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LETTER TO THE EDITOR

Does a congested fixture schedule affect psychophysiological parameters in elite volleyball players?

Est-ce qu'un calendrier surcharge affecte les paramètres psychosociologiques chez les joueurs d'élite de volleyball ?

KEYWORDS

Salivary cortisol;
Stress;
Competitive matches;
Team sport;
Sports monitoring

MOTS CLÉS

Cortisol salivaire ;
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Matchs compétitifs ;
Sport d'équipe ;
Surveillance sportive

1. Introduction

The effects of periods of fixture congestion have been investigated in team sports, notably in professional [1–3] and elite youth soccer players [4,5]. The concerns about fixture congestion in soccer is often justified based on the likelihood of increasing residual fatigue, risk of injury, and underperformance due to a reduced time for appropriate physical recovery related to an accumulation of matches over a short period of time [6]. However, to date, research using time-motion analyses suggests that running performance represented by distance covered is unaffected over periods of fixture congestion in soccer players [7]. Taken these results into account Carling et al. [7] have proposed

the adoption of a more holistic approach in order to quantify the demands from a competitive match-play and aid in interpretation of potential changes in match performance over congested schedule periods. Therefore, the authors [7] proposed the inclusion of technical parameters in conjunction with data from perceived effort and biochemical and hormonal responses for a more holistic analysis.

Whilst these issues have been largely debated in the literature of match analysis in soccer, there have been few attempts to investigate the effect of periods of congested fixture in other team sports. Indeed, the congested fixture might be a greater concern in volleyball competitions compared to soccer. Carling et al. [7], for example, questioned the real value of the existing time-motion research in the area of congested fixture in soccer, due to the apparent limited extent to which individual players repeatedly completed entire matches across the congested periods (i.e. eight matches in 26 days; six matches in 18 days; three matches in 5 days). The authors pointed out that because of the players' rotation strategies during periods of fixture congestion, the real-world magnitude of this issue is doubtful. However, contemporary professional volleyball teams are often involved in congested fixture schedules across the season. Important tournaments, such as the Olympic Games, domestic, national and international cups and qualifying events are played on a daily basis competition formats, in which players should participate in successive daily volleyball matches. The accumulation of daily playing-matches might potentially result in residual fatigue and underperformance due to the insufficient time for physical and mental recovery. Despite this scenario, less is known about the influence of congested match schedule on technical performance, hormonal concentration and perceived effort in professional volleyball players. It is prudent to advance the knowledge about these effects while aiding coaches and practitioners to optimize the athletes training plan and recovery procedures.

Volleyball has been classified as an intermittent sport with short periods of high-intensity bouts with varying recovery intervals [8,9]. The physiological and psychological players' responses have been investigated during official volleyball matches [10–12]. Heart rates, blood lactate, creatine kinase, cortisol concentration, among other biological

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parameters, have been assessed in these studies, and their findings have contributed to the advance of the knowledge regarding the volleyball match-demands [10,11,13–15]. In general, these findings demonstrated that participating in official volleyball matches may lead to changes in different psychophysiological parameters such as increased inflammatory cytokines, muscle damage markers [15] and cortisol concentration, and values of perceived effort [11]. Indeed, Mroczek et al. [12] monitored elite male volleyball players' motor actions (external load) and showed that running distance covered by players during the match is increased towards the end of the played sets.

It is worth mentioning that Souglis et al. [15] showed that $TNF\alpha$ increased by 90% and IL-6 by 200% from pre-to-post a single volleyball match, and that these inflammatory markers returned to baseline levels by the next morning in elite volleyball players. Moreover, these authors reported that muscle damage biomarkers, such as CK and LDH, increased by 150 and 80%, respectively, but did not recover to baseline 37 h post-match. Even though that it is unlikely that elite volleyball players actually experience a high degree of muscle damage every time they participate in official matches, these findings suggest that both, inflammatory and muscle damage biomarkers, present elevated magnitude of changes. Nevertheless, the biological meaning of these changes is yet to be determined, and it is still unknown whether these biological responses would be associated to impaired performance in elite players, notably when playing successive matches with reduced time for recovery.

