Physiology & Behavior 130 (2014) 170–175

Contents lists available at ScienceDirect

Physiology & Behavior

journal homepage: www.elsevier.com/locate/phb

The social environment during a post-match video presentation affects the hormonal responses and playing performance in professional male athletes

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HIGHLIGHTS

- The social environment during a video assessment might influence athlete hormones and performance.
- Familiarity and body size are two factors influencing the social environment.
- Athlete recovery can be influenced by post-match psychological factors.
- Social interactions could play a broader role in moderating stress reactivity.

ARTICLE INFO

Article history:
Received 30 May 2013
Received in revised form 10 March 2014
Accepted 2 April 2014
Available online 12 April 2014

Keywords:
Behaviour
Stress
Neuroendocrine
Sport
Recovery

ABSTRACT

This study examined the social environment effects during a post-match video presentation on the hormonal responses and match performance in professional male rugby union players. The study participants (n = 12) watched a 1-hour video of mixed content (player mistakes and successes) from a match played 1 day earlier in the presence of; (1) strangers who were bigger (SB), (2) strangers who were smaller (SS), (3) friends who were bigger (FB) and (4) friends who were smaller (FS). The salivary testosterone (T) and cortisol (C) responses to a physical stress test were assessed 3 days later, along with pre-match T levels and match-ranked performance 6–7 days later. All treatments were associated with elevated T responses (% change from baseline) to the stress test with SS > SB and FB > FS. The C stress responses after the SS and SB interventions were both greater than FS and FB. On match-day, the FB approach was linked to higher T concentrations than SB and better ranked performance than FS and SS. The subsequent testing of a population sub-group (n = 8) across a video (V) and a non-video (NV) presentation in a neutral social environment produced similar stress-test and performance outcomes, but pre-match T concentrations differed (V > NV). In conclusion, the presence of other males during a post-match video assessment had some influence on the hormonal responses of male athletes and match performance in the week that followed. Thus, the social environment during a post-match assessment could moderate performance and recovery in elite sport and, in a broader context, could be a possible modulator of human stress responses.

1. Introduction

Much evidence has been presented on the role of testosterone (T) in regulating or supporting male social behaviours in different species, especially those relating to dominance and aggression [1–4]. The social environment appears to be one important factor influencing male T concentrations and the subsequent expression of dominance behaviours relating to status-seeking motivation [1,5]. Specifically, it has been suggested that males receive various forms of sensory information during social interactions that can potentially be used to establish and maintain dominance hierarchies through these neuroendocrine signals [6].

Challenges in the social environment can modify human hormonal activity, including difficult family environments, traumatic social events, and competition [1,3,7]. Innocuous, everyday events can also induce a hormonal change. For instance, close proximity sleeping between fathers and their children can decrease the T concentrations of adult males over time [8], as does daytime father–child interactions [9]. Male T concentrations (and associated risk-taking behaviours) can

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http://dx.doi.org/10.1016/j.physbeh.2014.04.001

also acutely increase in the presence of females [10] and when interacting with adult women who are potential mates [11], but T levels may actually decrease if the woman is a conjugal partner of a close friend [11].

The presence of friends or strangers during male-to-male social interactions adds to these complexities. As an example, competing (non-physically) against either familiar men or strangers subsequently promoted different T responses in men [12] and male T levels increased when they defeated strangers, but not their friends [11]. Differences in male T concentrations have also been demonstrated when interacting socially with other males simply perceived to be similar (i.e. increasing T) or dissimilar (i.e. lowering T) [13].

Cortisol (C) may jointly work with T to moderate status-seeking behaviours [4]. Several mechanisms may explain this effect including; suppression the hypothalamic–pituitary–gonadal-axis (and T secretion), inhibition of the T actions on target tissue and/or the down-regulation of the androgen receptors [14]. Similar to T, C responsiveness can vary in the presence of strangers or friends [12,15]. The acute neuroendocrine responses to social interactions have possible implications for modifying future performance and recovery. Indeed, transient changes in T and C levels have been recently linked to recovery from a competitive sport and/or subsequent match performance [16,17].

Body size is another variable to consider during social interactions. In men, greater height is associated with feelings of greater power [18] and taller men are more likely to acquire power than shorter men [19]. Humans and other animals can also express power through open, expansive postures or poses [20]. For example, men assuming a power pose exhibited rapid T increases whilst those assuming more submissive poses showed decreases in T levels [20]. Power posing also decreased C levels [20], thereby potentially magnifying any behavioural change linked to T. Thus, in some social interactions, males might be attuned to the physical size of other males, possibly with larger males exhibiting or perceived to exhibit more dominant behaviour with associated neuroendocrine responses.

