

**When the Love Hormone Leads to Violence: Oxytocin Increases Intimate Partner  
Violence Inclinations among High Trait Aggressive People**

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## Abstract

Does oxytocin influence intimate partner violence? Clues from prior research suggest that oxytocin increases prosocial behavior, but this effect is reversed among people with aggressive tendencies or in situations involving defensive aggression. Animal research also indicates that oxytocin plays a central role in defensive maternal aggression (i.e., protecting pups from intruders). Among highly aggressive people, a boost of oxytocin may cause them to use aggression toward close others as a means of maintaining their relationship. Adopting an interactionist approach, we predicted that oxytocin would increase intimate partner violence inclinations, but this effect would be limited to people high in trait physical aggression. In a double-blind, placebo-controlled, between-subject experiment, participants varying in trait physical aggression received either 24 IU of oxytocin or a placebo. Following two provocation tasks, participants rated the probability that they would engage in various aggressive behaviors (e.g., slapping, throwing an object that could hurt) toward a romantic partner. Oxytocin increased intimate partner violence inclinations, but this effect was limited to participants prone to physical aggression. These data offer the first evidence that intimate partner violence inclinations have a biological basis in a combination of oxytocin and trait physical aggressiveness.

Keywords: oxytocin, intimate partner violence, trait aggression

## **When the Love Hormone Leads to Violence: Oxytocin Increases Intimate Partner Violence Inclinations among High Trait Aggressive People**

Why do people hurt the ones they love? This question continues to baffle researchers, who have spent the better part of half a century identifying risk factors that predispose people to behave aggressively toward romantic partners. Despite these efforts, intimate partner violence continues to occur at high rates: approximately one in six adults report at least one act of physical violence in their relationship over the past year (Shafer, Caetano, & Clark, 1998). The current investigation offers the first evidence that intimate partner violence inclinations have a biological basis involving a combination of oxytocin, a nonapeptide that has both peripheral and central functions, and trait physical aggressiveness.

### **Oxytocin, Aggression, and Close Relationships**

Over the past decade, interest in the social effects of oxytocin has swelled (e.g., Bartz, Zaki, Bolger, & Ochsner, 2011a). In the early stages of romantic relationships, plasma oxytocin levels increase and remain relatively stable over time (Schneiderman, Zagoory-Sharon, Leckman, & Feldman, 2012). The greater the surge of oxytocin early in a relationship, the higher probability of the relationship partners staying together. Given this relationship between higher oxytocin levels and romantic relationship maintenance, we focused our investigation on the role of oxytocin in shaping a specific type of romantic relationship maintenance behavior high trait aggressive people may use.

A number of studies show that oxytocin, administered by nasal spray, can increase positive interpersonal tendencies and processes, such as face recognition,

trust, altruism, empathy, and emotion recognition (Guastella et al., 2008; Heinrichs et al., 2003; Kosfeld et al., 2005; Zak et al., 2007; see Van IJzendoorn & Bakermans-Kranenburg, 2012 for a review). But oxytocin does not wield universally *prosocial* effects. Rather, the social effects of oxytocin often depend on contextual and person-level factors, and there is even evidence that oxytocin can produce antisocial effects (Bartz et al., 2011a). For example, intranasal oxytocin increases envy and gloating in competitive situations (Shamay-Tsoory et al., 2009) and decreases cooperativeness among people who high in rejection sensitivity and prone to aggression (i.e., individuals with borderline personality disorder; Bartz et al., 2011b).

Work in non-human animals also supports an association between oxytocin and aggression. Although considered a “prosocial” behavior (because it is aimed at protecting off-spring), numerous studies have shown that oxytocin promotes maternal aggression—that is, aggression towards intruders (e.g., Jia et al., 2008). Indeed, recent work by De Dreu et al. (2010) shows that oxytocin increases defensive aggression toward “out group” members, which suggests a similar designation in humans. Thus, animal data and preliminary human data suggest that oxytocin is not only involved in universally positive prosocial behaviors but also aggression. Crucially, oxytocin is linked to greater aggression when performed in the service of protecting oneself, one’s offspring, or one’s in-group members from threats. Because humans rely on close others for their well-being (Baumeister & Leary, 1995), another way to protect oneself may involve keeping a romantic partner close when one feels vulnerable.

