



Explicit and implicit caregiving interests in expectant fathers: Do endogenous and exogenous oxytocin and vasopressin matter?



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ABSTRACT

Caregiving interest in men ($N=46$) during the third trimester of their partner's pregnancy was examined. The study included both explicit and implicit measures of caregiving interest, assessments of basal urinary concentrations of oxytocin and vasopressin, and exogenous (intranasal) application of these hormones. Compared to control men ($N=20$), fathers-to-be reported more interest in direct care for children. In an immersive virtual environment, fathers-to-be, in comparison to control men, stood closer to and tended to spend more time looking at the baby-related avatars, and stood further away and tended to spend less time looking at non-baby-related avatars. Basal oxytocin and vasopressin were not related to caregiving interest in fathers-to-be, and were not different from control men. When vasopressin was administered, fathers-to-be invested more time watching the baby-related avatars compared to control men. No effects were found of exogenous oxytocin on the behavior of fathers-to-be and control men in the immersive virtual environment. These results point in the direction of an adjustment of fathers-to-be for fatherhood, both consciously and unconsciously, and support the possible role of vasopressin in human behavior in the transition to fatherhood.

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1. Introduction

In many cultures around the world extensive paternal care is fairly common (Marlowe, 2000). In contrast, in Western societies fathers have historically dominated the workforce and been expected to have little involvement in child caregiving responsibilities. Over the last decades, an increasing number of mothers have continued working after childbirth and this has brought changes in attitudes toward the fatherhood role (Cabrera, Tamis-LeMonda, Bradley, Hofferth, & Lamb, 2000). Apparently, there is a transitional shift toward men becoming recognizable caregivers (Kentner, Abizaid, & Bielajew, 2010; Lamb, 2010). Moreover, next to the maternal contribution, paternal involvement is recognized to be also important in childhood development. Active and regular engagement of the father with the child predicts a range of positive child outcomes, including less behavioral problems, less psychological problems, and enhanced cognitive development (Sarkadi,

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Kristiansson, Oberklaid, & Bremberg, 2008). Nevertheless, there is significant variation among men in their levels of paternal care. While some fathers show more interest and spend more time caregiving for their children, other fathers do not (Hewlett, 1991).

As most investigations focused on maternal care, and only a few studies investigated the hormonal correlates underlying paternal care (Gettler, McDade, Feranil, & Kuzawa, 2011; Gray, Parkin, & Samms-Vaughan, 2007), this will be studied in the present study. Caregiving interest will be examined in men who are about to become a father. Do males during their partners' pregnancy show more interest in infant caregiving as compared to childless male controls? In addition, do these expectant fathers show basal hormonal differences that are related to their caregiving interests? Moreover, we aim to investigate whether caregiving interest can be enhanced in expectant fathers and controls when exogenous hormones are administered.

Hormones have an important role in affiliative behavior, pair-bonding and also caregiving behavior (Heinrichs & Domes, 2008; MacDonald & MacDonald, 2010; Rilling, 2013). In animals, the changes in hormones involved in birth and lactation, including oxytocin, are also implicated in maternal behavior (Bosch & Neumann, 2012; Fernandez-Duque, Valeggia, & Mendoza, 2009). For example, increasing concentrations of oxytocin during pregnancy have been found to be related to higher maternal-fetal bonding (Levine, Zagoory-Sharon, Feldman, & Weller, 2007) and higher quality of human mother-infant interactions (Feldman, Gordon, Schneiderman, Weisman, & Zagoory-Sharon, 2010; Feldman, Gordon, & Zagoory-Sharon, 2011; Gordon, Zagoory-Sharon, Leckman, & Feldman, 2010).

