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Research report

Structure of depressive symptoms in pregnancy and the postpartum period

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Abstract

Background: The present study investigated the structure of depressive symptoms in the perinatal period. *Method*: The Zung Self-Rating Depression Scale (SDS) was administered to a total of 1329 women in early, middle and late pregnancy and 5 days, 1 month, 6 months, 12 months and 18 months after the delivery. *Results*: A number of somatic items and the suicidal ideation item of the SDS made low contributions to the evaluation of the severity of depression, and as a consequence these were excluded in the principal component analysis. Three factors were interpretable as ''Cognitive'', ''Affective insomnia'' and ''Attentional'' emerged at all eight assessment points. The goodness-of-fit index (GFI) generated by confirmatory factor analyses (LISREL 7.20) proved sufficiently high on all eight occasions. *Limitation*: The present study investigated only one self-rating scale and the sample comprised Japanese mothers only. *Conclusion*: The three-factor model of the SDS in the perinatal period was derived from exploratory and confirmatory factor analyses. It is noteworthy that the same three-factor structure emerged at all eight collection points in the present study.

Keywords: Depressive symptoms; Pregnancy and the postpartum period; Follow-up

1. Introduction

Recent psychiatric studies have shown a relatively high prevalence of depression in women in the postpartum period (Paffenbarger, 1961; Pitt, 1968) and pregnancy (Kitamura et al., 1993; Kumar and Robson, 1984). In the postnatal period, approximately 10% of women are clinically depressed (for discussion see O'Hara and Zekoski, 1988) and the incidence of antenatal depression has been reported to be 4–29% (Kitamura et al., 1996a,b). A number of studies have examined the prevalence and the

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effects of maternal perinatal depression on child development (e.g., Kitamura et al., 1996a,b; Kumar and Robson, 1984; Downey and Coyne, 1990; Zahn-Waxler, 1995; Sugawara et al., in press); however, the basic symptomatology of depression through pregnancy and the postpartum period remains unclarified. Moreover, because these previous studies have used the total score of self-rating scales to index the presence of perinatal depression, they do not provide information between certain dimensions of symptoms of maternal depression and child development (Rutter, 1990).

Despite the importance of information regarding the symptomatology of perinatal depression in understanding the psychopathology behind them, only a few factor analytic studies have been conducted to identify the symptom clusters in perinatal depression. The results of two such studies are summarized in the following: Pop et al. (1992) administered the Dutch version of the Edinburgh Postnatal Depression Scale (EPDS, Cox et al., 1987) to a sample of 293 postpartum women, and found that the symptoms formed two clusters which they called depressive mood and cognitive anxiety. The EPDS was originally designed as a unidimensional scale of depression; however, interestingly, a confirmatory factor analysis showed that a two-factor solution rather than a one-factor model better fitted the data. In another study, Salamero et al. (1994) extracted two factors which they termed cognitive-affective and somatic-inhibition from a factor analysis of the Beck Depression Inventory (BDI, Beck et al., 1961) administered to 882 pregnant women. Thus, although these two studies found two clusters of depressive symptoms, the identified dimensions varied. Both the EPDS and the BDI are self-rating depression scales but there are some differences between them. While the EPDS consists of ten items none of which relates to somatic symptoms of depression, the BDI consists of 21 items including some pertaining to somatic symptoms. The variation between the two scales at the item level, particularly the exclusion or inclusion of somatic items, seems to account for the difference in the identified dimensions between the two studies.

Certain somatic items were excluded in the development of the SPDS because Cox et al. felt that the experience of these symptoms were within the normal process of delivery. The possibility that the inclusion of certain somatic items of depression in self-rating scales might spuriously inflate the total score when these items are used in the population with the highest incidence of physical discomfort has also been noted by other researchers (Golden et al., 1991; Lustman et al., 1992; Cox et al., 1987; O'Hara et al., 1984). Moreover, in discussing the findings of his study of the structure of the BDI, Salamero et al. (1994) also cautioned against confusing somatic items of the scale with normal physical discomfort in pregnancy.

