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The effects of different pre-game motivational interventions on athlete free hormonal state and subsequent performance in professional rugby union matches

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ABSTRACT

We examined the effect of different pre-match motivational interventions on athlete free testosterone (T) and cortisol (C) concentrations and subsequent match performance in professional rugby union. Male participants (n = 12) playing at a senior or academy level in rugby union were recruited and each completed three interventions (15 min each) before a competitive game; 1) watching a video clip of successful skill execution by the player with positive coach feedback [VPCF1]; 2) watching a video clip of successful skill execution by an opposing player with cautionary coach feedback [VCCF], 3) the player left alone to self-motivate [SM1]. The first and last interventions were retested [VPCF2 and SM2]. Salivary free T and C measures were taken pre-intervention and pre-game. Within each game, players were rated by coaching staff on a key performance indicator (KPI) from identified skills and an overall performance indicator (OPI), where 1 = best performance to 5 = worst performance. The VPCF1 and VPCF2 interventions both promoted significant T responses (11.8% to 12.5%) before each game and more so than SM1, SM2 and VCCF. The VCCF approach produced the largest C response (17.6%) and this differed from all other treatments. The VPCF interventions were also associated with better game KPI (1.5 to 1.8) and OPI ratings (1.7 to 1.8) than SM1, SM2 and/or VCCF. Across all treatments, greater individual T responses and lower C responses were associated with better KPI and OPI outcomes. In conclusion, the pre-game presentation of motivational strategies to athletes involving specific video footage and coach feedback produced different outcomes on two indicators of match performance, which were also associated with changes in free hormonal state.

1. Introduction

Sports psychology is a well-established tool in modern day sport and is used to achieve optimal performance through many mechanisms including motivating and boosting athlete self-esteem, assisting with stress management, as well as providing focus and removing distractions for sporting tasks. As part of this process, a pre-match talk is commonly employed by a coach to motivate an athlete or team [1,2]. In rugby union, this may involve a team meeting at the venue (< two hours before kick-off) to discuss technical preparation, followed by verbal persuasion to motivate the team and individuals, and to instil confidence (< one hour), with these strategies repeated during the warm-up and final 20 min to further increase confidence and mental activation [2]. Despite this common practice, as yet, no objective assessment of its efficacy has been conducted on elite athletes within the sporting environment.

Athlete motivation during sports competition might be related, to some extent, to the effects of endogenous testosterone (T) on the brain. For example, it has been demonstrated that aggressive behaviour (e.g., offensive moves in combat sports such as judo) in sport correlates to T levels [3] and greater T increases have been observed in winners than losers during physical and non-physical competitions [4–6]. An elevation in T levels has also been demonstrated by athletes playing at their home ground, compared to an opponent's venue [7,8], and simply watching a video of a previous victory can elevate T [9]. These findings suggest a link between the hormonal state of athletes and competitive behaviour, whilst also highlighting the possible use of video clips as a stimulus for inducing such change.

Several groups have demonstrated acute changes in T concentrations with the watching of different video footage [10–12]. If a video presentation can acutely modify T, then such an approach could speculatively allow us to see any correlation between changes in athlete hormonal state, subsequent aggression and motivation to perform, and thereafter physical performance. Our recent work on athletes confirmed that the watching of different video clips (e.g., aggressive, motivational) can elicit a positive T response and subsequently improve voluntary squat performance [13]. However, little

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empirical evidence exists on the use of videos to modify these outcomes prior to, and during, actual sporting competition.

Verbal persuasion is also used within the sport of rugby union to motivate or encourage players for impending games [2]. Subliminal positive priming can increase one's motivation for action [14] and other data suggests that T might enhance general motivation by reducing fear [15]. Together with previous evidence, it is possible that the watching of a motivational video combined with more overt positive priming from a coach (i.e., positive verbal feedback) might produce a greater T response to improve athlete behaviour and subsequent performance in a game. Conversely, watching a stressful video and receiving somewhat negative coach feedback (e.g., cautionary feedback or warnings) may have the opposite effect on these outcomes. To our knowledge, no research has examined the combined effects of watching video clips with coach feedback on athlete hormonal state and competitive performance.

Other steroid hormones might also influence the T actions on the brain and behaviour. In particular, baseline cortisol (C) levels appear to moderate the effects of T on male behaviours [16,17] and C, along with other glucocorticoids, may also regulate the expression of androgen receptors to indirectly regulate the T effect [18]. Furthermore, it has been suggested that the hormonal axes cueing the stress-induced release of T and C have an antagonistic relationship [18]. Thus, one may expect to see opposing response patterns for these hormones following exposure to a psychological stressor in sport.

