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Management of Regeneration in Elite Sports

Presentations during the ECSS Congress MetropolisRuhr 2017

Invited Sessions

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[IS-PM04] Individualisation in recovery science (05.07.2017, Start: 15:30, Lecture room: "Europa/West") Chair: Tim Meyer

Individualized Diagnosis of Fatigue and Recovery Needs

Hecksteden, A.

The decisive difference in performance is generally tiny in today's competitive sports. Consequently, going to the limits of bearable training load is critical for success. However, such training "on the edge" is associated with the risk of accumulating fatigue. Therefore, monitoring of fatigue and recovery is an important aspect in the regular fine-tuning of training recommendations. During the last decades numerous fatigue markers have been reported, including a wide range of blood-borne parameters as well as psychological, autonomic and performance measures. Most of these parameters are justified by a significant main effect of fatigue and a clear physiological concept. However, accuracy and precision in the assessment of fatigue status in individual athletes is limited by large variability for all parameters available. This challenge may be addressed by individualizing cut-off values for single markers and / or joint consideration of several parameters. Individualized reference values increase diagnostic accuracy by eliminating between-subject variation, which is relevant for routine markers. Scores, non-linear multivariate classifiers and other forms of parameter combinations provide means to decrease the impact of fatigue-independent variation in single markers and gain information from parameter patterns. This lecture will present some approaches for personalized fatigue diagnostics including directions for future research.

Oral Presentations

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[OP-PM09] Performance and recovery (05.07.2017, Start: 14:00, Lecture room: "Berlin/West") Chair: Michael Kellmann & Katharina Trompeter

Effects of post-exercise sauna bathing on recovery of swim performance

Schimpchen, J., Skorski, S., Mittenmüller, J., Pfeiffer, M. Ferrauti, A., Kellmann, M., Meyer, T.

Introduction

Post-exercise recovery interventions have become a widespread addition to the daily routines of athletes. One common recovery modality that appears to be popular among athletes is sauna bathing. The aim of this study was to investigate whether sauna bathing following an intensive training session can enhance recovery in well-trained swimmers.

Methods

20 well-trained swimmers and triathletes (17.3 ± 2.1 y) participated in the study. Athletes completed an intensive 90 min training session (s-RPE: 593 ± 136 AU) followed by either a sauna bathing intervention (SAU) or a placebo condition (PLA) in randomized order and separated by 7 days. SAU consisted of 3x8 min of sauna bathing at 80-85°C, while during PLA athletes were required to apply a deidentified, pH-balanced massage oil to their body while passively resting in a seated position. Since the placebo effect might partly be responsible for benefits of SAU the athletes were told that this “novel recovery oil” was considered to be effective in terms of performance restoration (Broatch et al., 2014). Prior to training swimmers performed a CMJ test as well as a 4x50-m all out swim test with 30 s of recovery between bouts.

Additionally, venous blood samples (analyzed for CK and UREA) were drawn from the athletes and subjective ratings of general fatigue and recovery were collected using a questionnaire (Acute Recovery and Stress Scale) (Hitzschke et al., 2016). All assessments were repeated on the following morning prior to training.

Results

Athletes performed significantly worse during the 4x50-m swimming test after SAU compared to PLA (overall 200-m time: P=0.02; SAU vs CON: + 2.3 s), with the most pronounced decrease in performance occurring over the first 50-m bout (P=0.04; SAU vs CON: + 0.7 s). The performance of half of the athletes deteriorated beyond the day-to-day-variability, while only one athlete improved. CMJ performance (P=0.35) as well as the athletes' perception of overall recovery (P=0.59) and overall stress (P=0.09) were not affected by the intervention. With regard to blood parameters, there were no significant differences for either CK (P=0.39) or UREA (P=0.32).

Conclusions

A single exposure to SAU post-exercise was shown to impair the athletes' sport-specific performance capabilities during the following training session. Based on these results, athletes should be advised to abstain from sauna bathing prior to competition and hard training sessions. However, previous research has demonstrated favorable effects for a long-term use of SAU over 3 weeks with regards to aerobic performance (Scoon et al., 2007). Possibly there is a delayed SAU recovery effect. It appears that the use of SAU needs to be planned carefully to ensure all training benefits can be reached.

References

» Broatch J, Petersen A, Bishop D (2014). Med Sci Sports Exerc 11, 2139-2147
» Hitzschke B, Holst T, Ferrauti A, Meyer T, Pfeiffer M, Kellmann M (2016). Diagnostica 4, 212-226
» Scoon G, Hopkins W, Mayhew S, Cotter D (2007). J Sci Med Sport 10, 259-262

[OP-PM27] Interventions to optimize recovery (07.07.2017, Start: 09:45, Lecture room: "Rheinland/South") Chair: Lars Donath & Sarah Kölling

Regular active recovery during a high-intensity interval-training mesocycle does not attenuate training adaptation

Wiewelhove, T., Schneider, C., Schmidt, A., Raeder, C., Döweling, A., Ferrauti, A.