Thus, these two studies of perinatal women do not provide an account of the dimensions of depressive symptoms. For a better understanding of perinatal depression, the meaning of somatic symptoms in this period needs to be clarified. The present study was conducted to investigate the structure of depressive symptoms at different times during pregnancy and after delivery, and to examine the contribution that somatic and other symptoms make in assessing the severity of depression. The Zung Self-rating Depression Scale (SDS, Zung, 1965) was used to measure the symptoms and the severity of depression. The SDS was used in the present study because it is one of the most widely used self-report measures of depression severity and also because of its relatively balanced item content. The SDS includes six somatic items, six cognitive items, four behavioral items, three affective items, and one social relation item. The present study also aimed to investigate the case sensitivity of the identified dimensions of perinatal depression.

2. Method

2.1. Participants

A total of 1329 women who attended at the antenatal clinic in the department of obstetrics in a general hospital in Kawasaki, an industrial city in Japan, participated in a questionnaire survey. Their pregnancy was confirmed by the presence of fetal heart-beat on echocardiography using Doppler ultrasound.

Women who were at more than 12 weeks' gestation were excluded, but no other exclusion criteria were applied. Out of these 1329 subjects, psychiatric interviews were conducted on 120 randomly selected individuals (interviewed group). The subjects were aged between 17 and 42 years, with a mean (S.D.) of 27.9 (4.2) years. For 48.3% of these women, the pregnancy was their first. There were no significant differences between the total sample and the interviewed group in terms of mean age, educational attainment, annual family income, and parity.

A set of questionnaires was administered eight times during the pregnancy and after delivery: in early pregnancy (when the subjects were enrolled), middle pregnancy (approximately 20 weeks' gestation), late pregnancy (approximately 34 weeks' gestation), and 5 days (during hospitalization for delivery, the general length of admission for delivery in Japan is 5–7 days), 1 month (at medical examinations for babies and mothers in the hospital where the present study was carried out), 6 months, 12 months and 18 months after delivery. Up to 1 month after delivery, questionnaires were administered in the hospital; for the administrations at 6, 12 and 18 months after delivery, questionnaires were sent and collected by mail.

The number of subjects varied across different data collection points. There were 1059 subjects in middle pregnancy, 1064 in late pregnancy, 1108 at 5 days after delivery, 1002 at 1 month, 821 at 6 months, 723 at 12 months, and 615 at 18 months. A large part of the sample attrition was caused by moving away and change of hospitals. In Japan, some mothers bear their children at the hospital of their parents' homes and stay at their parents' homes until about 1 month after delivery. Some other drop-out cases were caused by pregnancy loss or refusal of cooperation for a longitudinal study. A series of attrition analyses (χ^2 and *t*-test of mean scores) comparing the 714 women who dropped-out of the study at 18 months with 615 who remained in it revealed no relationship between attrition and age ($p = 0.78$), annual income ($p = 0.41$), sex of child ($p = 0.12$), or total SDS score at early pregnancy, at what stage in pregnancy subjects were enrolled in the study ($p = 0.92$). Women who dropped-out of the study at 18 months, however, were more likely to have lower educational attainment ($p < 0.01$) than were those who remained.

2.2. Measures

2.2.1. Self-rating Depression Scale (SDS)

The total number of SDS items was 20; they were rated on a scale from never (0), to sometimes (1), often (2), and almost all of the time (3). The validity of the Japanese version of the SDS was shown by Kitamura et al. (1994) using a subpopulation of 120 women taken from the present study sample.

