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Behavioral and hormonal responses of men to brief interactions with women

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Abstract

This study tested for behavioral and hormonal reactions of young men to brief social encounters with potential mating partners. Male college students were randomly assigned to engage in a short conversation with either a young man (male condition) or a young woman (female condition). Participants provided saliva samples before and after the conversation, completed a battery of psychological measures after the interaction, and had their behavior rated by their conversation partners. Salivary testosterone (T) increased significantly over baseline levels in the female condition only, though differences between conditions were not significant. In addition, change in T was significantly correlated with the degree to which the female confederates thought the male participants were trying to impress them. These behavioral ratings, in turn, were correlated with the participants' ratings of the female confederates as potential romantic partners. Results were generally consistent with the hypothesis that human males may exhibit a behavioral and endocrine courtship response that is similar to that observed in males of many nonhuman vertebrate species.

Keywords: Human mating; Courtship; Testosterone; Attractiveness

1. Introduction

In most vertebrate species, males possess neuroendocrine mechanisms that regulate species-typical behavioral responses to cues from potential mates. Visual, auditory, chemo-

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sensory, or tactile cues from conspecific females are known to trigger species-specific male courtship and copulatory behaviors (Andersson, 1994). These relationships between input cues and output behaviors are mediated by phylogenetically conserved structures within a limbic–hypothalamic circuit, such as the medial preoptic area (e.g., Sipos & Nyby, 1996; for reviews, see Meisel & Sachs, 1994; Paredes & Baum, 1997). Since the hypothalamus regulates the release of sex steroids in vertebrates (e.g., Pfaff, 1981), the brain pathways that regulate responses to cues from females provide a mechanism whereby social stimuli could alter levels of sex hormones. Consistent with this, nontactile exposure to conspecific females produces transient and short-onset (10–30 min) increases in male testosterone (T) and luteinizing hormone levels across a wide range of mammalian species (e.g., Macrides, Bartke, & Dalterio, 1975; Mendoza & Mason, 1989; Pfeiffer & Johnston, 1992; Purvis & Haynes, 1972; for reviews, see Harding, 1981; Meisel & Sachs, 1994). As such, many vertebrate males exhibit a "mating response" to cues from potential mates: A reactive increase in sex hormone levels accompanied by species-specific courtship or sexual behaviors.

Few researches have investigated whether a similar mating response occurs in men. Among the few studies in this area, Grammer (1990) reported that men exhibit nonverbal dominance displays during dyadic interactions with women in whom they report romantic interest, though subsequent studies reported that male interest is correlated with speech duration but not with specific nonverbal displays (Grammer, Honda, Juette, & Schmitt, 1999; Grammer, Kruck, Juette, & Fink, 2000). Roney (2003) found that men who are visually exposed to potential mates produce self-descriptions that more closely match putative female mate preferences than do men in control conditions. Finally, a number of studies have found elevated luteinizing hormone and/or T levels in men within 10–20 min of the onset of exposure to erotic or sexually explicit movies (Hellhammer, Hubert, & Schurmeyer, 1985; LaFerla, Anderson, & Schalch, 1978; Redoute et al., 2000; Stoleru, Ennaji, Cournot, & Spira, 1993). No published studies, however, have demonstrated increases in T levels after more ecologically realistic interactions with women. Likewise, the relationship between possible T increases and behavioral reactions to potential mates has been entirely unexplored.

This study was designed to assess possible hormonal and behavioral reactions of heterosexual men to cues from potential mates in an ecologically realistic situation. Male participants were randomly assigned to engage in a short conversation with either a male or a female stimulus person. The male condition was included as a comparison group rather than as a control since interactions with other men might also prime various reactions. Saliva samples were collected before and after the conversation to assay possible reactive changes in T levels. Participants also completed various psychological measures after the conversation; since scores on these variables did not differ significantly between conditions, though, these measures are not presented in the present report. Finally, stimulus persons rated the degree to which the participants were interested in and tried to impress them. This measure was included to test whether courtship-like behavior directed toward the female conversation partners would be associated with hormonal reactions to the social interaction.

