

NOCTURNAL HEART RATE AND HEART RATE VARIABILITY AS A METHOD FOR MONITORING TRAINING LOAD

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Introduction

The basic principle of training is that training disturbs the homeostasis of the body and recovery is needed for adaptation and improvement of performance. Monitoring training load and recovery is of major importance in competitive sports. Recent studies suggest that heart rate (HR) and HR variability (HRV) changes during night sleep could be used to evaluate the training load of the preceding day (Hynynen et al. 2010) or the accumulated training load during a training period (Pichot et al. 2000). The aim of this study was to study nocturnal HR and HRV after a rest day and hard training day as well as study the repeatability of HR and HRV indices between two consecutive nights.

Methods

Eighteen male recreational runners (age 34 ± 8 years; VO_{2max} 52 ± 4 ml/kg/min) measured nocturnal RR-intervals with Suunto t6 heart rate monitor (Suunto Ltd., Vantaa, Finland) after a rest day and hard training day as well as after two consecutive light training days. Nocturnal HRV was analyzed with frequency domain method (Firstbeat Health Software, Firstbeat Technologies Ltd, Jyväskylä, Finland). HR, low frequency power (LFP), and high frequency power (HFP) were averaged in 15 min time periods throughout the nights.

Results

After the rest day HR was lower and HRV indices were higher compared to the hard training day ($P < 0.01$). HR decreased and HRV indices increased towards the end of the nights more after the hard training day than after the rest day ($P < 0.001$). The correlation coefficient between two consecutive nights was better in HR than in HFP and LFP ($r = 0.97, 0.91$ and 0.84 , respectively, $P < 0.001$). Increasing the length of the averaged time period improved the repeatability of HR and HRV indices. Coefficient of variation decreased from 8.4 to 4.0 (HR), from 11.4 to 5.7 (HFP) and 16.0 to 4.7 (LFP) when the averaged time period increased from 15 min to 4 h.

Discussion

The results suggest that nocturnal HR and HRV indices can be used to evaluate the training load of the previous day. The differences between the rest and hard day were greater in the beginning of the night decreasing towards the end of the night. The results also showed that nocturnal HR and HRV analysis is a repeatable method for monitoring training load in athletes. The reliability of the HR and HRV improves when the averaged time period is increased to several hours.

References

Hynynen E., Vesterinen V., Rusko H., Nummela A. (2010) Effects of moderate and heavy endurance exercise on nocturnal HRV. *Int J Sports Med*, in press.

Pichot V., Roche F., Gaspoz J.-M., Enjolras F., Antoniadis A., Minini P., Costes F., Busso T., Lacour J.-R., Barthelemy J.C. (2000) Relation between heart rate variability and training load in middle-distance runners. *Med Sci Sports Exerc* 32, 1729-1736.