2.2.2. Structured interview

Of the total 1329 sample, psychiatric diagnostic interviews were given to 120 randomly selected women in early and late pregnancy, and at 5 days and 1 month after delivery by either of the two psychiatrists (T.K. and S.S.), using the Schedule for Affective Disorders and Schizophrenia (SADS, Spitzer and Endicott, 1978a). The standard version of the SADS was given in early pregnancy and the change version of the SADS (SADS-C, Spitzer and Endicott, 1978b) in late pregnancy, and at 5 days and 1 month after delivery. Psychiatric diagnosis was established by the Research Diagnostic Criteria (RDC, Spitzer et al., 1978). The reliability of the SADS and the RDC diagnosis had been confirmed by a case vignette strategy (Kitamura et al., 1986).

Statistical analyses were conducted using the SPSS-X programs (SPSS Inc., 1986) and LISREL 7.20 (Joreskog and Sorbom, 1993).

3. Results

3.1. Descriptive data of the SDS

The mean (S.D.) of the total score on the SDS were 21.84 (6.74) in early pregnancy, 19.33 (6.00) in middle pregnancy, 19.87 (6.00) in late pregnancy, 15.95 (5.72) at 5 days after delivery, 17.82 (6.28) at 1 month, 17.29 (6.23) at 6 months and 17.42 (6.56) at 18 months, respectively. Table 1 summarizes the item-total correlation, Cronbach's α coefficient at the eight assessing points, and the mean of item-total

Table 1
Item-total correlation of SDS at eight assessing points

Items	Early-p	Mid-p	Late-p	5-days	1-m	6-m	12-m	18-m	Mean
1, Depressed affect	0.55	0.50	0.50	0.50	0.54	0.54	0.58	0.58	0.54
2, Diurnal variation	0.15	0.21	0.18	0.14	0.18	0.18	0.25	0.27	0.19
3, Crying spells	0.36	0.35	0.37	0.35	0.43	0.40	0.43	0.45	0.39
4, Sleep disturbance	0.31	0.32	0.31	0.33	0.31	0.33	0.34	0.39	0.33
5, Decreased appetite	0.31	0.23	0.27	0.31	0.33	0.26	0.24	0.25	0.27
6, Decreased libido	0.15	0.05	0.08	0.07	0.14	0.13	0.19	0.20	0.12
7, Weight loss	0.21	0.06	0.07	0.04	0.04	0.19	0.21	0.18	0.12
8, Constipation	0.16	0.20	0.11	0.15	0.14	0.13	0.05	0.01	0.12
9, Tachycardia	0.23	0.25	0.23	0.21	0.25	0.26	0.30	0.25	0.24
10, Fatigue	0.12	0.36	0.34	0.34	0.44	0.37	0.39	0.46	0.39
11, Confusion	0.55	0.51	0.52	0.53	0.55	0.54	0.55	0.59	0.54
12, Psychomotor retardation	0.54	0.53	0.50	0.53	0.61	0.58	0.60	0.63	0.57
13, Psychomotor agitation	0.29	0.33	0.36	0.33	0.31	0.34	0.44	0.31	0.34
14, Hopelessness	0.34	0.47	0.43	0.47	0.44	0.47	0.47	0.52	0.45
15, Irritability	0.17	0.44	0.44	0.45	0.47	0.50	0.52	0.51	0.48
16, Indecisiveness	0.54	0.53	0.57	0.57	0.60	0.55	0.57	0.62	0.57
17, Personal devaluation	0.38	0.45	0.44	0.47	0.44	0.45	0.45	0.55	0.45
18, Emptiness	0.18	0.56	0.55	0.56	0.57	0.63	0.63	0.61	0.57
19, Suicidal ideation	0.22	0.27	0.24	0.24	0.28	0.26	0.33	0.30	0.26
20, Dissatisfaction	0.17	0.57	0.55	0.52	0.59	0.62	0.59	0.61	0.57
Cronbach's α	0.79	0.79	0.79	0.79	0.81	0.81	0.82	0.81	

Early-p, early pregnancy; Mid-p, middle pregnancy; Late-p, late pregnancy; 5-days, 5 days after delivery; 1-m, 1 month after delivery; 6-m, 6 months after delivery; 12-m, 12 months after delivery; 18-m, 18 months after delivery.

correlation of the eight assessing points for each item.