Introduction

High-intensity interval-training (HIIT) can be extremely demanding and consequently can produce high blood lactate levels (Tschakert & Hofmann, 2013). Previous studies have shown that lactate is a potent metabolic stimulus, which is important for adaptation following endurance training (Wahl et al., 2010). Active recovery (ACT) after intensive intermittent exercise, however, enhances blood lactate removal in comparison with passive recovery (PAS) (Nèdèlec et al., 2012), and consequently may attenuate endurance performance improvements. Therefore, the aim of this study was to examine the influence of regular ACT on training adaptations during a HIIT mesocycle.

Methods

26 well-trained male intermittent sport athletes (age, 23.5±2.5 years; VO2max, 55.36±3.69 ml·min·kg-1) participated in a randomized controlled trial consisting of four-weeks of a running-based HIIT mesocycle with a total of 18 HIIT sessions. After each training session, participants completed 15 min of either moderate jogging (ACT) or PAS. Subjects were matched to the ACT or PAS groups according to age and performance.

Before the HIIT program and one week after the last training session, the athletes performed a progressive incremental exercise test on a motor driven treadmill to determine VO2max, maximum running velocity (vmax), running velocity at which VO2max occurs (vVO2max), and anaerobic lactate threshold (AT). Furthermore, repeated sprint ability (RSA) and total haemoglobin mass (tHbmass) were determined.

Results

The HIIT mesocycle induced a small to moderate increase in vmax (Overall [OVE]: effect size [ES]=0.65, $p<0.01$; ACT: ES=0.62, $p<0.01$; PAS: ES=0.67, $p<0.01$), vVO2max (OVE: ES=0.62, $p<0.01$; ACT: ES=0.73, $p<0.01$; PAS: ES=0.52, $p<0.01$), and AT (OVE: ES=0.56, $p<0.01$; ACT: ES=0.84, $p<0.01$; PAS: ES=0.27, $p=0.17$), as well as a small decrease in tHbmass (OVE: ES=-0.28, $p<0.01$; ACT: ES=-0.27, $p>0.07$; PAS: ES=-0.30, $p<0.01$), compared with the values before the intervention. VO2max and RSA remained unchanged throughout the study. In addition, no significant recovery intervention x time interactions were noted in any of the parameters between ACT and PAS, except for AT.

Discussion

Regular use of individualized ACT, consisting of 15 min of moderate jogging following each training session, did not attenuate training adaptations during a HIIT mesocycle compared to PAS. Interestingly, we found that the ACT group obtained a significantly higher AT following the training period compared to the PAS group. This could be because ACT allows a continuation of the training at a low-intensity and may potentially activate specific adaptive mechanisms that are not triggered during PAS.

References
» Nèdèlec, M., McCall, A., Carling, C., Legall, F., Berthoin, S., & Dupont, G. (2013). Sports Med, 43, 9-22
» Tschakert, G., & Hofmann, P. (2013). Int J Sports Physiol Perform, 8, 600-610
» Wahl, P., Hägele, M., Zinner, C., Bloch, W., & Mester, J. (2010). Wien Med Wochenschr, 160, 627-636

Does regular cold water immersion after strength training attenuate training adaptation? A randomized controlled trial

Poppendieck, W., Wegmann, M., Hecksteden, A., Darup, A., Fuhr, C., Krauss, K., Schimpchen, J., Skorski, S., Ferrauti, A., Kellmann, M., Pfeiffer, M., Meyer, T.

Introduction
Cold water immersion (CWI) after exercise is increasingly used by athletes aiming at speeding up recovery and restoring maximum performance. However, recently indications have emerged that regular use of CWI after training might be detrimental to training adaptation. Therefore, the aim of this study was to investigate if regular CWI after strength training of the legs attenuates training adaptation. Strength training was chosen as more pronounced local training effects can be expected compared to endurance training.

Methods
In a randomized cross-over design, 10 healthy trained subjects (26±4 years, 178±9 cm, 79±13 kg) performed two cycles of 24 leg training sessions over a period of 8-9 weeks, separated by at least 2 months. Each session consisted of three machine-based exercises (leg press, leg curl and leg extension).

For each exercise, three sets until fatigue at the 10-repetition maximum (RM) were performed with a break of 3 minutes. Load was determined during the first session, and was adjusted during the 13th session. In the intervention condition, the subjects performed a whole-body CWI at 12-15°C for 10 min after each session. In the control condition, no recovery intervention was applied. To assess training adaptation, the 1-RM at the leg press, as well as counter movement jump performance, were determined before and after both training cycles.