A post-match video presentation of an athlete or team performance is a common practice in elite sport. Video presentations can acutely modify male T concentrations [21–24] and thus, could potentially link through to changes in behaviour and short-term (<1–2 h) physical performance [17,21]. In fact, it was recently demonstrated that a psychological strategy involving a post-match video can influence these outcomes up to a week later in professional male athletes [16]. To our knowledge, no studies have examined if the social environment (i.e. presence of other males) during a post-match video presentation can also modify athlete hormones and performance on similar timescales. As the social environment is highly malleable, this would be a worthwhile addition to the field of psychobiology.

We examined the social environment effects during a post-match video presentation on the subsequent hormonal responses (i.e. stress test changes, pre-match levels) and match performance in professional male athletes. To modify the social environment the video presentations were completed in the presence of; (1) strangers who were bigger (SB), (2) strangers who were smaller (SS), (3) friends who were bigger (FB) and (4) friends who were smaller (FS). Considering previous work [18–20], we hypothesised that the SS and FS interventions would produce more favourable outcomes (i.e. greater T and lower C stress responses, higher pre-match T concentrations and better match performance) [16,17,21] during the following week when compared to the SB and FB approaches.

2. Methods

2.1. Participants

Twelve elite male rugby union players (6 forwards and 6 backs) playing for the same team were recruited for this study. They were all full-time athletes with between 2 and 4 years of training experience in a professional environment, and were considered healthy and injury-free at the time of this study. On a weekly basis, the participants were engaged in numerous training sessions (i.e. 4–5 days per week, 1–2 h in duration) involving physical and skill conditioning, team/positional preparation, recovery work, and they played in 1 competitive match. Each participant had a full explanation of the protocols and signed informed consent. The experimental procedures were performed with university ethics approval.

2.2. Experimental design

Using a cross-over design, participants ($n = 12$) attended a video review 1 day after a professional rugby union match in the presence of other males (i.e. SS, SB, FS and FB interventions). To isolate the video effect from the social environment, a sub-group ($n = 8$) was tested a year later to compare the effects of a video (V) and a non-video (NV) intervention in a neutral social environment. The delay in the V and NV treatments was unavoidable due to the competition schedule and athlete availability. As a consequence, the data collected across the 2 experimental blocks were not directly compared. All assessments were carried out the week after each intervention; the T and C responses to a physical stress test (3 days later) and pre-match T and match-ranked performance (6–7 days later). The experimental procedures were implemented within the training schedules of participants to improve adherence and the ecological validity of the study findings.

2.3. Post-match video reviews (Block 1)

The SB and SS interventions were implemented first with the FB and FS interventions completed across later games in the same season. Participants reported to the training facility 24 h after each match, where they were randomly assigned to 1 of 2 groups of equal size. Each group completed a different intervention (all 1 h in duration) and the 2 groups crossed over on the subsequent week to complete the corresponding intervention. The mean age, body mass and height of participants were 20.0 ± 0.7 years, 95.7 ± 9.5 kg and 1.85 ± 0.06 m, respectively. Testing in this block was conducted as follows:

1. *SB intervention*: Both groups saw video footage of the match played the previous day, which consisted of mixed content of player mistakes and successes. The video footage was selected by the coaching staff, based on the specific requirements of this study, and formatted by the team analyst to be played on a large video screen. During the watching of these videos, each group was accompanied by an equal number of male strangers whom they were told were there to simply observe and learn. The group of strangers was also rugby players, but they were chosen to be significantly ($P < 0.01$) taller (1.91 ± 0.03 m) and heavier (105.3 ± 6.7 kg) than the study population.
2. *SS intervention*: Both groups watched the same video footage described above, but in the presence of another group of male strangers. This group was also rugby players and chosen to be significantly ($P < 0.05$) shorter (1.78 ± 0.05 m) and lighter (88.0 ± 6.0 kg) than the assessed group. In both the SB and SS treatments, the unknown males made no comments concerning the video presentations, but they did interact in a social manner. The discussions between these athlete groups were not scripted in anyway, but the strangers were instructed to maintain a friendly conversation at all times.
3. *FB intervention*: Participants watched selected video footage of the previous match played, at which time they were accompanied by an equal number of male friends known to the study participants for more than two years and who were also rugby players. The group of friends was chosen to be significantly ($P < 0.01$) taller (1.91 ± 0.02 m) and heavier (115.3 ± 5.2 kg) than the assessed group of players.