions

When the subjects were divided into two groups according to their mean SOC score (i.e., high-SOC score group [>140]

Table 4 Relationship between s-IgA level/depression score in postpartum stage and some variables

Variable		n	s-IgA (μg/ml)	p-value	depression scale (score)	p-value
Age (years)	<30	33	24.94±13.96	0.234	34.8±7.1	0.236
	30≤	21	29.30±11.26		32.7±5.5	
Time required for delivery (hours)	<7.0	28	27.79±12.95	0.506	35.0±7.1	0.265
	7.0≤	26	25.40±13.28		33.0±5.9	
Gestational week (weeks)	≤39 weeks	28	25.51±12.50	0.515	35.4±7.1	0.105
	39 weeks<	26	27.86±13.75		32.5±5.7	
Birth weight (g)	<3000	18	28.72±15.01	0.413	33.3±6.4	0.571
	3000≤	36	25.60±12.04		34.4±6.7	
Amount of blood lost during delivery (ml)	≤500	27	28.30±13.32	0.140	33.6±5.6	0.682
	500<	27	24.97±11.15		34.4±7.5	
Measures used during delivery	absense	28	26.01±14.86	0.441	34.5±7.3	0.784
	presence	26	28.83±10.82		34.0±6.1	

t-test, Mann-Whitney U test.

Table 5 SOC score and postpartum s-IgA level based on postpartum depression score

depression score	n	SOC	p-value	s-IgA (μg/ml)	p-value
<40	49	140.1±23.7	0.664	27.74±12.95	0.024
≥40	5	133.2±23.0		15.84±8.98	

Mann-Whitney U test.

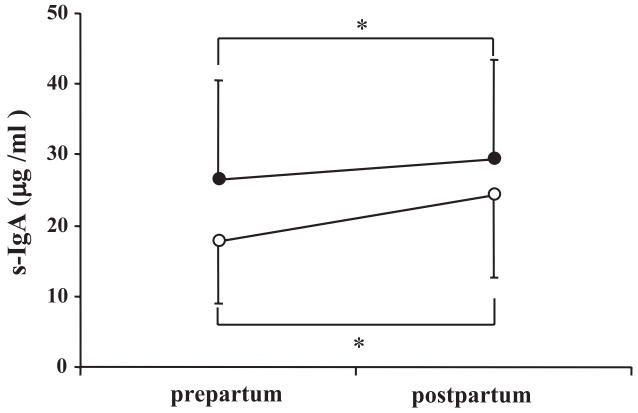

Fig. 1 Changes in s-IgA level according to prepartum stage in two groups. ●, high-SOC score group (>140, n=26); ○, low-SOC score group (≤139, n=28). Values represent mean±SD. Statistical analysis of difference was performed by repeated measures ANOVA. Significant differences by post-hoc test as compared with initial value. * $p<0.05$.

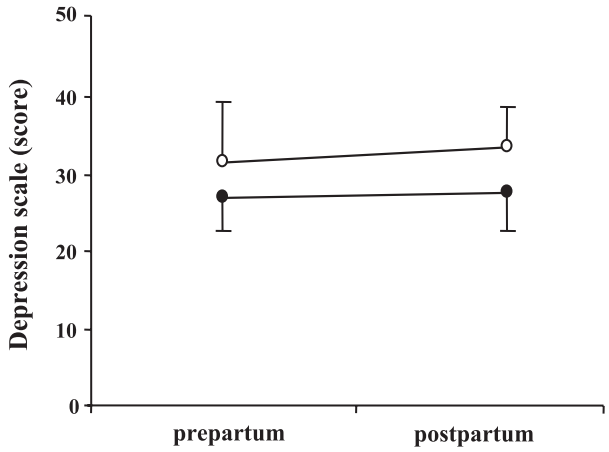

Fig. 2 Changes in depression score according to prepartum stage in two groups. ●, high-SOC score group (>140, n=26); ○, low-SOC score group (≤139, n=28). Values represent mean±SD. Statistical analysis of difference was performed by repeated measures ANOVA. Significant differences by post-hoc test as compared with initial value.