Viewed in this light, the antisocial effects of oxytocin are consistent with the general notion that oxytocin plays a role in relationship maintenance (e.g.,

Schneiderman et al., 2012; Turner et al., 1999). Specifically, oxytocin may promote aggressive tendencies because, at least for some individuals, such tendencies are thought to protect close bonds. Put another way, if oxytocin is involved in promoting behaviors that serve to protect a relationship (i.e., keep it intact), oxytocin may be especially likely to promote aggressive behaviors among people who use dominance and intimidation to keep their partners close.

### **Trait Physical Aggression and Intimate Partner Violence**

People high (vs. low) in trait physical aggression show various indicators of relationship instability, including greater intimate partner violence perpetration (Finkel et al., 2012), higher blood pressure when provoked (Suls & Wan, 1993), and stronger neural activity in brain regions associated with anger in response to provocation (Denson et al., 2009). When their oxytocin levels increase and they experience stressful interpersonal provocation, people high in trait physical aggression may attempt to maintain their relationships by dominating their partners to prevent them from leaving (Buss & Duntley, 2011; Daly & Wilson, 1988). Indeed, evolutionary psychologists argue that intimate partner violence represents one of several types of mate retention behaviors (Buss & Shackelford, 1997; Shackelford, Goetz, Buss, Euler, & Hoier, 2005).

To test this idea, we manipulated the availability of oxytocin and exposed participants to an interpersonal provocation; we then measured intimate partner violence inclinations. Given the numerous studies showing the effects of provocation among high trait aggressive participants (Anderson & Bushman, 2002), all participants in the current study experienced interpersonal provocation prior to reporting on their intimate partner violence inclinations. We predicted that oxytocin would increase

intimate mate retention manifested as partner violence inclinations, but only among high trait physically aggressive participants (who use such behaviors to protect their close relationship).

### **The Present Investigation**

The interactionist perspective adopted here has helped resolve seeming discrepancies in the literature on the social effects of oxytocin in humans (see Bartz et al. 2011a; De Dreu et al., 2010). Thus, there was both theoretical and empirical precedent to predict an interactive effect of oxytocin and trait physical aggression on intimate partner violence inclinations. The present study investigated whether oxytocin plays a role in the propensity for interpersonal violence that high trait aggressive individuals display. Specifically, we theorized that if oxytocin promotes relationship maintenance behaviors, especially in the face of threat, oxytocin would increase intimate partner violence inclinations among individuals predisposed toward physical aggression. To test this idea, we administered intranasal oxytocin or placebo and, following two provocation tasks, assessed intimate partner violence inclinations.

### **Method**

#### ***Participants***

Ninety-three undergraduates (47 male, 46 female) participated. Fifty five percent of participants were currently single [23% in oxytocin group, 32% in placebo group] and 45% were romantically attached [24% in oxytocin group, 21% in placebo group]. Within the oxytocin group, average male age was 20.68 ( $SD = 2.45$ ) and average female age was 19.18 ( $SD = 1.05$ ). Within the placebo group, average male age was 20.46 ( $SD = 2.41$ ) and average female age was 19.23 ( $SD = 1.15$ ). 36.4% of women in the oxytocin

group and 45.5% of women in the placebo group were currently taking hormonal contraception. Two women did not report the date of their last period. Of those who did, approximately 64% were currently in the luteal phase of their cycle. Because results did not differ as a function of whether participants reported on a current or previous relationship partner ( $p = .59$ ), we collapsed responses across relationship status.

### **Materials**

*Trait Physical Aggression.* Participants completed the two highest loading items from the physical aggression subscale of the Aggression Questionnaire (Buss & Perry, 1992; “Given enough provocation right now, I might hit another person,” “If I had to resort to violence to protect my rights, I would right now”; 1= *extremely uncharacteristic of me*, 7= *extremely characteristic of me*). Responses to the two items correlated highly ( $r = .61$ ,  $p < .001$ ) and were averaged to create a trait physical aggressiveness index. Scores did not differ between oxytocin ( $M = 2.17$ ,  $SD = 1.10$ ) and placebo ( $M = 2.09$ ,  $SD = 1.04$ ) participants,  $F(1, 91) = 0.14$ ,  $p = .71$ , or single ( $M = 2.16$ ,  $SD = 1.02$ ) and romantically attached ( $M = 2.11$ ,  $SD = 1.12$ ) participants,  $F(1, 91) = 0.04$ ,  $p = .83$ . Men ( $M = 2.44$ ,  $SD = 1.00$ ) reported higher levels of trait physical aggression than women ( $M = 1.82$ ,  $SD = 1.05$ ),  $F(1, 91) = 8.54$ ,  $p = .004$ .