3.2. Factor analyses of SDS

The items which had item-total correlation of smaller than 0.30 (the mean of item-total correlation of the eight assessing points were < 0.30, see Table 1) six somatic items (diurnal variation, decreased appetite, decreased libido, weight loss, constipation, tachycardia) and suicidal ideation were excluded from the following factor analyses.

Principal-component analyses with oblimin rotations were performed on the SDS at the eight assessing points separately. Oblique rather than orthogonal analysis was performed because of the high internal consistency of the SDS (see Table 1). It is reasonable to postulate inter-correlation among the factors extracted. Three factors were extracted according to the three relevant criteria (Schmidt et al., 1995): (1) Kaiser's criterion (eigenvalues more than unity, Kaiser, 1961); (2) a scree test (Cattel, 1966); and (3) the interpretability of resulting factor structures.

The same factor structures appeared at the eight assessing points (Table 2).

Factor 1 (Factor 2 for middle pregnancy, postnatal Month 6 and Month 18) consisted of depressed affect (Item 1), crying spells (Item 3), and irritability (Item 15), which are interpretable as affective symptoms. According to the 10th Revision of the International Classification of Diseases (ICD-10, World Health Organization, 1989), fatigue (Item 10) is also one of the central feature of 'mood disorder'. Therefore, this factor was named 'Affective Symptoms and Insomnia'. Factor 2 (Factor 1 for middle pregnancy, postnatal Month 6 and Month 18) included hopelessness (Item 14), personal devaluation (Item 17), emptiness (Item 18), and dissatisfaction (Item 20). Since these items represent cognitive symptoms, Factor 2 was named 'Cognitive Symptoms'. Factor 3 contained confusion (Item 11), psychomotor retardation (Item 12) and indecisiveness (Item 16), which were related to disturbance of concentration. Thus, Factor 3 was named 'Attentional Symptoms'.

This three-factor model was tested using confirmatory factor analysis (LISREL 7.20, Joreskog and Sorbom, 1993). The fit indices for the eight assessing

Table 2
The factor structures of depressive symptoms in perinatal period

Items	Early pregnancy ($n = 1329$)			Middle pregnancy ($n = 1059$)			Late pregnancy ($n = 1061$)		
	F1	F2	F3	F2	F1	F3	F1	F2	F3
1, Depressed affect	0.58	0.03	−0.30	0.73	0.04	−0.05	0.73	−0.16	0.05
3, Crying spells	0.61	−0.05	0.01	−0.64	0.03	0.03	0.68	−0.09	0.09
4, Sleeping disturbance	0.59	−0.12	0.16	0.62	0.08	0.15	0.61	0.07	0.03
10, Fatigue	0.12	0.13	−0.35	0.34	−0.18	−0.34	0.48	0.22	−0.25
13, Psychomotor agitation	0.62	0.01	−0.05	0.56	0.05	−0.00	−0.48	−0.03	−0.12
15, Irritability	0.67	0.05	−0.18	−0.67	−0.04	−0.15	0.74	−0.03	−0.01
14, Hopelessness	−0.08	−0.78	−0.02	−0.07	0.82	−0.07	0.07	−0.84	−0.04
17, Personal devaluation	−0.04	−0.72	−0.09	−0.01	0.76	−0.03	−0.08	−0.79	−0.06
18, Emptiness	0.05	−0.84	−0.03	0.09	0.85	−0.02	0.07	−0.84	0.04
20, Dissatisfaction	0.19	−0.72	−0.01	0.22	0.65	−0.09	0.23	−0.67	−0.04
11, Confusion	−0.01	−0.14	−0.78	−0.09	0.14	−0.82	−0.04	−0.09	−0.82
12, Psychomotor retardation	0.00	0.02	−0.85	0.00	0.00	−0.86	−0.00	0.03	−0.85
16, Indecisiveness	0.00	−0.22	−0.69	0.07	0.21	−0.62	0.05	−0.17	−0.71
Contribution (%)	31.5	14.1	8.9	12.7	33.1	9.3	32.6	14.0	9.1