2. Methods

2.1. Participants and stimuli

Participants were male University of Chicago students recruited from an electronic mail list and paid US$10 for their participation. A total of 41 individuals completed the experiment, but data from two participants who reported a gay sexual orientation were excluded. Ages of the remaining 39 participants ranged from 18 to 36 with $M = 21.36$ and S.D. = 3.56.

Young men and women served as the stimuli to which participants were exposed. In the "male" condition, participants engaged in a brief conversation with one of two men (ages 23 and 32). In the "female" condition, participants talked with one of five different young women (ages 19–23). Stimulus persons were aware of the true purpose of the study.

2.2. Procedure

Participants were randomly assigned to the male ($n = 18$) or female ($n = 21$) condition.[1] Testing was completed between 1100 and 1600 h. A male experimenter greeted each participant in the lobby of the testing building and then led him to an isolated testing room. Participants were told that a research assistant was late but would arrive soon and take over data collection. The confederates in fact were seated in an office next to the testing room and noted the time when the experimenter and participant passed them. Upon arrival in the testing room, participants first completed the informed consent process during which they read the cover story that described the study as an investigation of possible relationships between hormone levels and psychological variables such as mood and personality traits. Participants were next asked to produce a saliva sample. Approximately 5 min after having seen the participant pass, confederates came into the testing room and apologized for being late. In most cases, participants had already given the saliva sample and were beginning to complete a general background form. At that point, the experimenter "oriented" the confederate to where the participant was in the process and announced that he had the wrong version of the next questionnaire and would have to go print out the correct version. This left the participant and confederate alone with nothing to do and so served as the pretence for their conversation. Stimulus persons were told to engage in a friendly but natural conversation with the participant. These conversations were timed to last 5 min, after which the experimenter returned with the next surveys.

Participants then privately completed the psychological measures. During this time the stimulus persons completed the surveys that assessed their perception of the participant

[1] The male condition was split into two subconditions: One in which the participant saw only a male experimenter and one in which a male confederate replaced the experimenter via the same procedures used in the female condition (see below). The two subconditions are combined throughout the results since scores on the dependent measures did not differ across subconditions.

and his behavior during the preceding conversation. A second saliva sample was collected 20 min following the start of the 5-min conversation. This time interval was chosen based on the typical latencies for testosterone responses to sexual stimuli in human and nonhuman species (see references above). After collection of the second saliva sample, participants were probed for suspicion regarding the true purpose of the study and then told that part of that true purpose was the assessment of how people form first impressions of others. Toward that end, the participants were instructed to complete the questionnaires that assessed their perceptions of the confederate (see below). After completion of these ratings, participants were fully debriefed regarding the purpose of the experiment. Finally, a personal background survey followed the debriefing (see below). These procedures were approved by the Social Sciences IRB.

2.3. Questionnaires and scales

Participants completed three questionnaires that assessed their impressions of their conversation partners. Two a priori subscales were relevant to the present report. A physical attractiveness scale was composed of the items: physically attractive, sexy, and cute ($\alpha = .92$). Attractiveness of stimulus persons as romantic partners was assessed via items that asked participants to rate the likelihood that the stimulus person would: be desirable to others as a romantic or date partner, be a desirable marriage partner, and be desirable to others as a casual date ($\alpha = .76$).

Participants also completed three miscellaneous surveys. A general background questionnaire assessed such variables as height, weight, and age. A personal background form inquired about participants' sexual orientation, relationship status, day and time of their most recent ejaculation, frequency of sexual intercourse over the last 6 months, and subjective estimates of their sex drive after the experiment. A debriefing form probed for suspicion regarding the true purpose of the study. In addition to written measures, participants provided two saliva samples by expectorating 3–5 ml of saliva into plastic vials that had been pretreated with sodium azide.

