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Original research

Wellbeing perception and the impact on external training output among elite soccer players

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ABSTRACT

Objectives: The objective of the investigation was to observe the impact of player wellbeing on the training output of elite soccer players.
Design: Prospective cohort design.
Methods: Forty-eight soccer players (age: 25.3 ± 3.1 years; height: 183 ± 7 cm; mass: 72 ± 7 kg) were involved in this single season observational study across two teams. Each morning, pre-training, players completed customised perceived wellbeing questionnaires. Global positioning technology devices were used to measure external load (total distance, total high-speed running distance, high speed running, player load, player load slow, maximal velocity, maximal velocity exposures). Players reported ratings of perceived exertion using the modified Borg CR-10 scale. Integrated training load ratios were also analysed for total distance:RPE, total high speed distance:RPE player load:RPE and player load slow:RPE respectively.
Results: Mixed-effect linear models revealed significant effects of wellbeing Z-score on external and integrated training load measures. A wellbeing Z-score of −1 corresponded to a −18 ± 2 m (−3.5 ± 1.1%), 4 ± 1 m (−4.9 ± 2.1%,) 0.9 ± 0.1 km h^{-1} (−3.1 ± 2.1%), 1 ± 1 (−4.6 ± 2.9%), 25 ± 3 AU (−4.9 ± 3.1%) and 11 ± 0.5 AU (−8.9 ± 2.9%) reduction in total high speed distance, high speed distance, maximal velocity, maximal velocity exposures, player load and player load slow respectively. A reduction in wellbeing impacted external:internal training load ratios and resulted in −0.49 ± 0.12 m min^{-1}, −1.20 ± 0.08 m min^{-1},−0.02 ± 0.01 AU min^{-1} in total distance:RPE, total high speed distance:RPE and player load slow:RPE respectively.
Conclusions: The results suggest that systematic monitoring of player wellbeing within soccer cohorts can provide coaches with information about the training output that can be expected from individual players during a training session.

1. Introduction

It is important for practitioners to fully appreciate the impact that player wellbeing can have on training output.[1] An imbalance between training/competition load and recovery over extended periods of time may contribute to long-term reductions in players training output and result in overtraining symptoms. This has resulted in attention increasingly being given to the evaluation of monitoring tools which may indicate the fatigue status of athletes. These indicators include heart-rate derived indices,[2] salivary hormones and neuromuscular indices.[3] In contrast to the above assessments, perceived wellbeing scales represent a valid, time-efficient and non-invasive method for practitioners to gain information related to a player's wellbeing status and overall readiness to train and compete.[1,4] Such characteristics are particularly important within soccer during the in-season competitive phase. During these periods players can compete in two or three matches over a 7-day period where time constraints may restrict the use of more invasive tests.[4] Therefore the use of maximal performance tests may further reduce the physical status of

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players and/or increase the risk of injury.[3] Therefore, practitioners have been encouraged to incorporate customised, shortened questionnaires[5,6] into their monitoring practices to assess the general fatigue and perceived wellbeing status of athletes.[6,7]

The research investigating the relationship between training and these customised questionnaires typically explores perceived wellbeing in response to training and/or match load.[8–10] In soccer cohorts Thorpe et al.[7] reported that wellbeing outcomes are reduced by 35–40% post-match day when contrast to pre-match day wellbeing measures ($p < 0.001$). These measures then improved by 17–26% between post-match day and 2 days post-match day. Wellbeing ratings were observed to remain stable between the second and fourth day post-match. Furthermore, smaller (7–14%) improvements occurred between the fourth day post-match and subsequent pre-match day ($p < 0.01$). Within rugby league cohorts, overall self-reported wellbeing was significantly reduced ($p < 0.01$, $d = -1.64$) 1 day post-match regardless of the length of the microcycle (5, 7 or 9 days between matches). At 2 days post-match wellbeing only remained reduced for the 7 day and 9 day cycles ($p < 0.05$, $d = -1.53$; $p < 0.05$, $d = -0.18$, respectively).[8]

Currently within soccer cohorts the effect of wellbeing on training output is not fully understood. Many investigations within soccer only report the relationship between wellbeing status across the training week after match play or the descriptive analysis of these measures across phases of the competitive cycle. With the prevailing popularity of customised, self-report questionnaires in team sport setting due to their practicality and ease of administration, the purpose of the current investigation was to examine the relationship between self-reported pre-training wellbeing scores and external training load outputs in training sessions across a competitive season. The impact of perceived wellbeing on a range of training load parameters such as total high speed running, player load, maximal velocity, RPE and integrated training load ratios in elite professional soccer players were explored.