Despite the advances on knowledge of volleyball demands, there is still less information regarding the effects of successive matches in physiological, perceived effort and stress tolerance measures in professional players. This knowledge could be useful for sports scientists and practitioners working with volleyball teams who are often faced with this situation in practical setting. Therefore, the aim of this study was to examine the effect of a congested fixture schedule (CFS), which included three successive official volleyball matches played within a 3-day period, on salivary cortisol level, technical parameters, internal match-load, and stress tolerance, in male professional volleyball players. It was hypothesized that higher post-matches salivary cortisol concentrations would be observed compared to baseline (resting) value. In addition, it was hypothesized that salivary cortisol concentration would progressively increase during the competition (> values for the 2nd and 3rd matches compared to 1st match), and that such increases would be accompanied by the internal match-load; moreover, due to the accumulated psychophysiological stress inherent to this CFS, it was expected to observe a decrease in players stress tolerance.

2. Materials and methods

2.1. Experimental approach

In order to examine the effect of a CFS on volleyball players' responses, the data collection occurred during a 3-day competition period. Three matches were played over 3 successive days. The tournament was a qualifying competition for the main Brazilian volleyball league. The reference team

won the second and third matches (3×2 and 3×0 , respectively) and lost the first match (0×3). Three sets were played for the 1st and the 3rd matches. The duration of the matches was 84 min and 99 min, respectively. Five sets were played during the 2nd match, which lasted 157 min. All the assessed matches were played at the same time of the day (between 2:00 and 3:00 pm). The athletes were allowed to drink water and sports drinks before, during, and after all matches. There were no injuries that limited the players' participation across the investigated competition. The matches were filmed and individual technical parameters notated for analysis. Salivary samples were collected between 15–20 min after the end of each match. The baseline samples were collected at rest, one day before the 1st match, at the same time of the played matches. The session-RPE was collected 20–25 min after the end of the matches, after saliva sampling; and the DALDA questionnaire for assessing stress tolerance was fulfilled at night, at the same time for the 4 occasions (the day before the 1st match and for the 3 assessed matches).

2.2. Subjects

Twelve male professional volleyball players volunteered for this study. Data of 11 players (mean \pm SD: age, 26.4 ± 4.4 years; height, 191.4 ± 8.4 cm; body mass, 85.1 ± 8.7 kg) were retained for analysis based on the participation of the players in the 3 assessed official matches (players who participated in all the sets played in the three matches). Habitually, the players were used to participating in five training sessions (120 to 180 min per session) during the preparation for the competition. This preparation included 14 weeks (from the beginning of the training period to the final round of the competition) with 9 official matches played before the analyzed tournament. The training sessions usually consisted of specific physical training preceded by strength and power exercises, and technical-tactical training according to the adopted periodization. All athletes gave informed consent following full disclosure of procedures in accordance with the Helsinki Declaration. All procedures received University Ethics Committee approval (No.: 84097/2012).

2.3. Hormonal assessments

Whole saliva samples were collected between 15 and 20 minutes after the end of each match. The baseline samples were collected at rest approximately at 4:00 pm, to coincide with the estimated end of the assessed matches. The subjects abstained from food and caffeine products for at least 4 hours prior to the saliva collection. Initially, the subjects were required to rinse out their mouths with distilled water to remove possible sample contaminants that might affect salivary cortisol levels. Unstimulated saliva was collected into sterile 15 mL centrifuge tubes over a 5-min period for each sample. Immediately after collection, the saliva samples were frozen and stored at -80° C until assayed for salivary cortisol concentration. Salivary cortisol concentrations were measured in duplicate, using an ELISA (Cortisol–Direct Salivary EIA kit; ALPCO Diagnostics), in accordance with previous study [16]. The average

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