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BOOK OF ABSTRACTS Open Access

Methods of monitoring training load in well-trained competitive cyclists: the dose-response relationship with changes in fitness and performance

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Abstract

Background: Quantifying training load is an important part in the training monitoring process of cyclists. An essential part in evaluating the validity of a training load method is to examine the dose-response relationship between the dose of exercise (training load) and the response (training outcome) (Manzi et al., 2009: Medicine and Science in Sports and Exercise, 41(11), 2090-2096). The most important advantage of an increased understanding of the dose-response relationship is that it allows coaches and trainers to improve the knowledge of how an athlete might respond to a given training dose. Knowing this, the coaches can be more proactive in the future when manipulating the training dose instead of reacting to a response (e.g. performance test).

Purpose: The aim of this study is to assess the dose-response relationship between different training load measures and aerobic fitness and performance in well-trained competitive cyclists. HR-based internal training load measures (i.e. TRIMP methods), session-RPE together with power output (PO) based external training load measures will be tested and compared to each other.

Methods: 15 well-trained competitive cyclists (aged 22 ± 2.5 yr, height 187.7 ± 4.2 cm, weight 74.2 ± 4.7 kg, VO2max 62.2 ± 4.3 ml/min/kg) volunteered to participate in the study. All cyclists are well-trained competitive cyclists active in national and international competitions. Training data was collected during a 10-week training period. Before and after the training period, subjects underwent a laboratory incremental exercise test with gas exchange and lactate measures. As a measure of performance an 8-min time trial (8MT) was performed before and after the training period. Training load was calculated using different methods based on either HR, PO or rating of perceived exertion (RPE). Internal training load methods included Banister's TRIMP (bTRIMP), Edwards' TRIMP (eTRIMP), individualized TRIMP (iTRIMP) and session-RPE (sRPE). The PO-based Training Stress Score™ (TSS) was used a measure of external training load.

Results: There were very large significant correlations (±95% confidence limits) between iTRIMP (r = 0.81±0.21, P = < 0.001, ES = very large) and TSS (r = 0.75±0.31, P = 0.005, ES = very large) and percentage changes in power output at 2 mmol·L-1 (Table 1). Significant correlations were also observed for sRPE (r = 0.54±0.39, P = 0.038, ES = large), bTRIMP (r = 0.52±0.40, P = 0.046, ES = large), eTRIMP (r = 0.64±0.34, P = 0.011, ES = large) and changes in power output at 2 mmol·L-1. Percentage changes in power output at 4 mmol·L-1 was very largely significantly related to iTRIMP (r = 0.77±0.25, P = 0.001, ES = very large), eTRIMP (r = 0.73±0.28, P = 0.002, ES = very large) and TSS (r = 0.79±0.27, P = 0.002, ES = very large). For sRPE (r = 0.60±0.36, P = 0.018, ES = large) and bTRIMP (r = 0.67±0.32, P = 0.007, ES = large) the relationships were significant and large. No significant relationships were observed between sRPE (r = 0.51±0.41, P = 0.064, ES = large), bTRMP (r = 0.40±0.45, P = 0.159, ES = moderate), eTRIMP (r = 0.48±0.42, P = 0.082, ES = moderate), TSS (r = 0.41±0.51, P = 0.205, ES = moderate), and changes in power output during the 8MT performance test. However, large significant relationships were observed for iTRIMP (r = 0.63±0.34, P = 0.016, ES = large).

Conclusions: The main and novel finding in this study is that all training load methods used in this study show a significant relationship between quantified training load and changes in aerobic fitness variables (power at 2 and 4 mmol·L-1) in this group of competitive cyclists. Even though all methods show significant relationships for changes in fitness, strongest relationships with both aerobic fitness variables were observed for iTRIMP and TSS. Both methods integrate individual physiological characteristics suggesting this to be an essential factor in the quantification of training load. Overall, dose-response relationships with performance changes were less strong with the results indicating iTRIMP to be the best methods to track changes in performance.

Table 1. Relationship between training load measures and percentage changes in aerobic fitness variables and performance. Pearson's product-moment correlation coefficients with 95% confidence intervals

	sRPE	iTRIMP	bTRIMP	eTRIMP	TSS
% ∆PO 2mmol·L^{-1}	0.54* [0.04 to 0.82]	0.81** [0.51 to 0.93]	0.52* [0.01 to 0.82]	0.64* [0.19 to 0.87]	0.75** [0.31 to 0.93]
% ∆PO 4mmol·L^{-1}	0.60* [0.13 to 0.85]	0.77** [0.43 to 0.92]	0.67** [0.24 to 0.88]	0.73** [0.35 to 0.90]	0.79** [0.40 to 0.94]
% ∆PO 8MT	0.51 [0 to 0.81]	0.63* [0.17 to 0.86]	0.40 [-0.14 to 0.76]	0.48 [-0.04 to 0.80]	0.41 [-0.21 to 0.80]

Abbreviations: sRPE; session rating of perceived exertion, iTRIMP; individualised training impulse, bTRIMP; Banister's training impulse, eTRIMP; Edwards' training impulse, TSS; Training Stress Score. % ∆PO 2 mmol·L^{-1}; percentage change in power output at 2 mmol·L^{-1} pre vs. post, % ∆PO 4 mmol·L^{-1}; percentage change in power output at 4 mmol·L^{-1} pre vs. post, % ∆PO 8MT percentage change in power output during the 8MT pre vs. post.

**. Correlation is significant at the 0.05 level (2-tailed).*

***. Correlation is significant at the 0.01 level (2-tailed).*

Keywords: Cycling, training load, performance.

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