and low-SOC score group [≤139]) and their changes in s-IgA level after delivery were subjected to randomized block two-way analysis of variance, SOC and time were found to exert major effects, and postpartum s-IgA level was significantly higher than prepartum s-IgA level ($p<0.01$). Furthermore, s-IgA level was significantly higher in the high-SOC score group than in the low-SOC score group ($p<0.01$). However, no interaction was observed between these factors, and the change in s-IgA level following delivery did not differ between the high- and low-SOC score groups (Fig. 1).

When the depression score was compared between the high- and low-SOC score groups, SOC was identified to exert the main effect, and the depression score was significantly higher in the low-SOC score group than in the high-SOC score group ($p<0.05$); however, no significant difference between the prepartum and postpartum stages was observed when the same items in the depression scale were compared, although the depression score in the postpartum stage tended to be higher than that in the prepartum stage. Moreover, no interaction was observed between these factors (Fig. 2).

Difference in SOC score and postpartum s-IgA level based on postpartum depression score

The Mann-Whitney U test showed no significant differ-

ence in the SOC score between the two groups with high depression (≥40) and low depression scores (<40 scores), but showed that postpartum s-IgA level in the high-depression score group was significantly lower than that in the low-depression score group (Table 5).

Discussion

Before this study, few studies have shown the quantification of stress-related substances in pregnant or puerperal women. Thus, basic data on this topic had been quite limited. No cut-off point for the determination of high-or low-stress reactions had also been determined. As shown in previous studies, the levels of stress-related substances vary greatly among individuals. It is therefore not appropriate to simply compare the level of these substances on the basis of the measured data. Thus, we carried out a comparison with existing studies by focusing on the differences in the prepartum and postpartum levels of a stress-related substance (i.e., s-IgA) in this study to establish a relationship between stress-coping capabilities and stress reactions.

Difference between prepartum and postpartum s-IgA levels

In a previous study (18) in which the time course of maternal serum s-IgA level was monitored from the pregnancy period to the third postpartum day, s-IgA level increased significantly towards the end of pregnancy and further increased on the third postpartum day. The postpartum change in s-IgA level observed in this study was in good agreement with that in the previous study.

Relationship between SOC and s-IgA level

In the analysis of the relationship between SOC and s-IgA level, s-IgA level was significantly lower in the low-SOC score group than in the high-SOC score group. It was previously shown that s-IgA level increases in response to acute stress. It seems unlikely that the women surveyed in this study were exposed to acute stress, considering that this study was performed from the third to the fifth postpartum days when women after having delivered can usually peacefully review their experience of giving birth. In addition, according to a prevailing view, immunity is suppressed by stress (19–21). Yajima et al. (22) also showed in their study of the relationship between psychological stress and immunity that stress reduces s-IgA level. Moreover, we found that no factor which could affect immunity level was associated with the changes in s-IgA level. In view of these findings, the significant difference observed in s-IgA level indicates that immunity was more suppressed in the low-SOC score group than in the high-SOC score group, that is, psychological stress reactions were more intense in the low-SOC score group.

Relationship between SOC and depressive tendency

Compared with those of women in the high-SOC score group, the depression scores in both the prepartum and postpartum stages of women in the low-SOC score group were high, which suggests that a low SOC score can affect mental health.

Furthermore, it has been pointed out that although the early detection and treatment of postpartum depressive tendency can suppress the progression of this tendency from developing into major mental health disorders, a delay in the detection of this tendency can lead to psychiatric disorders (23, 24). In this sense, it is important to identify pregnant women who are likely to develop postpartum depressive tendency as early as possible.

The finding of a relationship between the low SOC score in the prepartum stage and depressive tendency suggests that women who are likely to develop depressive tendency can be predicted in the prepartum stage. Moreover, the importance of measuring SOC in the prepartum stage (e.g., when women are given delivery guidelines during pregnancy) was suggested to prepare an appropriate therapy for postpartum depressive tendency.