The hormonal correlates of paternal care have not been studied as extensively as those of maternal care (Bridges, 2010; Gettler et al., 2011; Gray et al., 2007). Nevertheless, there are indications that changes in hormone patterns observed in expectant human fathers residing with their partner, may prime the onset of paternal behavior (Storey, Walsh, Quinton, & Wynne-Edwards, 2000). Moreover, in paternal animals a similar pattern has been shown, together with an absence of similar hormonal changes in non-paternal animal species (e.g., Reburn & Wynne-Edwards, 1999). Although males are not directly affected by pregnancy-related hormones, hormones released in response to mating and cues from pregnant partners might facilitate male parental care (Brown, 1993). Indeed, there is some evidence in humans that male hormone concentrations change during their partner's pregnancy. For example, Storey et al. (2000) observed elevated prolactin and cortisol levels in expectant fathers immediately prior to birth, while Berg and Wynne-Edwards (2001) reported higher estradiol levels and reduced testosterone levels during the last few months of their partner's pregnancy.

It is less clear whether male oxytocin concentrations also change during pregnancy and are related to a possible increase in caregiving interest in men who are about to become fathers. In addition to oxytocin, paternal vasopressin concentrations might also change during pregnancy. While both oxytocin and vasopressin have been widely recognized as important for affiliation, and the architecture of these two hormones is very similar (i.e. 7 of 9 amino acid positions are identical; Bosch & Neumann, 2012; Carter, 1998), vasopressin is suggested to be even more affiliated with paternal behavior than oxytocin (Carter, 2007; Storm & Tecott, 2005; Taylor, Saphire-Bernstein, & Seeman, 2010; Wang, Liu, Young, & Insel, 2000; Wynne-Edward, 2001). For example, Taylor et al. (2010) showed that relationship distress was more associated with oxytocin in women and with vasopressin in men. They suggest that vasopressin may function in men as oxytocin functions in women.

To date, most studies focused on how endogenous variations in hormone concentrations correlate with social behavior. Within this context, however, it should be noted that there are several confounding factors, including the release of other hormones, for which it is difficult to control (Heinrichs & Domes, 2008). Fortunately, neuropharmacological research has shown that neuropeptides gain access to the human brain after intranasal administration (Born, Pietrowsky, & Fehm, 1999; Neumann, Maloumy, Beiderbeck, Lukas, & Landgraf, 2013; Pietrowsky, Strüben, Mölle, Fehm, & Born, 1996) for studying the central nervous effects of oxytocin and vasopressin (Heinrichs & Gaab, 2007; MacDonald & MacDonald, 2010). Studies using oxytocin and vasopressin nasal sprays have already shown to promote social cognition and the interpretation of social communication, possibly representing an enhanced readiness to show social approach behavior and empathy (Heinrichs & Domes, 2008). In this line, it can be hypothesized that caregiving interest, as a manifestation of social behavior, can also be manipulated when oxytocin and vasopressin are administered. In order to be better able to unravel the underlying biological mechanisms of human paternal care, studies are needed involving intranasal administration of hormones in double-blind, placebo-controlled designs (MacDonald & MacDonald, 2010).

Caregiving interest in expectant fathers may be influenced by hormones and cues from pregnant partners (Hirschenhauser, Frigerio, Grammer, & Magnusson, 2002). In turn, caregiving interest may be related to how fathers-to-be perceive environment relevant cues, especially those related to infants and the paternal role. In social psychological research, two types of perception processes are distinguished (Lansu, Cillessen, & Karremans, 2012). Explicit perceptions or associations are deliberate, controlled, and under awareness. Implicit perceptions or associations are non-deliberate, automatic, and often without awareness. These explicit and implicit perceptions do not need to be concordant, as explicit perceptions for example can be subject to socially desirable answering (Paulhus, 1991). Taking into account that expectant fathers are going through psychological as well as physiological changes whilst approaching parenthood, we hypothesize that expectant fathers will show more explicit as well as implicit caregiving interest.

While explicit perceptions will be studied through self-report, implicit perceptions will be studied by observing the behavior of expectant fathers in a virtual reality setting containing baby cues. Immersive Virtual Environment (IVE) is a technique that permits participants to move around freely in an immersive, three-dimensional computer-generated environment. While the participant walks around in the test room, he views the virtual environment designed for the test room

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