This study examined the effects of different pre-match motivational strategies on salivary free T and C concentrations and indicators of athlete performance during professional rugby union games. Three interventions were assessed in this study; (1) watching a video clip of successful skill execution by the player with positive coach feedback [VPCF]; 2) watching a video clip of successful skill execution by an opposing player with cautionary coach feedback [VCCF], 3) the player left alone to self-motivate [SM]. The VPCF and SM interventions were also retested. We hypothesized that the VPCF approaches would produce the largest pre-game T responses and smallest C responses and the best performance outcomes. We further hypothesized that the VCCF intervention would promote the smallest pre-game T response and largest C response and produce the worst performance outcomes.

2. Material and methods

2.1. Subjects

Twelve rugby union players were recruited for this study with a mean age, body mass and height of 21.8 ± 1.3 years, 98.5 ± 10.4 kg and 1.85 ± 0.07 m, respectively. Participants were all professional rugby players at an academy or senior level. Each subject had a full explanation of the protocols and signed informed consent before the study commenced. The experimental procedures were performed with university ethics approval and in compliance with national legislation and The Code of Ethical Principles for Medical Research involving Human Subjects of the World Medical Association (Declaration of Helsinki).

2.2. Experimental procedures

This study was conducted across five consecutive games (each 5–7 days apart) during the competitive rugby union season. In the first three matches, three pre-game motivational interventions (VPCF, VCCF and SM) were presented to the participants in a randomised fashion. In games four and five the SM and VPCF interventions were repeated. However, due to the perceived negative impact of the VCCF approach by the coaching staff, this strategy was not retested. The main outcomes were free T and C responsiveness before each game and two coach-rated indicators of player performance during that game.

2.3. Pre-game interventions

On each day of testing subjects arrived at the playing venue approximately 2 h before the kick-off for each rugby union match. A saliva sample was taken from the participants by passive drool 85 min before each game started. Next, the participants were moved to a quiet room at the playing venue and one of three interventions was randomly presented to three groups of four players as follows:

1. VPCF — sitting in front of individual computer screens (Dell Inspiron with 1024×768 pixel screen resolution) for 15 min to watch footage of themselves performing two successful playing executions from the game played the previous week (5–7 days prior) with the coach present during the viewing and providing scripted commentary. The video footage was selected by the coaching staff, based on the specific requirements of this study, and formatted by the team analyst to allow each video clip to be played on a laptop computer. Whilst the players watched these clips, the coach affirmed the positive action of each player and the strength of this action on the game in a very simple manner. Coach script consisted of choosing one of several key phrases, for example “you performed that well” and “that's how I want you to do that”.
2. VCCF — sitting in front of a single computer screen for 15 min watching footage of their opposing player performing 2 successful playing executions from previous games with the coach present. During the watching of these clips, the coach provided scripted comments with phrases such as “don't let him get away with that today” and “watch out for him doing that”.
3. SM — sitting by themselves in the testing room for 15 min, with no video footage shown and no coach present, just quiet meditation and listening to music if they chose (all participants chose the option of music).

The pre-game interventions were completed at either 1 h and 15 min, or 1 h prior to each rugby union game, so that the same coach could present to each group for consistency. These were rotated across games one, two and three such that each athlete completed all three interventions using a cross-over design. These were coded VPCF1, VCCF and SM1. The first and last interventions were retested on games four and five (but not randomised) and were coded SM2 and VPCF2, respectively. At the completion of each pre-game intervention, the subjects made their way to the training ground with the rest of the team to complete their normal warm-up procedures over a period of 40 min. The warm-up was standardized for all players (and across all five games) and this comprised of running drills, small ball games, contact work, set plays and dynamic stretching between activities. This was followed by a final team debrief, after which another saliva sample was taken 5 min before each game. The procedures outlined are typical of the professional rugby union environment. Because this study was undertaken in an elite environment certain constraints present themselves within the current design. For example, randomisation of the last two interventions was not possible within the training schedules of the team.

The participants consumed a familiar breakfast (between 0800 and 0830 h) on the morning before each period of saliva sampling, and after at least 7 h of sleep from the previous night. Breakfast generally comprised cereals, yoghurt, toast, eggs, fruit juice and/or water. No carbohydrate or protein-rich food or drinks were taken by the participants 1.5 h before the first saliva sample [19]. However, the participants did have access to low-carbohydrate sports drinks during the warm-up procedures and this was monitored to ensure consistent fluid intake across each intervention. The assessed matches were all played at different venues on a home ($n = 3$) and away ($n = 2$) basis, and these games started at a similar time of day (1430–1500 h), which helped