



Within-cycle fluctuations in progesterone negatively predict changes in both in-pair and extra-pair desire among partnered women



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ABSTRACT

Grebe et al. (2016) argued that women's sexual interest in their own partners may be under different hormonal regulation than their sexual desire for other men. They measured partnered women's salivary hormones and reports of attraction to different categories of men at two time points separated by one week. Change in progesterone positively predicted change in women's desire for their own partners, whereas change in estradiol was a negative predictor. These results are opposite to those we previously reported for the hormonal prediction of general sexual desire in a study that employed frequent hormone sampling across multiple menstrual cycles (Roney and Simmons, 2013). Here, to test replication of the Grebe et al. findings, we assessed hormonal predictors of targeted in-pair and extra-pair desire among the subset of the sample from our 2013 paper who reported being in romantic relationships. Contrary to Grebe et al. (2016), we found that within-cycle fluctuations in progesterone were negatively correlated with changes in women's desire for both their own partners and other men. In addition, both in-pair and extra-pair desire were elevated within the fertile window and lowest during the luteal phase. Our findings contradict the idea that partner-specific desire has a unique form of hormonal regulation, and instead support a general elevation of sexual motivation associated with hormonal indices of fecundity. Discussion focuses on possible reasons for the discrepancies in findings between our study and that of Grebe et al. (2016), and on the evolved functions of women's sexual motivation.

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Introduction

Few studies have directly investigated the hormonal predictors of women's sexual motivation in natural menstrual cycles, despite considerable interest in this topic (for a review, see Wallen, 2001). Recently, Roney and Simmons (2013) collected daily saliva samples across 1–2 menstrual cycles from a sample of young women and reported positive effects of estradiol and negative effects of progesterone on within-cycle fluctuations in women's self-reported sexual desire. These patterns are consistent with those found in a wide range of nonhuman species (for a review, see Roney, 2015).

Grebe et al. (2016), writing in response to the Roney and Simmons (2013) findings, have argued that the hormonal predictors of women's sexual desire may depend on the specific targets of such desire. In particular, they argue that women may generally experience increased desire for their long-term partners during the non-fecund luteal phase when progesterone is high, with the evolved function of this desire being the extraction of direct benefits from partners (see also Thornhill and Gangestad, 2008). By contrast, during the fertile window

when estradiol is high and progesterone low, they argue that women experience heightened attraction to men with cues of good genes, whether such men are their own partners or others. Thus, two forms of sexuality are postulated – estrus and extended sexuality – that may be oppositely regulated by within-cycle fluctuations in estradiol and progesterone.

In support of their position, Grebe et al. (2016) demonstrated that changes in salivary progesterone measured one week apart positively predicted women's sexual attraction to their own romantic partners, whereas changes in estradiol negatively predicted such attraction. Note that these findings are opposite to those reported by Roney and Simmons (2013) for general sexual desire. Hormone fluctuations did not predict attraction to extra-pair partners in Grebe et al.'s sample of partnered women. Nonetheless, with respect to in-pair desire, their findings suggest that progesterone may be activational and estradiol inhibitory.

The idea that in-pair desire may have distinct hormonal regulation compared to other forms of desire is provocative and exciting. It is worth emphasizing that estradiol appears to be consistently excitatory and progesterone consistently inhibitory for sexual motivation across virtually all primate species that have been studied (for reviews, see Dixson, 1998; Emery Thompson, 2009; Roney, 2015; Wallen, 2001, 2013). As such, the reversal of these effects for in-pair desire proposed

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by Grebe et al. (2016) would imply a dramatic change in responses to hormone fluctuations specifically in humans that could profoundly alter our understanding of human sexuality. The implications of these findings underscore the importance of further tests of their robustness. Our goal here is to provide such a test.

One limitation of the Grebe et al. (2016) study, acknowledged by the authors, is that the majority of their samples (48 out of 61) appeared to be drawn from the luteal phase, based on the assayed progesterone concentrations. As such, many of the women in their study were likely sampled twice in the luteal phase, which obscures the ability to test whether hormonal signals characteristic of the luteal phase up-regulate in-pair desire relative to hormonal signals characteristic of the follicular phase. A more ideal design for testing whether estrus and extended sexuality are oppositely regulated by fluctuations in estradiol and progesterone would involve sampling the hormones more evenly across the entire cycle. The Roney and Simmons (2013) study employed just such a design, and the present report assesses hormonal predictors of previously unanalyzed variables from that study in order to test replication of results from the Grebe et al. (2016) paper.

