

# Mood and hormonal changes during late pregnancy and puerperium

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*Summary:* The present study was designed to assess the relationship between puerperal hormonal changes and mood. Twenty-five postpartum physically and mentally healthy, drug-free women were included in the study; seven later dropped out. Blood samples were drawn between 8 and 9 a.m. just prior to delivery, and again three days after delivery, before discharge. Blood levels of LH TSH, FSH, estrogen and prolactin were determined. Three days after delivery, a psychiatric interview was conducted during which psychometric rating scales (Brief Psychiatric Rating Scale, Hamilton Depression and Hamilton Anxiety Rating Scales, and Beck Depression Inventory) were completed. The rate of change in hormonal blood levels was analyzed in relation to the scores on the rating scales.

Results showed that the rise in prolactin plasma levels had a negative and significant correlation with the scores on the Hamilton anxiety scale. This may indicate that high prolactin plasma levels, associated with milk production, may lead to lower anxiety levels in lactating women.

*Key words:* Postpartum; Mood; Hormonal changes.

## INTRODUCTION

Women in the postpartum period are at a high risk of psychiatric morbidity<sup>(1, 2)</sup>. The most common syndrome observed

after delivery is the postpartum blues. Presenting symptoms include lability of mood, dysphoria, crying spells, anxiety, insomnia, and subjective confusion<sup>(3)</sup>. Symptoms generally peak between the third and seventh postpartum day<sup>(4)</sup>, although psychiatric assessment scales show the highest scores between the third and fourth postpartum days<sup>(5, 6)</sup>. At the same time, there are dramatic changes in hormonal levels of the hypothalamic-pituitary-gonadal axis.

No definite correlation has yet been found between mood changes and levels of plasma luteinizing hormone (LH), follicle-stimulating hormone (FSH), estrogen, progesterone<sup>(7)</sup>, or thyroid-stimulating hormone (TSH)<sup>(8)</sup>. However, some as-

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sociations were found between female gonadal hormone levels affecting, for example, the sedative effect of progesterone in animals <sup>(9)</sup>, or progesterone involvement in depressed mood in some women taking contraceptives <sup>(10)</sup>. The association between postpartum hyperprolactinemia and mood changes is controversial <sup>(11, 12)</sup>. The postpartum elevation in prolactin plasma levels begins earlier than the third day after delivery and is related to lactation <sup>(13)</sup>. The third postpartum day is the day of discharge from hospital, and this has a psychological effect on the new mother. The present study was designed to examine the relationship between changes in blood hormone levels and mood on the third postpartum day, just before exposure to such environmental stresses as the maternal role and family reorganization <sup>(14, 15)</sup>.

## METHODS

The study included 25 consecutive physically and mentally healthy pregnant women, aged 21-41 years (mean, 28.83 years), who were hospitalized prior to delivery in the Department of Obstetrics and Gynecology at Beilinson Medical Center. All subjects were drug-free and gave informed consent to participation in the study. Blood samples were obtained for determination of LH, FSH, estrogen, progesterone, TSH, and prolactin levels, once between 8 and 9 a.m. just before delivery and again between 8 and 9 a.m. before breast feeding, (to avoid the effect of sucking on prolactin levels) on the third day after delivery, a few hours before discharge. The second sample was not obtained from seven of the women (in four because of their refusal), and these subjects were dropped from the study. All women were lactating after delivery. The participants were interviewed by a trained senior psychiatrist to detect those women with any emotional disturbances not related to normal changes in hormonal levels <sup>(16)</sup>. The severity of the depression and anxiety symptoms was rated on the 24-item Hamilton depression rating scale (HDRS) <sup>(17)</sup> and the 14-item Hamilton anxiety rating scale (HARS) <sup>(18)</sup>.

The women were also evaluated using the brief psychiatric rating scale (BPRS) <sup>(19)</sup> and the self-rated Beck depression inventory (BDI) <sup>(20)</sup>. Hormonal levels were determined by radioimmunoassay and analyzed in relation to the scores

of the rating scales, using Pearson's correlation test. The changes in hormonal levels were evaluated using the paired two-tailed t test.

## RESULTS

None of the women met the DSM-III-R criteria for psychiatric disorders. Results are presented in Table 1. Significant reductions in LH, progesterone, and estrogen were found after delivery ( $t = 2.52$ ,  $df = 12$ ,  $p = 0.027$ ;  $t = 3.17$ ,  $df = 8$ ,  $p = 0.013$ ;  $t = 3.15$ ,  $df = 7$ ,  $p = 0.016$ ; respectively). Blood levels of FSH and TSH also fell, but not significantly ( $t = 1.95$ ,  $df = 13$ ,  $p = 0.07$ ;  $t = 0.73$ ,  $df = 8$ ,  $p = 0.489$ ; respectively), and prolactin plasma levels increased significantly. The rise in plasma prolactin levels showed a negative and significant correlation with the scores on the HARS ( $r = -0.7$ ,  $p = 0.017$ ) but not with the reduction in the scores on the HDRS ( $r = -0.537$ ,  $p = 0.068$ ). No other changes in hormonal levels correlated significantly with the scores on any of the other rating scales.

These results indicate that an increase in prolactin three days after birth might relate to a decrease in anxiety in lactating women.