The stimulus persons rated the attractiveness of the participants, and also rated their impressions of how the participant had behaved during their conversation together. The latter measure read: "To what extent was the participant. . .." Fourteen items were rated on a seven-point scale (1 = *not at all*, 7 = *very much*), and examples included, "trying to impress you" and "showing off" (see Table 1).

2.4. Hormone assays

Saliva samples were shipped to the Northwestern University Medical School for testosterone assay. Testosterone was measured by radioimmunoassay (RIA) with antiserum prepared within the laboratory. Cross-reactivities with dihydrotestosterone and androstendione were 13% and 0.2%; those for androsterone, etiocholanolone, estradiol, and dehydroepiandrosterone were all less than 0.1%. The intraassay coefficient of variation

Table 1
Factor scales for ratings of participants' behavior during the conversation

Factor	
Polite Interest (28%)	
Listened carefully	.91
Interested in hearing about you	.88
Asked questions about you	.87
Made eye contact	.68
Was bored	−.53
Was talkative	.52
Was quiet	−.50
Arousal (20%)	
Was speaking fast	.88
Was excited	.76
Was bored	−.61
Was quiet	−.61
Was talkative	.54
Eager to talk about himself	.46
Display (21%)	
Tried to impress you	.93
Showed off to you	.87
Eager to talk about himself	.66
Revealed details about himself	.65
Was talkative	.43

was 13.29%, which is consistent with published accounts of other assays from this laboratory (e.g., Chatterton, Vogelsong, Lu, & Hudgens, 1997).

3. Results

3.1. Background variables and perceptions of stimulus persons

No items from either the general or personal background questionnaire differed significantly across conditions. Participants on average rated the female confederates slightly above the midpoints of the seven-point scales that assessed perception of physical attractiveness ($M = 4.95$, S.D. = 0.96) and desirability as a romantic partner ($M = 5.19$, S.D. = 0.86). Such ratings suggest that the participants had at least some degree of interest in the female confederates but did not typically perceive them as extremely attractive.

3.2. Hormonal measures

Testosterone levels were log transformed to eliminate skew in the data. Data were excluded from two men in the female condition, one due to blood contamination of the saliva sample

Fig. 1. Relationship between participants' recent sexual experience and average percentage change in testosterone levels. Sexual experience is defined as either being in a relationship or having reported a nonzero frequency of sexual activity over the last 6 months.

and the other because his baseline T measure was 5 S.D. above the mean. These exclusions left $n = 18$ in the male condition and $n = 19$ in the female condition for all analyses involving T levels. Baseline T levels did not differ between conditions. Time of day did not correlate with baseline, second sample, or change scores.

Change scores were first computed separately within each condition since we hypothesized an increase in T levels in the female condition but were agnostic about possible reactive changes in the male comparison group. Average change from baseline to second sample was +13.43% in the male condition (raw baseline $M = 50.01$ pg/ml, S.D. = 14.79; second sample $M = 55.04$ pg/ml, S.D. = 21.16), and +29.86% in the female condition (raw baseline $M = 43.87$ pg/ml, S.D. = 19.48, second sample $M = 49.85$ pg/ml, S.D. = 11.68). Paired t tests on the log transformed data revealed a significant increase in T in the female condition, $t(18) = 2.10$, $P = .05$, $d = .99$, but not in the male condition, $t(17) = 0.90$, $P = .38$, $d = .44$. Average differences in T levels did not differ significantly between conditions, $t(35) = .98$, $P = .34$, $d = .17$.[2] In sum, T levels did increase in the female condition, but this increase was not significantly larger than in the male condition.