In our previous study (8), we showed that a lower degree of satisfaction with delivery was associated with a higher likelihood for developing postpartum depressive tendency. If this finding is considered together with the results in this study, we may say that enhancing SOC or the degree of satisfaction with delivery can be a factor for preventing postpartum depressive tendency. However, SOC is developed from good pleasant experiences in one's life and SOC is reinforced by successful experiences in dealing with tension. This suggests that SOC is developed during the course of life of each individual. Furthermore, Antonovsky (15) stated that: "a change in SOC is not an accidental outcome. The change itself is not attributable to a single experience. Instead, SOC changes just because the individual attempts to adopt a new pattern of life. If a new pattern of life can be maintained for years, SOC can gradually change." Thus, a single event such as giving birth cannot easily change SOC in a woman. Therefore, from the viewpoint of preventing postpartum depressive tendency, it seems important, particularly for pregnant women with a low SOC score, to enhance their degree of satisfaction with delivery.

Possibility for predicting postpartum depression

We showed that postpartum s-IgA level in the high-depression score group (≥40) was significantly lower than that in the low-depression score group (<40). Accordingly, postpartum depression after one month in the early puerperium can be predicted by determining s-IgA level, because a previous study showed that women with depressive tendency in the early puerperium tended to develop depression after one month (24). However, this consideration will be demonstrated in a study using a longitudinal design regarding depression.

In summary, compared with women with a high SOC score, women with a low SOC score had a lower immune function and a higher likelihood for developing depressive tendency, indicating that stress reactions were more intense. This study revealed that for women with a low SOC score, stress reactions were more intense from the viewpoints of both a subjective indicator and an objective indicator. Ogawa et al. (25) stated that a low SOC score can adversely affect mental health and also has adverse effects on physical health regarding issues related to daily life of individuals. These results support the view of Ogawa et al. that a low SOC score can adversely affect both mental and physical health.

Our study may be viewed as having yielded a novel finding, because the results suggest that women who are likely to develop depressive tendency can be predicted through the evaluation of SOC score as a scale of the stress-coping capabilities of pregnant women. Moreover, from the viewpoint of delivery care, the significance of measuring SOC in the prepartum stage is suggested.

Acknowledgments

We would like to thank all mothers and staff members of respective clinics or hospitals for their cooperation in this study. This study was part of a research supported by a Grant-in-Aid for scientific research from the Ministry of Education, Culture, Sports, Science and Technology from 2004 to 2006.