Items	Postnatal Day 5 ($n = 1108$)			Postnatal Month 1 ($n = 1002$)			Postnatal Month 6 ($n = 821$)		
	F1	F2	F3	F1	F12	F3	F2	F1	F3
1, Depressed affect	0.68	−0.17	0.00	0.71	−0.15	−0.02	0.68	0.13	−0.06
3, Crying spells	0.62	−0.02	0.01	0.63	0.00	−0.08	0.65	0.07	0.01
4, Sleep disturbance	0.52	0.11	−0.2	0.58	0.13	−0.04	0.60	−0.01	0.05
10, Fatigue	0.43	0.15	−0.23	0.65	0.02	−0.03	0.61	−0.05	−0.00
13, Psychomotor agitation	0.59	−0.03	0.04	0.56	0.02	−0.00	0.50	−0.10	−0.15
15, Irritability	0.80	−0.09	0.10	0.77	−0.12	0.10	0.75	0.06	−0.01
14, Hopelessness	−0.06	−0.81	−0.05	−0.04	−0.85	0.04	−0.04	0.84	0.03
17, Personal devaluation	−0.17	−0.79	−0.10	−0.09	−0.76	−0.10	−0.13	0.76	−0.12
18, Emptiness	0.06	−0.87	−0.03	0.05	−0.88	0.00	0.08	0.84	−0.04
20, Dissatisfaction	0.22	−0.69	0.01	0.16	−0.73	−0.08	0.23	0.76	0.03
11, Confusion	−0.02	−0.07	−0.81	−0.07	0.00	−0.91	−0.03	−0.03	−0.89
12, Psychomotor retardation	0.00	0.02	−0.87	0.06	−0.01	−0.84	0.12	−0.01	−0.80
16, Indecisiveness	0.17	0.08	−0.65	0.06	−0.06	−0.77	−0.02	0.15	−0.75
Contribution (%)	33.7	13.8	8.4	36.1	14.9	8.1	13.3	35.9	8.6

Items	Postnatal Month 12 ($n = 723$)			Postnatal Month 18 ($n = 615$)		
	F1	F2	F3	F2	F1	F3
1, Depressed affect	0.69	−0.20	−0.01	0.66	0.16	−0.07
3, Crying spells	0.58	0.00	−0.15	0.73	−0.05	−0.08
4, Sleep disturbance	0.60	0.09	−0.03	0.71	0.08	0.21
10, Fatigue	0.70	−0.04	0.12	0.47	−0.08	−0.32
13, Psychomotor agitation	0.42	0.07	−0.32	0.57	−0.05	−0.02
15, Irritability	0.71	−0.06	−0.05	0.70	0.10	−0.05
14, Hopelessness	−0.06	−0.87	0.02	−0.10	0.85	−0.03
17, Personal devaluation	−0.17	−0.70	0.22	0.01	0.76	−0.07
18, Emptiness	0.10	−0.84	−0.07	0.04	0.88	−0.01
20, Dissatisfaction	0.29	−0.76	0.10	0.15	0.75	−0.02
11, Confusion	−0.02	−0.02	−0.87	−0.03	0.06	−0.86
12, Psychomotor retardation	0.08	−0.02	−0.83	0.05	0.05	−0.83
16, Indecisiveness	0.05	−0.13	−0.72	0.02	0.13	−0.75
Contribution (%)	37.2	13.1	9.5	12.5	40.2	8.5

Items 2, 5, 6, 7, 8, 9 and 19 were deleted in the factor analyses.