Change in T levels was not significantly related to participants' ratings of the confederates' physical attractiveness or desirability as a romantic partner. Data depicted in Fig. 1, however, suggest that sexual experience may have influenced reactions to potential mates. Of particular interest is the fact that the mean change in T levels was close to zero among men in the female condition who reported little experience with women (i.e., they were not in a relationship and reported no sexual activity). Although the small cell sizes in Fig. 1 preclude adequate statistical tests of possible interaction effects (the contrast between the two experience conditions in the female condition was not

[2] This t test is equivalent to a test of the interaction between group and repeated measures of T within a mixed model ANOVA, $F(1,35) = .95$, $P = .34$.

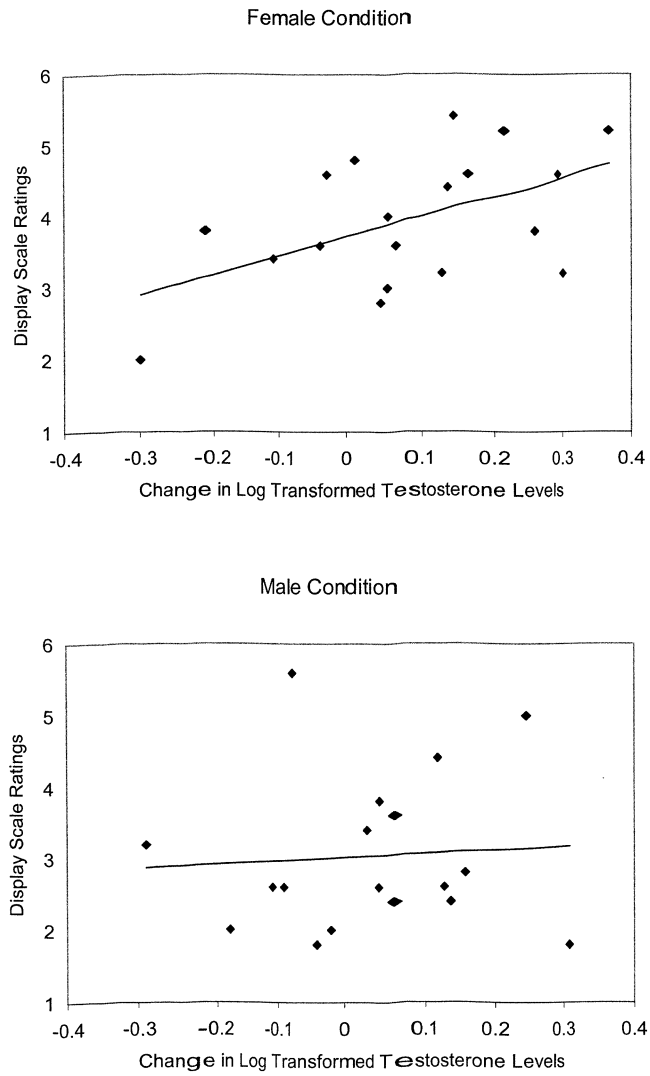

Fig. 2. The degree to which conversation partners rated the participants as exhibiting display behaviors plotted against participants' change in testosterone levels.

statistically significant, $t(17) = 1.79$, $P < .10$), this pattern suggests the importance of accounting for sexual experience in future research on hormonal reactivity to potential mates.

3.3. Behavioral ratings

The questionnaire on which confederates rated participants' behavior was factor analyzed via principal components analysis with varimax rotation. The resulting factors, item

loadings, and variance accounted for appear in Table 1. The first factor has been labeled "polite interest" since the highest loading items relate to gathering information about the conversation partner. In contrast, the "display" factor is comprised of items that indicate outward projections of information about oneself in an attempt to impress the conversation partner. The display factor thus appears to index what would commonly be thought of as courtship-like behavior. Finally, the third factor appears to be a more general measure of excitement or arousal.