2. Methods

The current investigation was a prospective cohort study of elite soccer players competing for two teams at the highest level of European competition (Liga NOS and Champions league). Data were collected for 48 players (Mean ± *SD*, age: 25.3 ± 3.1 years; height: 183 ± 7 cm; mass: 72 ± 7 kg) over one season. The study was approved by the local institute's research ethics committee and written informed consent was obtained from each participant. The study period involved all pitch based training sessions during the 2014/2015 season. In total 48 players participated in 460 training sessions resulting in the collection of data on 22,080 individual pitch based training sessions which were examined. Participants had been familiarized to all experimental protocols as these were part of day-to-day practice. Players were instructed to complete a customised perceived wellbeing questionnaire before any physical training, during the season, except on rest days. The questionnaire was designed to be short, specific and based on the components common in the shortened psychological tools used to assess training imbalances in the literature.[1,11] The questionnaire assessed the following elements of wellness: 1) muscular soreness, 2) sleep quality, 3) fatigue, 4) stress and 5) energy level, on a seven-point likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The five individual wellbeing responses for a given day were summed to provide a quantitative score of overall perceived wellness for each player with a maximal wellbeing score of 35 arbitrary units. Coefficients of variation for the five indices ranged from 9 to 14%. Only data from individual's whose wellbeing scores were deemed normally distributed were used.[12] Z-scores were calculated using the following formula: (individual players score − individual player's average)/individual player standard deviation, a Z-score is the number of standard deviations the response is above or below the mean of the distribution.

During the year all pitch based training sessions were monitored for external training load. Players wore a commercially available global positioning technology device, with tri-axial accelerometers (MinimaxX, Team 2.5, Catapult Innovations, Australia). The device was worn in a custom-made vest, fitting the unit tightly between the shoulder blades. Following each training GPS data were downloaded using proprietary software (Catapult Sprint 5.0.6 software), with the transition time in between training drills removed prior to analysis. This was completed in order to not underestimate the proportion of total distance covered in certain speed zones, or at maximal velocity during training drills.[13] Additionally, all data was reported relative to the time on the pitch during each training session to provide an understanding of session intensity ($m\,min^{-1}$, $n\,min^{-1}$, $AU\,min^{-1}$). The data was then exported and placed into a customised spreadsheet (Microsoft Excel, Redmond, USA). The spreadsheet allowed analysis of distance covered (m) in the following categories; total distance (m); total high-speed distance (≥19.8–25.2 $km\,h^{-1}$) sprint distance (≥25.2 $km\,h^{-1}$),[14] maximal velocity ($km\,h^{-1}$), maximal velocity distance (m), maximal velocity exposures (n), player load (AU) and player load slow (AU) were monitored for all players during training. Player load is a vector magnitude algorithm which combines the rate of change in acceleration from three planes of movement and is suggested to incorporate all forms of activity including skill- and contact-based activities. Recent research has suggested that player load provides different information to traditional speed-based time motion analysis. Initially players were tested for maximal velocity capacity. Maximal velocity was assessed via dual beam electronic timing gates that were placed at 0-, 10-, 20-, 30-and 40-m (Witty, Microgate, Bolzano, Italy). Speed was measured to the nearest 0.01 s with the fastest value obtained from 3 trials used as the maximal velocity score. The calculated velocity between the 20 and 40 m gates was used as a measure of maximal velocity.[15] The intra-class correlation coefficient for test-retest reliability and typical error of measurement for the 10, 20, 30 and 40 m sprint tests were 0.95, 0.97, 0.96 and 0.97 and 1.8, 1.3, 1.3 and 1.2%, respectively. Analysis of calculated speeds revealed a significant correlation ($r = 0.89$, $p = 0.02$) between GPS and timing gate measures, with no significant difference between measures of speeds measured by the timing gates (31.2 $km\,h^{-1}$) and GPS measures (31.1 $km\,h^{-1}$) ($p = 0.892$). If a player produced a maximum velocity in training that was greater than the test value this became the playersw' ne maximum velocity for the period.[16]

The intensity of all training and match play sessions (including rehabilitation sessions) were estimated using the modified Borg CR-10 rate of perceived exertion (RPE) scale, with ratings obtained from each individual player within 30 min each training session. Players were educated in the RPE scale, with players encouraged to give a global rating of the entire session using any intensity cues they deemed relevant. Referencing the anchors, a rating of 0 was deemed as rest and 10 as the hardest exercise exertion ever performed; players were prompted for their RPE individually using a touch sensitive customised spreadsheet (Microsoft Excel, Redmond, USA) on a portable tablet (iPad, Apple Inc., California, USA). Each player selected his RPE rating by touching the respective score on the tablet, which was then automatically saved under the player's profile. This method helped minimize factors that may influence a player's RPE rating, such as peer pressure and replicating other players' ratings.[17] Each individual RPE value was multiplied by the session duration to generate an RPE-load value.[18] This allowed for the creation of integrated training load ratios with external load placed into perspective relative to internal load.[1,19]