References

(1) Mercer RT. Relationship of birth experience to later mothering behaviors. J Nurse Midwifery. 1985;30:204–211.
(2) Highley B, Mercer R. Safeguarding the laboring woman's sense of control. Am J Matern Child Nurs. 1978;3:39–41.
(3) Simkin P. Just another day in a woman's life? Women's long-term perceptions of their first birth experiences. Part I. Birth. 1991;18:203–210.
(4) Tipping V. The vulnerability of a primipara during the antepartal period. Matern Child Nurs J. 1981;10:61–77.
(5) Tokiwa Y. Relationship between self-assessment childbirth-related experiences and depressive tendency during early puerperium. Journal of Japan Academy of Midwifery. 2003; 17:27–38. (Article in Japanese)
(6) Kaminiwa S. Basics of neuropsychiatric immunoendocrinology. In: Kaminiwa S, Kubota M editors. Mental and Physical Networks and Their Architecture from the Standpoint of Neuropsychiatric Immunoendocrinology. Osaka: Shinryo Shinsha; 2000. p. 1–35. (Article in Japanese)
(7) Lazarus RS, Folkman S. Concepts of stress in life science. In: Psychology of Stress—Cognitive Evaluation and Countermeasures (supervised a translation by Motoaki H, Haruki Y, Oda M). Tokyo: Jitsumu Kyoiku Shuppan; 1994. p. 3–24. (Article in Japanese)
(8) Sekizuka N. Relationship between the degree of satisfaction with delivery and postpartum stress responses. Journal of Japan Academy of Midwifery. 2005;19:19–27. (Article in Japanese)
(9) Tokiwa Y. Analysis of factors affecting the self-assessment of child-birth-related experiences—Differences in primipara and multipara. Annals of Gunma University School of Health Sciences. 2001;22:29–39. (Article in Japanese)
(10) Tokiwa Y, Imazeki S. Preparing a self-assessment scale for labor-related experiences and its reliability and validity. Nihon Kango Kagakkaishi. 2000;20:1–9. (Article in Japanese)
(11) Tateoka Y. Study of stress during labor and s-IgA level in colostrums from the standpoint of neuropsychiatric immunoendocrinology. Nihon Kango Kagakkaishi. 2004;24:30–38. (Article in Japanese)
(12) Fukuda K, Kobayashi S. The Research of self-assessment depression scale. Seishin Shinkeigaku Zasshi. 1973;75:673–679. (Article in Japanese)
(13) Antonovsky A. The structure and properties of the sense of coherence scale. Soc Sci Med. 1993;36:725–733.
(14) Yamazaki Y. Salutogenetic theory (a new theory of health) and the concept SOC (sense of coherence). Quality Nursing. 1999;5:81–88. (Article in Japanese)
(15) Antonovsky A. Solving the mystery about health—Stress-coping and health-preserving mechanisms. In: Successful Coping and a Path towards Health (supervised a translation by Yamazaki Y, Yoshii K). Tokyo: Yushindo Kobunsha; 2001. p. 149–187. (Article in Japanese)
(16) Fujimura S, Toshiro E, Tsustumi T, Sato Y, Kozaki S, Yoshida T, et al. A study of maternity blues—First report: Analysis of changes in depression from prepartum to postpartum periods using SDS. Medical Journal of Japanese Red Cross Wakayama Medical Center. 1997;15:57–61. (Article in Japanese)
(17) Ikemoto K, Iida H, Kikuchi S, Takahashi S, Takahashi K. Investigation of so-called "Maternity Blues"—First report: Its incidence and clinical features. Clinical Psychiatry. 1986;28:1011–1018. (Article in Japanese)
(18) Ichikawa S, Tsukano K, Takahashi K, Ueji M, Masuda K. Changes in maternal serum s-IgA level during the course of pregnancy. Perinatal Medicine. 1989;19:713–716. (Article in Japanese)
(19) Groer MW. Characterizations and psychoneuroimmunologic implications of secretory immunoglobulin A and cortisol in preterm and term breast milk. J Perinat Neonatal Nurs. 1994;7:42–51.
(20) Annie CL, Groer M. Childbirth stress an immunologic study. J Obstet Gynecol Neonatal Nurs. 1991;20:391–397.
(21) Shitami C. Study of changes in salivary levels of secretory IgA and stress factors in women during perinatal period. Journal of Japan Academy of Midwifery. 2004;18:29–36. (Article in Japanese)
(22) Yajima J, Tsuda A, Kuwabata T, Yamada S. Relationship between neuropsychiatric immunoendocrinonological changes and mental health using mental health tests. Japanese Journal of Behavioral Medicine. 2002;8:17–22. (Article in Japanese)
(23) Beck CT, Gable RK. Postpartum depression screening scale: development and psychometric testing. Nurs Res. 2000;49: 272–281.
(24) Okano T, Nomura J, Koshikawa N, Doi M, Tatunuma T. A study of maternity blues and postpartum depression from the viewpoint of comparative culture. Clinical Psychiatry. 1991;33:1051–1058. (Article in Japanese)
(25) Ogawa Y, Nakamura H, Nagase H, Ogino K, Ooshita Y, Tsukahara S. Structural analysis of psychosocial factors involved in the risk for habit-related chronic diseases, with emphasis laid on health locus of control (HLC) and sense of coherence (SOC). Nippon Eiseigaku Zasshi. 2001;55:597–606. (Article in Japanese)