*Intimate partner violence (IPV) inclinations.* Participants reported how likely they would engage in five behaviors toward their current (or, if they were single, most recent) romantic partner based on how they currently felt: “throw something at my partner that could hurt,” “twist my partner’s arm or hair,” “push or shove my partner,” “grab my partner,” and “slap my partner” (ranging from 1 = *Not at all likely right now* to 5 = *Extremely likely right now*). The behaviors were taken from the physical assault

subscale of the Revised Conflict Tactics Scale (Straus et al., 1996). Responses were averaged to form an intimate partner violence inclinations index ( $M= 1.13$ ,  $SD=0.39$ ;  $\alpha = .92$ ).

### ***Procedure***

Participants provided informed consent, which was followed by exposure to the oxytocin manipulation. First, participants were exposed to the double-blind, oxytocin manipulation. By random assignment, half of the participants received 24 IU of oxytocin that was administered intranasally (Syntocinon, Novartis). The other half of the participants received a similar amount of placebo, which consisted of 0.90% w/v of sodium chloride in odorless, double distilled water. To allow the drug to reach peak activation in the central nervous system, the main outcome was assessed approximately 45-min post exposure.

While participants waited, they completed three tasks. The first task involved an attachment priming manipulation as part of an unrelated study, in which concepts related to attachment figures (attachment prime condition) or neutral concepts (control condition) were activated. The second and third tasks were designed to increase stressful provocation, which is “perhaps the most important single cause of human aggression” (Anderson & Bushman, 2002, p. 37). Specifically, participants gave a public speech in front of an unsupportive audience, and then experienced physical pain by placing an ice bandage on their forehead (cold pressor task; von Baeyer et al., 2005). Both negative feedback and physical pain are known to increase aggression (Anderson & Bushman, 2002). These provocation tasks were included to cultivate a context in which participants would be predisposed to report aggressive inclinations.



Participants reported their levels of stress after each task, which did not differ between drug conditions (Speech task:  $t=1.21$ ,  $p=.23$ ; Cold pressor task:  $t<1$ ,  $p=.80$ ). Participants then completed the trait physical aggression items and intimate partner violence inclination items.

Trait physical aggression did not differ as a function of drug condition,  $\beta=0.02$ ,  $t(89)=0.19$ ,  $p=.85$ . Therefore, trait physical aggression was centered and multiplied with drug condition to create an interaction term. Neither gender ( $p=.12$ ) nor priming condition ( $p=.84$ ) moderated the effect of drug condition, trait aggression, or their interaction. Gender and priming condition were added as covariates in all analyses.

## Results

Oxytocin increased intimate partner violence (IPV) inclinations, but this effect was only present among participants predisposed toward physical aggression. A regression analysis revealed a significant oxytocin x trait physical aggression interaction,  $\beta = 0.29$ ,  $t(87)= 3.17$ ,  $p = .002$  (see Figure 1). The oxytocin main effect was significant,  $\beta = 0.18$ ,  $t(87)= 1.98$ ,  $p = .050$ , such that oxytocin increased aggressive inclinations. The trait physical aggression main effect was also significant, with higher levels predicting stronger intimate partner violence inclinations,  $\beta = 0.34$ ,  $t(87)= 3.57$ ,  $p = .001$ . Gender and attachment priming were also associated with stronger IPV inclinations, such that females (vs. males) and participants in the attachment priming condition (vs. the neutral condition) reported stronger intimate partner violence

inclinations [Gender:  $\beta = -0.26$ ,  $t(87) = -2.73$ ,  $p = .008$ <sup>1</sup>; Attachment priming:  $\beta = 0.20$ ,  $t(87) = 2.13$ ,  $p = .036$ ].

Next, we examined the effect of oxytocin administration among people relatively high and low in trait physical aggression (i.e., one standard deviation above and below the mean; Aiken & West, 1991). Among participants high in trait physical aggression, oxytocin increased their aggressive inclinations compared to participants who received the placebo,  $\beta = 0.48$ ,  $t(87) = 3.64$ ,  $p < .001$ . Conversely, oxytocin did not influence aggressive inclinations among participants low in trait physical aggression,  $\beta = -0.11$ ,  $t(87) = -0.85$ ,  $p = .40$ .

