



Regular article

Psychosocial stress moderates the relationships between oxytocin, perinatal depression, and maternal behavior



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ABSTRACT

The hormone oxytocin (OT) is of particular interest in the study of childbearing women, as it has a role in the onset and course of labor and breastfeeding. Recent research has linked OT to maternal caregiving behavior towards her infant, and to postpartum depressive symptomatology. There is also evidence that psychosocial adversity affects the oxytocin system. The present study investigated the relationship of endogenous OT in women during pregnancy and at 8 weeks postpartum to psychosocial stress, maternal symptoms of depression, and maternal sensitive behavior. It was hypothesized that OT would mediate the effects of maternal depressive symptoms on maternal interactive behavior. We also tested the hypothesis that psychosocial stress would moderate the relationship between OT and maternal depressive symptoms and sensitive behavior. A community sample of 287 women was assessed at 12–14 weeks of gestation, 32–34 weeks of gestation, and 7–9 weeks postpartum. We measured plasma OT, maternal symptoms of depression and psychosocial stress. At the postpartum home visit, maternal behavior in interaction with the infant was videotaped, and then coded to assess sensitivity. In the sample as a whole, OT was not related to maternal depressive symptoms or to sensitive maternal behavior. However, among women who reported high levels of psychosocial stress, higher levels of plasma OT were associated with fewer depressive symptoms and more sensitive maternal behavior. These results suggest that endogenous OT may act as a buffer against the deleterious effects of stress, thereby protecting high risk women from developing depressive symptoms and promoting more sensitive maternal interactive behavior.

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Introduction

Community studies of depression during pregnancy and postpartum report prevalence rates of 6.5–13% (Gavin et al., 2005). Depressive symptoms affect not only the woman herself, but also the mother–infant relationship and infant development. Depressed mothers are less likely than other mothers to engage in maternal behaviors such as face-to-face visual contact, “baby talk”, affectionate touch, sensitivity and contingent responsiveness that are associated with optimal infant cognitive and socioemotional development (Cohn et al., 1990; Feldman and Eidelman, 2007; Field, 2010). While maternal psychological distress

may be a proximal cause of parenting behavior, a mother's own history of poor parenting, experiences of abuse and neglect and current stressors may be distal influences on her parenting capacity (Barrett and Fleming, 2011).

Recent research has examined neuroendocrine function as it relates to maternal experiences of adversity, depressive symptomatology, and interactive behavior. The hormone oxytocin (OT) is of particular interest in the study of childbearing women since it is implicated in labor and birth through stimulation of uterine contractions (Zeeman et al., 1997) as well as milk letdown (Brunton and Russell, 2008). OT may have a role in the regulation of both mammalian social behaviors and emotional reactivity (Carter and Keverne, 2002). It is synthesized within the paraventricular and supraoptic magnocellular nuclei of the hypothalamus, where it is transported axonally to the posterior pituitary gland, and also acts on brain regions involved in emotions and social

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cognition (Neumann and Landgraf, 2012). OT can modulate stress reactivity by attenuating activation of the HPA axis (Smith and Wang, 2012), and can down-regulate the response to stressors and the reactivity of the autonomic nervous system (Neumann, 2008).

There is conflicting evidence regarding the association between OT and depression. Some studies have found lower levels of plasma and salivary OT in depressed patients as compared to non-depressed controls (Apter-Levy et al., 2013; Zetzsche et al., 1996), with OT plasma concentrations decreasing with more elevated levels of symptomatology (Scantamburlo et al., 2007). In contrast, other research reports higher levels of plasma OT in depressed patients as compared to healthy controls (Parker et al., 2010). Yet another study found no difference between patients and controls in absolute levels of plasma OT, but reported a dysregulated pattern of OT pulsatile release in depressed patients under stressful conditions (Cyranowski et al., 2008). Lower OT levels during pregnancy have been associated with postpartum depression, though there was no concurrent association between OT and depressive symptoms during pregnancy (Skrundz et al., 2011). These discrepant findings may be due in part to a small sample size (often fewer than 25), and different timings, frequencies and methodologies of OT assays.

Psychosocial stress may be related to dysregulation of the OT system. There is very limited and conflicting evidence concerning the effects of childhood traumatic experiences on the OT system, with some research finding lower levels of OT in women with a history of childhood maltreatment compared to healthy controls (Heim et al., 2009), others finding higher levels in response to a stressor (Seltzer et al., 2014) and yet others finding no such difference (Pierrehumbert et al., 2010). Experimental research has shown that the effects of intranasal OT administration are moderated by early experience (Riem et al., 2014; Simeon et al., 2011), enhancing social cognition and attenuating stress reactivity only in those with a history of early adversity. Studies of concurrent stress are also contradictory: higher plasma OT levels have been associated with marital quality (Gouin et al., 2010) but also with perceptions of interpersonal distress (Taylor et al., 2010; Turner et al., 1999). There is a need to consider how psychosocial stress may moderate the effects of endogenous OT on perinatal depression and maternal behavior.