points were as follows: The goodness-of-fit index (GFI) was 0.948 (AGFI = 0.923, $\chi^2 = 525.00$, $df = 62$, $p = 0.000$, RMS = 0.05) in early pregnancy, 0.960 (AGFI = 0.941, $\chi^2 = 288.90$, $df = 62$, $p = 0.000$, RMS = 0.04) in middle pregnancy, 0.955 (AGFI = 0.944, $\chi^2 = 262.46$, $df = 62$, $p = 0.000$, RMS = 0.04) in late pregnancy, 0.962 (AGFI = 0.934, $\chi^2 = 334.76$, $df = 62$, $p = 0.000$, RMS = 0.05) at 5 days after delivery, 0.945 (AGFF = 0.919, $\chi^2 = 378.16$, $df = 62$, $p = 0.000$, RMS = 0.05) at 1 month, 0.965 (AGFI = 0.949, $\chi^2 = 189.45$, $df = 62$, $p = 0.000$, RMS = 0.04) at 6 months, 0.954 (AGFI = 0.932, $\chi^2 = 254.81$, $df = 62$, $p = 0.000$, RMS = 0.05) at 12 months, 0.960 (AGFI = 0.942, $\chi^2 = 173.58$, $df = 62$, $p = 0.000$, RMS = 0.04) at 18 months, respectively.

Following the results of the factor analysis, three subscales of the SDS were defined as Affective Symptoms and Insomnia subscale which consisted of the items 1, 3, 4, 10, 13 and 15; Cognitive Symptoms subscale which consisted of the items 14, 17, 18 and 20; Attentional Symptoms subscale which consisted of the items 11, 12 and 16. The reliability of these subscales is presented in Table 3.

3.3. Longitudinal relationships of symptom subscales

Longitudinal correlation between each of the subscales were computed for subjects who administered the SDS at all measuring points ($n = 492$). The ranges of correlation coefficients were as follows: Affective Symptoms and Insomnia, 0.33–0.59; Cognitive Symptoms, 0.55–0.75; Attentional Symptoms, 0.40–0.67. All of the coefficients reached significant level ($p < 0.01$).

3.4. Case sensitivity of symptom subscales

In the interviewed group of women ($n = 120$), the number of usable questionnaires (SDS) returned was 111, 102, 91 and 101 at the first and third trimesters, and at 5 days and 1 month postnatally, respectively. The number of women whom we did not interview was 15, 17 and 15 at the third trimester, 5 days and 1 month postnatally; 2 women experienced neonatal death, 3 experienced miscarriage, and the remaining women either moved out of the area or did not attend.

In the present study, depressive disorder (*case*) included major depression, minor depressive disorders and atypical depression. The number of cases were as follows: 12 in early pregnancy (9 were major depressive disorder and 3 were minor depressive disorder), 10 in late pregnancy (5 were major depressive disorder and 5 were minor depressive disorder), 11 on Day 5 postnatally (4 were major depressive disorder and 7 were minor depressive disorder) and 9 were at 1 month postnatally (3 were major depressive disorder, 4 were minor depressive disorder and 2 were atypical depression). The number of cases which were diagnosed in more than two consecutive assessment periods was 8 (early pregnancy to late pregnancy was 3, Day 5 to 1 month postnatally was 4 and late pregnancy to 1 month postnatally was 1).

The mean subscale scores for cases and non-cases are presented in Table 4. The significant differences were found at four interviewing points in Affective Symptoms and Insomnia. The score of Attentional Symptoms differed also between the groups on all assessment occasions, except for postnatal Day 5. The mean Cognitive Symptoms scores did not differ

Table 3
Reliability of three subscales of the SDS (Cronbach's α coefficients)

Subscales	Assessing points							
	Early − p	Mid − p	Late − p	5-days	1-m	6-m	12-m	18-m
Affective symptoms and insomnia (items 1, 3, 4, 10, 13 and 15)	0.68	0.67	0.70	0.68	0.72	0.71	0.73	0.75
Cognitive symptoms (items 14, 17, 18 and 20)	0.76	0.82	0.82.	0.84	0.84	0.84	0.84	0.85
Attentional symptoms (items 11, 12 and 16)	0.77	0.77	0.76	0.77	0.82	0.80	0.82	0.83

Early-p, early pregnancy; Mid-p, middle pregnancy; Late-p, late pregnancy; 5-days, 5 days after delivery; 1-m, 1 month after delivery; 6-m, 6 months after delivery; 12-m, 12 months after delivery; 18-m, 18 months after delivery.

