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# Physiology & Behavior

journal homepage: [www.elsevier.com/locate/phb](http://www.elsevier.com/locate/phb)

## Influence of fatigue, stress, muscle soreness and sleep on perceived exertion during submaximal effort



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### ARTICLE INFO

#### Article history:

Received 23 April 2012

Received in revised form 11 May 2013

Accepted 20 June 2013

Available online 29 June 2013

#### Keywords:

Soccer

Young players

RPE

Hooper's Index

### ABSTRACT

The aim of this study was to assess the effects of the Hooper's Index variations (i.e., self-ratings of fatigue, stress, delayed onset muscle soreness (DOMS), and sleep) on rating of perceived exertion during a 10 min submaximal exercise training session (RPE-10 min) and then check the stability and the internal consistency of RPE-10 min. Seventeen junior soccer players took part in this study. The individual Hooper's indices taken before each training session were correlated with RPE-10 min during a constant intensity and duration effort (10 min) using Pearson product moment correlation. Intraclass correlation (ICC) was used to assess the internal consistency of the RPE-10 min. All individual correlations between RPE-10 min and quality of sleep and quantity of fatigue, stress, and DOMS were non-significant ( $p > 0.05$ ). No significant correlations were resulted between RPE-10 min and Hooper's Index in all athletes. The ICC of RPE-10 min was 0.77 thus demonstrating internal consistency. The results of the present study demonstrated the objectivity and utility of RPE as a psychological tool for monitoring training during traditional soccer training. Therefore, the results of the present study suggest that fatigue, stress, DOMS and sleep are not major contributors of perceived exertion during traditional soccer training without excessive training loads. It seems that psychobiological factors other than fatigue, stress, DOMS and sleep may have mediated the 10 min exercise perceptual intensity.

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### 1. Introduction

Humans are equipped with the best monitoring tool (i.e., their brain) for objective perception of training, quantifying internal training load, expressing the feeling of negative adaptations to training, and impairment of psychophysiological processing in term of function since the brain integrates all the information from the periphery of the body and the state of the body homeostasis [1]. Studies (see for review Ref. [2]) support the hypothesis that the sense of physical effort is best conceptualized as a psychobiological complex. Numerous quantification systems have been developed over the years with the aim to assess this subjective feeling and the current popular tools are the Borg category ratio (CR-10) rating of perceived exertion (RPE) scale and the Hooper's Index using rating scales of sleep, fatigue, stress, and delayed onset muscle soreness (DOMS) scales.

Hooper's Index is a method based on self-analysis questionnaires involving the well-being ratings relative to fatigue, stress level, delayed onset muscle soreness (DOMS), and sleep quality/disorders

[3]. Each of these constructs was measured separately before training sessions and matches. The Hooper's Index is the summation of these 4 ratings. In accordance with Hooper et al. [3], subjective ratings using scales of 1–7 from “very very low-or-good” (point 1) to “very very high-or-bad” (point 7) have been suggested as one of the most cost-effective strategy for early detection of overtraining syndrome (i.e., alteration of physiological functions and adaptation to performance, impairment of psychological processing, immunological dysfunction, and biochemical abnormalities [4]) and hence monitoring of training [3,5]. Thus, the Hooper Index measured daily training session, not only allows better detecting individual signs of pre-fatigue when interpreted along with the players' training loads (TL) [3], but also eventually adapting the scheduled training loads of the day in light of the players' status (i.e., amateur or professional players). This will eventually allow the staff and fitness coach to accurately schedule and adapt the TLs in order to reach optimal performance with fit players. This index was validated initially in swimming [3] and then used by others researchers in soccer [6].

After training sessions and matches, training load can be monitored by the RPE method. RPE has been widely applied to evaluate the relationship between the psychophysical responses and the

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