Additional analyses showed that among participants in the oxytocin condition, trait physical aggression was associated with greater aggressive inclinations,  $\beta = 0.63$ ,  $t(87) = 4.74$ ,  $p < .001$ . In contrast, trait physical aggression was uncorrelated with aggressive inclinations among participants in the placebo condition,  $\beta = 0.05$ ,  $t(87) = 0.38$ ,  $p = .70$ . Thus, modulation of aggressive impulses as a function of trait physical aggressiveness was specific to participants who received oxytocin.

## Discussion

Relationships can be riddled with difficulties, from minor spats to violent altercations. Oxytocin is often associated with positive tendencies and processes that foster relationship maintenance, such as trust, cooperation, and greater sensitivity to

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<sup>1</sup> The question of whether women and men differ in their rates of intimate partner violence perpetration has dominated the intimate partner violence literature over the past several decades. Whereas it was long believed that men perpetrated the highest rates of intimate partner violence, recent meta-analytic evidence suggests little or no gender differences in perpetration rates—and where differences do occur, they are sometimes in the direction of women perpetrating *more* IPV than men (Archer, 2000).

social cues. But oxytocin may also enhance relationship maintenance processes that involve antisocial behavior, such as territoriality and aggression. To investigate whether oxytocin may play a role in intimate partner violence inclinations, we adopted an interactionist approach drawn from human research on non-romantic relationships (Bartz et al., 2011a; also see De Dreu, 2012). Specifically, we examined whether oxytocin increases IPV inclinations, and whether this effect was modulated by trait physically aggressiveness. We predicted that oxytocin would selectively increase IPV inclinations in high trait aggressive people because such individuals often use physical aggression as a way to cope with perceived threats to themselves and their close relationships.

Oxytocin increased aggressive inclinations among participants high in trait physical aggression. These results jibe with recent research showing that oxytocin reduces trust and prosocial behavior among people who have chronic interpersonal difficulties (Bartz et al., 2011b), activates negative cognitions about attachment figures in highly anxiously attached individuals (Bartz et al 2010), and increases intolerance and aggression toward out-group members (De Dreu et al., 2010, 2011). Our findings also resonate with recent research showing that oxytocin causes people exposed to infant crying to use more excessive force when using a hand-strength instrument, but this excessive force is greatest among participants who experienced harsh discipline during childhood (Bakermans-Kranenburg et al., 2012).

Why does oxytocin, the so-called “love hormone,” increase aggressive inclinations? One reason is that people high in trait aggression may have mental representations of close relationships that include heightened levels of physical

aggression. Evolutionary theorists have argued that intimate partner violence can serve as a mate retention tactic, in which the aggressor limits the victim's access to potential suitors, thereby ensuring access to the victim's sexual and material resources (Buss & Duntley, 2011; Buss & Shackelford, 1997; Shackelford et al., 2005). When people high in trait physical aggression get a boost of oxytocin that signals a need to keep their partners close, they may respond by engaging in relationship-schema consistent behaviors—behaviors designed to dominate their partners so that they do not flee the relationship. Because physical aggression is a key part of their interpersonal repertoire, oxytocin may increase such behaviors. Thus, the roots of intimate partner violence may originate in part from a combination of availability of oxytocin and individual differences in physical aggressiveness. Indeed, this idea is consistent with Bartz et al's (2010) theorizing that oxytocin may activate the attachment system and bring to mind the associated expectancies, behaviors, and coping strategies.

Our findings add to the understanding of the “prickly side of oxytocin” (Miller, 2010). Far from being a panacea for all social ills, oxytocin may have a much more diversified effect, as in the current case, increasing the likelihood that people who are inclined toward physical aggression will inflict harm on their romantic partners.