Table 4
The comparison of factor scores between cases and non-cases

Factors	Early pregnancy			Late pregnancy		
	Cases ($n = 12$)	Non-cases ($n = 104$)	t	Cases ($n = 10$)	Non-cases ($n = 92$)	t
Affective	3.82 (1.72)	1.49 (1.51)	4.80**	2.40 (1.08)	4.45 (1.36)	2.14*
Cognitive	6.09 (3.21)	4.97 (2.13)	1.13^{ns}	5.80 (2.25)	4.2 (1.92)	1.35^{ns}
Attention	6.45 (1.86)	2.13 (0.21)	2.90**	6.00 (2.31)	4.27 (1.53)	2.31*
Factors	Postnatal Day 5			Postnatal Month 1		
	Cases ($n = 11$)	Non-cases ($n = 8O$)	t	Cases ($n = 9$)	Non-cases ($n = 92$)	t
Affective	1.64 (1.29)	0.71 (1.27)	2.27*	2.44 (1.81)	1.26 (1.45)	2.28*
Cognitive	5.54 (2.42)	4.06 (2.16)	1.98^{ns}	5.11 (3.33)	3.77 (2.05)	1.18^{ns}
Attention	3.91 (1.87)	4.44 (1.73)	0.41^{ns}	5.78 (2.05)	4.11 (1.73)	2.72**

S.D. in parentheses. * = $p < 0.05$; ** = $p < 0.01$; ns, Not Significant.

significantly between the groups at any of the assessing points.

4. Discussion

From the analysis of item-total correlation of the SDS in pregnancy and the postpartum period, the six somatic items (diurnal variation, decreased appetite, decreased libido, weight loss, constipation, tachycardia) and suicidal ideation made a low contribution to the evaluation of depression severity. Although these somatic items are considered to be depressive symptoms, they are also of a physical nature due to pregnancy or childbearing. To avoid the confusion between normal distress related to perinatal physical changes and depressive symptoms, it was decided to remove these somatic items from the assessment measures of perinatal depression.

In developing the EPDS, Cox et al. (1987) excluded the pure somatic items a priori, based on a similar point of view. However, sleep disturbance and fatigue had a moderate correlation with the total SDS scores at all of the eight assessing points in our data. The sleep of some mothers is frequently interrupted because of feeding and so on, and the lack of sleep could well lead to the feeling of distress. While the mothers who are not depressed could catch up with sleep when they have a chance, the mothers who are depressed may not be able to do the same. Stein (1982) noted that insomnia was one of the major symptoms of ‘maternity blues’. Fatigue had the same magnitude of mean correlation with the total score as crying spells (0.39) which was one of the representative symptoms of depression; the results of the present study suggests that fatigue should not be neglected as a symptom of depression even during this period.

Suicidal ideation also made a low contribution to the severity of depression. Sakamoto et al. (1998), using an undergraduate sample, reported that because most of subjects answered ‘little or none of the time’ to this item, suicidal ideation was not significantly loaded on any factors. In the present study, this item also had the lowest mean score of the twenty SDS items. Although suicidal ideation is one of the symptoms in the criteria of major depression (e.g. DSM-IV, American Psychiatric Association, 1994; ICD-10, World Health Organization, 1989), depression may not immediately be linked to suicidal ideation in non-consulting samples.