## DISCUSSION

After delivery, dramatic changes in hormonal levels occur; during the same period, women incline to mood and anxiety morbidity <sup>(2)</sup>. Both these phenomena have been studied, but no clear relationship between them has been established <sup>(1, 7)</sup>. We focussed on the changes in plasma gonadal and pituitary hormone levels in relation to changes in mood and anxiety, on the assumption that mood after childbirth, especially the post-partum blues, might be affected by endocrine levels <sup>(21)</sup>. Our results did not reveal any significant correlation between the changes in plasma progesterone, estrogen, LH,

Table 1. — Hormone levels and scores on Beck depression inventory, brief psychiatric rating scale (BPRS), Hamilton depression rating scale (HDRS) and Hamilton anxiety rating scales (HARS) in postpartum women.

Variable	N.	Mean	Range	Std. Dev.
Age (yrs)	18	28.8	21 - 41	5.38
LH 1 mIU/ml	17	1.17	.10- 4.40	1.21
LH 2 mIU/ml <sup>x, a</sup>	14	0.74	.10- 3.90	1.31
FSH 1 mIU/ml	17	0.45	.1 - 1.1	0.34
FSH 2 mIU/ml	15	0.25	.10- .70	0.17
Progesterone 1 nmol/L	14	275.00	127 -800	242.72
Progesterone 2*, <sup>b</sup> nmol/L	12	27.72	4.6 -254.0	71.29
Estrogen 1 nmol/L	14	26681.43	3600 -84136	24351.97
Estrogen 2*, <sup>c</sup> nmol/L	11	730.82	120 -1891	502.51
Prolactin 1 nmol/L	13	172.45	30.3 -390.0	90.81
Prolactin 2 nmol/L**, <sup>d</sup>	11	277.85	122.0 -433.3	107.07
TSH 1 mIU/L	13	1.58	.98- 2.80	0.62
TSH 2 mIU/L	14	1.28	.40- 2.28	0.59
<i>Rating Scale</i>				
Beck	18	8.00	3 - 19	4.50
BPRS	18	24.17	18 - 31	3.29
HDRS	18	15.33	4 - 27	8.42
HARS	18	22.28	16 - 32	4.43

Legend: 1 - before delivery; 2 - three days after delivery; \*  $p = 0.05$ ; \*\*  $p = 0.001$ ; <sup>a</sup>:  $t = 2.52$ ,  $df = 12$ ; <sup>b</sup>:  $t = 3.17$ ,  $df = 8$ ; <sup>c</sup>:  $t = 3.15$ ,  $df = 7$ ; <sup>d</sup>:  $t = 4.81$ ,  $df = 8$ .

FSH, and TSH with scores on the psychometric scales (HDRS, HARS, BPRS, and BDI) on the third day after childbirth.

These findings are in agreement with those of Nott *et al.* (<sup>7</sup>) who failed to find any evidence of a relationship between hormonal changes and mood, although a slight correlation was found between depressive symptoms within the first ten postpartum days and the amount of decrease in progesterone level, as well as between symptoms of sleep disturbance and low levels on estrogen. Dalton (<sup>21</sup>) claimed that postnatal depression is by definition a result of hormonal changes, specifically the sharp drop in circulating progesterone in the puerperium; these data were not confirmed in another study (<sup>22</sup>). Our study, which did not show any association between plasma and mood, also disagreed with the finding of Stewart *et al.*

(<sup>8</sup>) and Stewart (<sup>32</sup>), who suggested that thyroid dysfunction should be considered in the individual woman with postpartum depression; however, the importance of the thyroid in the etiology of this condition has not yet been established.

The major finding of the present study was the negative correlation between the increase in prolactin levels and anxiety three days after delivery. High ratios of prolactin to progesterone and estrogen levels after delivery have been proposed as a cause of postpartum mood disorders in one study (<sup>24</sup>), but not in another (<sup>25</sup>). Our results disagree with those of Fava *et al.* (<sup>26, 27</sup>), who studied changes on the seventh postpartum day and showed significantly less depression and anxiety in women who did not suffer from hyperprolactinemic amenorrhea. However, the difference between our results and those

of Fava *et al.* <sup>(26, 27)</sup> may be related to differences in the study groups. The women in the present study were in the immediate postpartum period, whereas those of Fava *et al.* <sup>(26, 27)</sup> suffered from amenorrhea. The rise in prolactin plasma levels in the present study was associated with elevated breast milk and better breast feeding, whereas the hyperprolactinemia in the studies of Fava *et al.* <sup>(26, 27)</sup>, was associated with amenorrhea.

These findings may indicate that those women who have more milk and a higher increase in prolactin are less anxious and that the psychologically satisfying effect of breast feeding, rather than the change in prolactin level, is the basis for this phenomenon. We conducted this study during the postnatal hospitalization period immediately (three days) after delivery to avoid the effect of social, psychological, and environmental stresses at home.

In conclusion, the findings in the present study indicate that the postpartum increase in plasma prolactin levels is associated with low anxiety scores, an effect which may be ascribed to the positive effect of breast feeding on anxiety during the first postpartum days, as part of a more complex psychophysiological interaction <sup>(4, 29)</sup>.

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