In our previous publication (Roney and Simmons, 2013), we tested hormonal predictors of a single self-report item assessing general sexual desire, in addition to testing predictors of self-reported sexual behaviors. However, participants had additionally completed daily survey items similar to those reported in Grebe et al. (2016), including attraction specifically to their own partner among those women in relationships, degree of fantasy about individuals other than a partner, and amount of flirtation with non-partners (see Appendix A for the full list of items). The analysis strategy in Roney and Simmons (2013) focused on the single item measure of desire because we wanted an item that was applicable to all of the participants (in-pair desire was applicable only to those in relationships, and attraction to non-partners has different meaning for single and paired women), and that was unambiguously related to sexual motivation (some of the other items could index attraction or desire that was not specifically sexual). In addition, the paper was already quite long and complex, and we thus deferred examination of the additional items to a future manuscript.

The Grebe et al. (2016) findings provide a clear theoretical rationale for testing the additional items in our study, as well as a specific data analysis strategy. In deciding which items to test and how to construct any composite variables, we have attempted to replicate the Grebe et al. (2016) variables as closely as possible (see Methods). In particular, separate regression models were constructed to test hormonal predictors of general sexual desire, in-pair sexual interests (for women in relationships), extra-pair sexual interests, and amounts of flirtation. Following Grebe et al. (2016), we tested effects of the estradiol to progesterone ratio as well effects of estradiol, progesterone, and testosterone. Grebe et al. (2016) sampled only women in romantic relationships, whereas our data allowed us to test and compare patterns across both single and partnered participants.

Methods

Participants

Fifty-two naturally cycling women participated in a first menstrual cycle of data collection, with 37 women having returned for a second cycle (for full details, see Roney and Simmons, 2013). Saliva samples were assayed for hormones from 43 women in cycle 1 and from 36 women in cycle 2; to save costs, samples from women with many missing days were not sent for assay. Mean age of the 43 women with hormone data was 18.76 ± 1.15 years, and all self-reported a heterosexual orientation.

Women were surveyed daily about whether they were currently in a romantic relationship, and answered partner-specific questions contingent upon a positive answer (see below). Fourteen women reported being in a relationship for at least some portion of cycle 1; 11 reported

being in a relationship for the entire cycle, one entered a relationship during this cycle, and two more reported having ended a relationship during the cycle. Of these 14 women, 12 returned for cycle 2, with 9 of these having reported being in a relationship for at least part of the second cycle; one woman who was single in cycle 1 was paired for cycle 2. Among the 10 women who were partnered for at least part of cycle 2, 8 were in relationships for the full cycle, while one entered and one ended a relationship during the cycle. Although the number of women in relationships was relatively small, frequent hormone and self-report sampling across 24 cycles (14 in cycle 1 and 10 in cycle 2) produced sufficient power to detect a number of within-cycle effects of hormone fluctuations among the partnered women (see Results).

As part of an intake survey that occurred before daily sampling in cycle 1, women were asked to report length of time in current relationships. The mean time in relationships was 12.85 months (median = 12 months); by comparison, the 33 partnered women in Grebe et al. (2016) had mean relationship duration of 27.6 months (median = 14 months). The same survey items completed by women in relationships before the start of cycle 2 produced slightly higher values, as expected given that the cycles were separated by 1–2 months: mean relationship duration was 14.78 months (median = 15 months). None of the women were married or co-habiting with their partners. All 15 women who were partnered for at least part of the study self-reported nonzero frequencies of sexual behavior, where sex was defined as “intercourse or other forms of genital stimulation with another person” (see Roney and Simmons, 2013).

Procedure

Women participants completed a self-report survey each morning via a secure website. The measures analyzed here were contained in this survey (see below). Women were also instructed to collect a saliva sample each morning via passive drool into pre-labeled polypropylene vials, ideally upon first waking, and at least 30 min after any eating or drinking. Participants stored these vials in home freezers and then delivered them weekly to our research lab, at which time they were given new batches of pre-labeled vials. Samples were then stored at $\approx 0^\circ\text{C}$ until being shipped for assay.

Measures

We identified four main dependent variables related to sexual interest, with items chosen from the daily survey to match as closely as possible the dependent variables analyzed in Grebe et al. (2016). The Appendix A presents the exact wording for each of the relevant items, as well as the wording of the corresponding measures from Grebe et al. (2016). It can be seen that the measures of general sexual desire, in-pair sexual interest (a mean of two items), and amount of flirtation were similar across the two studies, although subtle differences in wording are noted in Appendix A. For extra-pair sexual interest, Grebe et al. (2016) employed five items that assessed attraction to and fantasy about different categories of individuals other than a current partner. Our extra-pair interest variable, by contrast, was comprised of a single item that assessed fantasy about multiple categories of individuals (other than a current partner) within the same question. Following Grebe et al. (2016), we also created a difference between extra- and in-pair interests variable (for women in relationships), computed as the average of the two in-pair items subtracted from the one extra-pair item. The items in Grebe et al. (2016) asked participants to assess their feelings “over the past two days,” while items in the present study referred to the previous day. Because of the references to “yesterday” in the current study, survey responses were aligned with hormone concentrations from the previous day.

Three additional items related to interest in members of the opposite sex appeared in the daily survey and are also presented in Appendix A. These items were excluded from the main dependent measures because

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