The three-factor model (‘Affective Symptoms and Insomnia’, ‘Cognitive Symptoms’, and ‘Attentional Symptoms’) of the SDS in the perinatal period was derived from exploratory and confirmatory factor analyses. It is noteworthy that the same three-factor structure emerged at all eight data collection points in the present study. These three subscales had also relatively high internal consistency, despite the small number of items.

In previous factor analytic studies of the SDS in different sample populations, three- or two-factor models were proposed. The two-factor models have been proposed by some researchers who performed principal component analysis with varimax rotation (Kawada and Suzuki, 1993; Schotte et al., 1996). However, these findings were somewhat unclear. Although Kawada and Suzuki (1993), in a sample of night-shift workers, obtained four factors with eigenvalues of more than unity (Kaiser's criterion), they decided to extract factors with eigenvalues of more than two, for unclear reasons. Schotte et al., 1996 (in-patient sample) also reported two factors; those eigenvalues were more than three and some items were loaded on the two factors. Using a similar statistical method as in the present study (principal component factor analysis with oblique rotation), to interpret the resulting factor structures, (Sakamoto et al., 1998, undergraduate sample, $N = 2258$) found three factors: 'cognitive symptoms', 'affective symptoms' and 'somatic symptoms'. Their 'affective symptoms' factor was the same as Affective Symptoms and Insomnia in the present study, excluding the item of sleep disturbance, but their 'cognitive symptoms' factor was in addition to our Cognitive Symptoms and Attentional Symptoms. There is a need to investigate whether the split of the general cognitive item cluster between hopelessness-related items and items related to poor concentration is specific to the symptomatological phenomena of perinatal depression.

The longitudinal correlation and case sensitivity of the three SDS subscales were also investigated in the present study. All of the three subscale scores showed a positive correlation from early pregnancy to 18 months after delivery. The subscale score at one assessing point may have a positive correlation with those at subsequent time-points due to a continuing depressive state, because the interval in our study between assessments was relatively short. However, even considering the scores in early pregnancy and at 18 months after delivery, there was a moderate magnitude of correlation (Affective Symptoms and Insomnia = 0.39, Cognitive Symptoms 0.56, Attentional Symptoms = 0.41). Recently, Young et al. (1996) found that there were stable individual trait components of hopelessness, and like hopelessness, the above depressive symptoms may have some trait-like components. Cognitive Symptoms showed the highest longitudinal stability of these three subscales. Moreover, the discriminating (cases and non-cases) power of Cognitive Symptoms subscales was the lowest of the three: none of the differences in Cognitive Symptom scores between cases and non-cases was significant. More detailed investigation will be needed of individual differences in the scores of these three symptom clusters.

The present study has some strengths (longitudinal design, relatively large sample), but also some limitations. First, it investigated only one self-rating depression scale; the SDS. However, to establish the structure of depressive symptoms in the perinatal period, there is a need to accumulate findings from factor analytic studies of other self-rating depression scales as well as cluster analysis of diagnostic assessments of depression (e.g., DSM-IV, American Psychiatric Association, 1994; ICD-10, World Health Organization, 1989) in pregnancy and the postpartum period. Second, since all our sample were Japanese mothers, there may be ethnic and cultural differences affecting the structure of the SDS. Future study is needed to replicate these data in different ethnic or cultural samples. Third, there was a substantial sample attrition in the present study. Although it does not appear that the variables of particular interest in the present study, such as total SDS score in early pregnancy, were predictive of dropout status, still the question remains whether some of the subjects dropping out may have developed depression. The best methodology of maintaining the sample size and following the dropout subjects needs to be developed.

Using these subscales in addition to the total score of the SDS, future studies may be able to answer such research questions as: 'What symptomatic profile (combination of symptom clusters) of depression are there in the perinatal period?', 'What kinds of risk factors relate to which symptom cluster?', or 'What type of treatment is effective for which symptom cluster?', etc. Dimensions of depressive symptoms may help further clarify causal mechanisms of the effects of perinatal depression on child development and maternal psychological adjustment.

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