Factor scales were computed as the average score across items within the respective factors. Men in the female condition were rated higher on the polite interest and display scales [$ts(35) > 2.1$, $Ps < .05$], though ratings of arousal did not differ between conditions. In addition, the participants' ratings of the female confederates' desirability as romantic partners predicted female confederates' ratings of participants' polite interest ($r(19) = .60$, $P < .01$), arousal ($r(19) = .53$, $P < .05$) and display behaviors [$r(19) = .44$, $P < .06$]. These correlations support the validity of the behavioral rating scales by demonstrating that the female confederates were able to accurately detect those behaviors that were associated with participants' romantic interest in them. No such correlations were significant in the male condition.

3.4. Relationships between hormonal and behavioral measures

Fig. 2 plots the relationship between change in T levels and the stimulus persons' ratings of participants' display behaviors within each condition. This correlation proved significant in the female condition, $r(19) = .52$, $P < .05$, but not in the male condition, $r(18) = .07$, $P = .78$.[3] These results suggest that the female confederates detected more courtship-like behaviors directed toward them from those men who showed more positive changes in T levels from before to after the conversation. This effect was restricted to the courtship-like behaviors indexed by the display factor, as change in T levels was not significantly correlated with the polite interest or arousal factors in either condition.

4. Discussion

This study represents one of the first attempts to assess hormonal and behavioral reactions of men to brief interactions with women. Results were generally consistent with the possibility of a mating response in human males. Men in the female condition showed a significant increase in testosterone over baseline levels and were rated as having expressed more polite interest and display behaviors than were men in the male condition. In addition, those men who were rated as having directed more courtship-like behaviors toward their female conversation partners also showed more positive changes in T levels and rated the

[3] The difference between the magnitude of these correlations was marginally significant, $Z = 1.41$, $P < .08$ (see Rosenthal & Rosnow, 1991).

female confederates as more attractive romantic partners. No such relationships were significant in the male condition.

The significant increase in T in the female condition provides some of the first evidence that men may show reactive T increases after social encounters with women. As such, the present research complements recent findings that have suggested changes in T levels on longer time scales after marriage or fatherhood (Gray, Kahlenberg, Barrett, Lipson, & Ellison, 2002). In addition, the present results suggest the possibility that sexual experience may have moderated hormonal reactions to interactions with women. This possibility is consistent with a wealth of evidence from nonhuman species demonstrating that sexual experience can sensitize male behavioral and hormonal responses to cues from conspecific females (e.g., Clancy, Singer, Macrides, Bronson, & Agosta, 1988; Domjan, Akins, & Vandergriff, 1992; Lumley & Hull, 1999; Pfeiffer & Johnston, 1994).

The significant correlation between changes in T levels and female confederates' ratings of subjects' display behaviors is perhaps the most novel finding to emerge from this study. Similar relationships between T increases and courtship and copulatory behaviors have been found in a wide array of nonhuman species (see Introduction for references). This correlation thus provides suggestive evidence that human courtship may be regulated in part by neuroendocrine mechanisms similar to those implicated in the courtship behaviors of other vertebrate species. Although the precise causal nature of the relationship between T changes and behavioral expressions is unclear, the very existence of a causal nexus between courtship behaviors and neuroendocrine mechanisms suggests the importance of future research on the hormonal correlates of courtship as a possible window onto the design of human mating mechanisms.

Despite generating potentially interesting findings, this study had a number of limitations. One of these was the uncertain strength of the stimulus cues in the experimental condition—i.e., the perceived attractiveness of the female confederates. Variability in the participants' interest in the confederates may in part explain the lack of significant differences between conditions on the psychological and hormonal measures. Future work might avoid interpretive ambiguities by pretesting reactions to stimulus cues. More precise information about participants' sexual histories would also allow for better tests of the possible interaction between sexual experience and hormonal reactivity to potential mates. Finally, the small sample sizes in the current study allowed detection of only relatively large effect sizes. These limitations notwithstanding, we hope the positive results reported here will spur interest in the neuroendocrine mechanisms implicated in human courtship and thereby promote further research into the relationships between behavioral and endocrine variables.

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