There is evidence in both the animal and the human literature implicating OT and its receptor in the mother–infant relationship. In rats, lactating females who exhibit low licking and grooming (LG) and their pups have lower OT receptor (OTR) binding in the medial preoptic area (MPOA) than high LG mothers and their offspring (Champagne et al., 2001; Francis et al., 2000). In human mothers, plasma OT is related to maternal mental representations of attachment (Levine et al., 2007), and to maternal behaviors such as gaze, vocalizations, positive affect, and affectionate touch (Feldman et al., 2007). Variation in the OT receptor gene (OXTR) has been associated with sensitive parenting behavior (Bakermans-Kranenburg and van IJzendoorn, 2008).

These lines of evidence suggest that the OT system may represent a potential mechanism through which maternal mental health influences the development of the mother–infant relationship. Psychosocial stress early in life, as well as later adverse life circumstances, may be associated with dysregulation of the OT system, which in depressed mothers may affect their ability to manage stress, and provide sensitive and responsive care. The present study investigated the relationship of endogenous OT levels in women during pregnancy and at 8 weeks postpartum to psychosocial stress, maternal symptoms of depression, and maternal sensitive behavior. We examined changes over time in OT levels and in depressive symptoms, and whether such changes might be related. We tested the hypothesis that psychosocial stress moderates the association of OT with depressive symptoms and maternal sensitive behavior. We also tested the mediational hypothesis that mothers with more depressive symptoms have lower levels of endogenous OT, which in turn is associated with less sensitive maternal behavior.

Methods

Sample

A community sample of women was recruited from obstetrical practices and prenatal clinics at a general hospital and a birthing center in Montreal, Quebec, during the first routine prenatal examination. In order to be eligible for this study, women had to be 18 years of age or over, within 12–14 weeks of gestation, and expecting to deliver a single infant. An additional inclusion criterion was the ability to respond to questionnaires in either English or French. Women were excluded from the sample if they delivered preterm (before 36 weeks of gestation), and their infants were admitted to neonatal intensive care. A total of 341 women were recruited, of whom 29 were ultimately excluded due to miscarriage or preterm birth. The number of women followed to 8 weeks postpartum was 287, for a retention rate of 92%; 25 women did not complete the study because they were no longer interested, unavailable, did not wish to have a blood draw, or were asked by their partner to withdraw. This sample of 287 women was used in the analyses reported here. Dropouts did not differ from those retained in the study in terms of demographic variables, depressive symptoms and plasma OT levels at baseline. Demographic characteristics of the sample are shown in Table 1. Almost all the participants (93%) reported that they were breastfeeding their infants at 7–9 weeks postpartum.

Previously published data from a subsample of the participants in this study showed that parity was associated with OT levels in late pregnancy, which were in turn associated with a more negative self-reported experience of labor and an increased likelihood of having epidural anesthesia during labor (Prevost et al., 2014). In addition, the amount of synthetic OT (syntocinon) administered during labor was associated with postpartum OT levels. These results do not alter the interpretation of the data presented in this report.

Procedures

Participants were assessed at 3 points in time: 12–14 weeks of gestation (T1), 32–34 weeks of gestation (T2), and 7–9 weeks postpartum (T3). The first two assessments took place at the hospital or birthing center, at regularly scheduled obstetrical care appointments. The postpartum assessment was conducted at the home of the participant. At each time point, participants completed a self-report questionnaire assessing symptoms of depression, and provided a 10 ml sample of blood, to measure circulating plasma OT levels. The postpartum blood sampling took place at least 30 min following breastfeeding. The measure of psychosocial stress was obtained at the first prenatal assessment.

Table 1
Sample characteristics.

Variable	Mean (SD) or N (%)
Maternal characteristics	
Age (years)	31.48 (4.56)
Years of schooling	16.50 (3.05)
Primiparous mothers	137 (47.74%)
Married or living with partner	270 (94.08%)
Infant gender (male)	152 (52.96%)
Psychosocial stress (ANRQ score)	18.95 (10.28)
Endogenous oxytocin (pg/ml)	
In early pregnancy	311.91 (283.81)
In late pregnancy	395.21 (278.31)
Early postpartum	283.96 (269.89)
Maternal depressive symptoms	
EPDS score in early pregnancy	6.08 (4.22)
EPDS score in late pregnancy	5.69 (4.27)
EPDS score early postpartum	4.73 (4.00)
Maternal behavior	
Sensitivity	3.55 (0.62)

ANRQ = Antenatal Risk Questionnaire; EPDS = Edinburgh Postnatal Depression Scale; and SD = standard deviation.

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