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The effects of competition and implicit power motive on men's testosterone, emotion recognition, and aggression

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ABSTRACT

A contribution to a special issue on Hormones and Human Competition. We investigated the effects of competition on men's testosterone levels and assessed whether androgen reactivity was associated with subsequent emotion recognition and reactive and proactive aggression. We also explored whether personalized power (p Power) moderated these relationships. In Study 1, 84 males competed on a number tracing task and interpreted emotions from facial expressions. In Study 2, 72 males competed on the same task and were assessed on proactive and reactive aggression. In both studies, contrary to the biosocial model of status (Mazur, 1985), winners' testosterone levels decreased significantly while losers' levels increased, albeit not significantly. Personalized power moderated the effect of competition outcome on testosterone change in both studies. Using the aggregate sample, we found that the effect of decreased testosterone levels among winners (compared to losers) was significant for individuals low in p Power but not for those with medium or high p Power. Testosterone change was positively related to emotion recognition, but unrelated to either aggression subtype. The testosterone-mediated relationship between winning and losing and emotion recognition was moderated by p Power. In addition, p Power moderated the direct (i.e., non-testosterone mediated) path between competition outcome and emotion recognition and both types of aggression: high p-Power winners were more accurate at deciphering others' emotions than high p-Power losers. Finally, among high p-Power men, winners aggressed more proactively than losers, whereas losers aggressed more reactively than winners. Collectively, these studies highlight the importance of implicit power motivation in modulating hormonal, cognitive, and behavioral outcomes arising from human competition.

1. Introduction

1.1. Biosocial model of status and the 'winner-loser' effect

The quest to study the hormonal correlates of status competitions in humans was spurred by experiments in the 1970s that monitored testosterone levels in male rhesus monkeys jockeying for rank (Rose et al., 1972; Rose et al., 1975). Although these studies failed to become impactful due to social scientists' apprehension with biological explanations of human behavior at the time (Grant, 1998), they nevertheless paved the way for those willing to challenge the prevailing zeitgeist. In the coming years, sociologist Allan Mazur (1985) developed a biosocial model of status to describe the relationship between testosterone and dominance behavior aimed at achieving or maintaining high status over another individual (see also Mazur and Booth, 1998). The model postulates that status gains elicit surges in testosterone while status losses lead to drops in testosterone, a phenomenon commonly known as the 'winner-loser effect.' It also specifies that causation works in the opposite direction; increasing or heightened testosterone levels help status-seeking behaviors, whereas decreasing or reduced levels deter such behaviors.

Mazur (1985) argued that the feedback between testosterone and dominance helps to explain not only the stability of social hierarchies in primates, but also the mechanism involved in winning and losing streaks. With each triumph, there is an accompanying elevation in testosterone that enhances the winner's assertiveness and a likelihood of future victories. Each defeat, however, brings about a testosterone reduction that reinforces the loser's aversion to future challenges and, consequently, a likelihood of sequential losses. Such a system would equip high-status individuals with the hormone-induced motivation to maintain their hierarchical position while discouraging low-status ones from attempts to increase theirs. Over the last 35 years, numerous studies have confirmed the presence of the winner-loser effect in males across various contexts, including team sports (Aguilar et al., 2013; Flinn et al., 2012; Jones and Josephs, 2006), individual sports (Booth et al., 1989; Jiménez et al., 2012), contrived laboratory tasks (Carré et al.,

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2013; Zilioli and Watson, 2012), chess competitions (Mazur et al., 1992), games of chance (McCaul et al., 1992; Study 2), financial trading (Coates and Herbert, 2008), hunting behaviors (Trumble et al., 2014), and even vicarious experiences (Bernhardt et al., 1998; Stanton et al., 2009).

To understand the degree to which competition outcomes modulate testosterone reactivity in men, Archer's meta-analysis (2006) reported 12 effect sizes and showed that winners had elevated testosterone levels compared to losers in sporting events and contrived laboratory tasks. In a more recent meta-analysis that reported 44 effect sizes from male samples alone, Geniole et al. (2017a) replicated the winner-loser effect and lent overall support for the biosocial status model. However, the authors noted the plethora of contradictory findings (for a comprehensive list, see Geniole et al., 2017a, Table 1). While many studies showed null effects of competition outcome on testosterone levels of male winners and losers (Gonzalez-Bono et al., 1999; Mehta and Josephs, 2006; Parmigiani et al., 2009; Salvador et al., 1987; Serrano et al., 2000; Steiner et al., 2010; Suay et al., 1999; Trumble et al., 2012), some reported a significant increase in losers' testosterone levels relative to winners' (Filaire et al., 2001; Oliveira et al., 2014; Study 1 of Schultheiss et al., 2005; van der Meij et al., 2010). To explain mixed findings, scholars proposed several underlying psychological and situational factors that moderate the effect of competition outcome on testosterone change (see Archer, 2006, pp. 327–328; Geniole et al., 2017a, Tables 2 and 3).