When might oxytocin decrease intimate partner violence? From an interactionist perspective, two factors may moderate the relationship between oxytocin and intimate partner violence. First, oxytocin may reduce intimate partner violence among people who have mental representations of others characterized by stability and closeness. For example, people who perceive their partner as fulfilling attachment needs (e.g., proximity seeking, safe haven; Gillath & Shaver, 2007) may report especially low

aggressive inclinations when they receive oxytocin compared to placebo. Instead of dominating their partners to keep them close, people who feel that their partner strongly fulfills their attachment needs may act kindly toward them to maintain their bond, or use a different set of retention strategies that are not aggressive. Second, oxytocin may reduce intimate partner violence in situations where aggression may compromise goals for survival and reproduction. For example, oxytocin may cause men to behave less aggressively toward their mates when they are pregnant compared to when they are not pregnant because such aggression would decrease the chances that the unborn child would survive.

### **Limitations and Future Directions**

Our results are consistent with existing findings on oxytocin and aggression in the human and animal literatures. Yet several limitations exist. First, the dependent measure assessed aggressive inclinations instead of actual aggressive behavior. Hence, it is an open question as to how the current results can be applied to actual IPV perpetration. Ethical considerations restrict researchers' ability to overcome this limitation because it is unfeasible to give participants an opportunity to engage in the aggressive behaviors used in this study (e.g., slapping, throwing something at the partner that could hurt). Because the dependent measure was modeled after a widely used measure of IPV perpetration (CTS; Straus et al., 1996), we predict that our results would replicate if researchers assessed actual intimate partner violence perpetration using other measures.

Our trait physical aggression measure also consisted of only two items, which raises the possibility that it yielded an unreliable measure compared to what might be

expected from a lengthier measure. We chose these two items because they originated from a widely used measure of trait physical aggressiveness and to reduce the length of the delay between the stressors and the IPV inclinations measure. Similar approaches have been used to create valid and reliable, single-item measures (e.g., Robins et al., 2001). We predict that using the full version of the scale would yield identical results.

It is an open question as to whether our results would extend to general violent tendencies. We focused on intimate partner violence inclinations because of prior working linking elevated oxytocin levels to romantic relationship maintenance behaviors (Schneiderman et al., 2012). But other research suggests that, under certain circumstances, boosting oxytocin can reduce prosocial behavior and enhance defensive aggression toward strangers (Bartz et al., 2011; De Dreu et al., 2010). We predict that oxytocin would relate to greater overall aggression toward out-group members or other potential threats, especially among high trait aggressive people. This possibility awaits future research.

One factor that may modulate the association between oxytocin and trait physical aggressiveness on intimate partner violence inclinations is self-regulatory depletion (Finkel et al., 2009, 2012). Self-regulation and aggression are intimately linked, with better regulated people behaving less aggressively than their sluggardly counterparts (Denson et al., 2012; Finkel et al., 2009, 2012; Vohs, Glass, Maddox, & Markman, 2010). In our study, participants underwent a pair of stressful, provocative tasks that may have taxed their mental energy. Although we did not include tasks to assess potential self-regulatory impairments, prior research has shown that stressful provocation can deplete mental energy (Denson, Pedersen, Friese, Hahm, & Roberts,

2011). Therefore, oxytocin may have increased intimate partner violence inclinations among people predisposed toward physical aggression because they experienced self-regulatory depletion. Future research may include self-regulation measures to establish whether the observed effects were due in part to self-regulation impairments. A comparison condition, in which participants experience no stressful provocation, may also add to understanding the mechanism underlying our effects.

An additional limitation is that we did not examine the proximate mechanisms underlying our effects. Prior research has shown associations between endogenous oxytocin levels, lifetime history of aggression, and suicidal intent (Jokinen et al., 2012; Lee et al., 2009). Other recent research has shown that individuals with borderline personality disorder, who are prone to aggression, also have lower endogenous levels of oxytocin (Bertsch, Schmidinger, Neumann, & Herpetz, & 2013). These findings suggest that among aggression-prone individuals, the oxytocin system may be disrupted. For this reason, these individuals may show a differential response to exogenous (i.e., intranasal) oxytocin. This possibility awaits future research.

## **Conclusion**

Our findings add to the understanding of how oxytocin influences social behavior. Far from being a panacea for all social ills, oxytocin may have diversified effects, increasing the likelihood that people who are inclined toward physical aggression will inflict harm on their romantic partners. By taking an interactionist approach to understanding the role of oxytocin on intimate partner violence, researchers can understand not only who is at risk for behaving aggressively – but also how to prevent such aggression.

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### Figure Caption

Figure 1. Trait physical aggression interacts with oxytocin condition to predict greater intimate partner violence inclinations.