Table 1
Correlations, descriptive statistics, and conditional process analysis results for Study 1.

Variable	1	2	3	4	*M*	*SD*
1. Pre-competition T (pg/ml)	–				108.89	40.63
2. Post-competition T (pg/ml)	0.80***	–			107.16	37.53
3. Testosterone change	0.00	0.60***	–		−1.85	25.13
4. p Power	0.17	−0.04	−0.08	–	9.20	5.10
5. Emotion recognition	−0.13	0.09	0.33**	0.17	14.21	6.31

Conditional process analysis - Emotion recognition (N = 84)	**Effect (SE)**	***t***	***p***	**95% CI**
Aim 1 Outcome: Testosterone change p Power moderates the Competition outcome → Testosterone change relation				
Competition outcome	−0.43 (0.22)	−1.92	0.058	−0.873, 0.015
p Power	−0.45 (0.18)	−2.44	0.017	−0.817, −0.082
Competition outcome × p Power	0.75 (0.23)	3.25	0.002	0.292, 1.218
Aim 2 Outcome: Emotion recognition Testosterone change → Emotion recognition				
Testosterone change	1.92 (0.68)	2.81	0.006	0.561, 3.274
Aim 3 Outcome: Emotion recognition Testosterone change mediates the Competition outcome x p Power → Emotion recognition relation				
Index of moderated mediation	1.45 (0.83)	–	–	0.207, 3.521
Aim 4 Outcome: Emotion recognition p Power moderates the Competition outcome → Emotion recognition relation				
Competition outcome	2.81 (1.39)	2.02	0.047	0.036, 5.577
p Power	−1.70 (1.67)	−1.45	0.150	−4.018, 0.627
Competition outcome × p Power	3.82 (1.51)	2.53	0.013	0.820, 6.824

Note: In the correlation table, testosterone change and p Power are standardized residuals. The means and standard deviations of testosterone change and p Power are in raw scores.
†$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

1.2. Competition, implicit power motive, and testosterone

Among the psychological factors, research has shown that individual differences in implicit power motivation influence the extent to which testosterone concentrations fluctuate in rigged laboratory competitions, particularly in men (Hall et al., 2010). The implicit power motive is the emotional satisfaction felt from having impact on others through positive (e.g., helping) or negative behaviors (e.g., attacking), as well as behaviors directed at expressing and maintaining one's status (Winter, 1973). It has been further conceptualized as personalized power (p Power) which is the need to sway others for self-serving purposes, and socialized power (s Power) which is the desire to influence others through prosocial acts (McClelland et al., 1972). Competitions are social encounters that formalize status contests between people (Casto and Edwards, 2016; Edwards, 2006). Given its association with the motivation to dominate others, p Power is more closely related to the psychophysiological reactions that accompany successes and failures in competitive status-seeking pursuits (Schultheiss et al., 1999). This subtype of implicit power is characterized as egoistic and helping to serve one's interests at the expense of another's welfare, while socialized power (or s Power) is associated with the desire to use one's influence to benefit another (Winter, 1994). Therefore, we focused exclusively on p Power because of its closer association with a distributive outcome orientation (win-lose), as opposed to s Power which is conceptually tied to an integrative outcome orientation (win-win) (McClelland, 1975).

1.3. Aim 1: p Power moderates the link between competition outcome and testosterone change

Some scholars have found that implicit power predicted testosterone increases and decreases in male winners and losers, respectively (Schultheiss et al., 1999, 2005; Schultheiss and Rohde, 2002). Schultheiss et al. (1999) proposed that, compared to low p-Power individuals, those who are high in this form of implicit power experience a greater sensation of dominance after a victory and a stronger reaction after a defeat because of the importance they attribute to impacting other people. In light of the scientific community's plea for reproducibility of psychological studies (Open Science Collaboration, 2015), the first aim of this paper is therefore to replicate the interaction of implicit power motive and competition outcome on testosterone change in two novel experiments involving young males. Thus, it follows that high p-Power males will demonstrate a greater testosterone response after a contest compared to low p-Power males, with winners manifesting an increase in testosterone and losers a decrease.

1.4. Aim 2: Testosterone change following competition affects emotion recognition, and reactive and proactive aggression

The second aim of this paper is to test the consequences of post-competition testosterone changes on emotion recognition (Study 1) and two forms of aggressive behavior: proactive and reactive aggression (Study 2). Emotion recognition is important in human relations as it predicts not only happier marriages (Noller et al., 1994) and social adjustment (Gleason et al., 2009), but also successful negotiations (Elfenbein et al., 2007) and leadership effectiveness (Rubin et al., 2005). Individuals coming off a victory or defeat continue to interact with others, and to the extent that they bring with them shifting physiological outcomes begs the question: why should a change in testosterone after competition influence subsequent emotion recognition? As mentioned, Mazur (1985) maintained that victories enable winners to secure dominant positions, prompting testosterone elevations and facilitating subsequent dominance behaviors. In contrast, defeats relegate losers to submissive positions, triggering testosterone drops and

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