Results

For CWI, the 1-RM was increased by 2.4±7,5 kg. The increase in the control condition was 5.1±7.5 kg. The corresponding effect size (Hedges' g) between groups was 0.37, indicating a small, but not significant ($p=0.30$) effect. No significant differences ($g=0.03$, $p=0.95$) were found for the changes in jump performance (cooling: +0.9±2.2 cm, control: +0.8±5.4 cm).

Discussion

While CWI after exercise appears to elicit some positive effects on recovery, regular use of post-exercise cooling may attenuate training effects. This hypothesis is based on the idea that while cooling may reduce exercise-induced inflammation and thereby speed up recovery, the inflammation reaction is also a precondition for the adaptive processes yielding improved muscular performance. The present investigation does not support a significant detrimental effect of cooling on training adaptation. However, for leg press performance, a small effect size was observed, suggesting that a cooling-induced attenuation of strength training adaptation cannot be ruled out.

[OP-PM29] Monitoring team sport athletes (07.07.2017, Start: 16:15, Lecture room: "Mailand/West") Chair: Billy Sperlich & Jaime Fernandez-Fernandez

Heart rate measures during a HIIT shock microcycle - A methodological comparison

Schneider, C., Wiewelhove, T., Raeder, C., Döweling, A., Ferrauti, A.

Introduction

Monitoring the cardiac autonomic nervous system (ANS) using heart rate (HR) and heat rate variability (HRV) might give useful insights into athletes training response. Several methods for data treatment and practical thresholds had been suggested, without reaching scientific consensus, yet [1,2]. Aim of the study was to compare common HR and HRV analysis methods for monitoring fatigue and recovery during a HIIT shock microcycle.

Methods

18 intermittent sport athletes (mean±SD, age 25.2±2.8 yrs, VO-2peak 58.3±8.8 ml/min/kg) completed a 6-day running-based HIIT microcycle (eleven sessions total). HR and HRV (Ln rMSSD) were assessed daily upon awakening during a 4-day baseline, a 6-day shock microcycle and a 4-day recovery period. HR and HRV were calculated using the last 5 min of a 7-min recording. Changes in repeated-sprint ability (RSA, criterion measure), HR and HRV were analyzed using magnitude-based inferences [3] between baseline (BL), one (fatigued, FAT) and four days (recovered, REC) after the microcycle. Test accuracy was derived from 2x2 contingency tables and ROC curves (area under the curve, AUC) for different concepts of meaningful change (typical error: TE, individual variability: CV or Z-score, performance equivalent: SWC).

All analysis of daily and 4-day rolling averages (4d) of HR and HRV were performed for individual Z-scores, absolute and percent changes.

Results

RSA showed very likely small changes at FAT (-3.2%) and REC (+3.7%). 4d-HR displayed possibly to most likely small changes (FAT +1.5 bpm, REC -2.9 bpm) and likely small reductions (-2.0 bpm) at REC for daily HR. HRV-changes remained trivial. Likely moderate correlations (r=.38-.45) between changes in RSA and daily HR, as well as daily HRV at FAT were observed for individual Z-scores. Test accuracy was higher in daily vs. 4d-values for HRV-changes and HR-changes at FAT. 4d-HR at REC was more accurate than daily HR. Threshold concepts based on individual variability showed highest test accuracy (44-67%). Overall accuracy for detecting RSA-changes was insufficient (AUC for Z-scores: 0.2-0.7).

Discussion

Overall, daily HR and HRV were superior to 4-day averages, with HR being closer related to RSA-changes than HRV. Present findings indicate the usefulness of considering individual variability, compared to fixed benchmarks such as TE or SWC. Independent of data treatment and threshold concept ANS-alterations were poorly related to overload induced short-term performance changes. Current results display an important starting point for future multivariate analysis using ANS-markers.

References

» Buchheit M (2014) Front Physiol, 5(73)
» Akenhead R, Nassis GP (2016) Int J Sports Physiol Perform, 11(5), 587-593
» Hopkins WG, et al (2009) Med Sci Sports Exerc, 41(1), 3-12

[OP-BN15] Modeling sports performance (08.07.2017, Start: 08:00, Lecture room: "Mailand/West") Chair: Will Hopkins & Mark Pfeiffer

Performance prediction using antagonistic models in rowing

Rasche, C., Endler, S., Pfeiffer, M.

Introduction

In training science, many attempts have been made to model the individual load-performance relationship of athletes using antagonistic performance models. These systems models abstract real-world settings and underlying physiology, while training load is typically merged into a single variable, so that vital information regarding the type of training is lost (Taha & Thomas, 2003). Furthermore, past research predominantly focused on simulation accuracy, whereas a comprehensive comparison of the predictive abilities has not yet been carried out (Clarke & Skiba, 2013). The Performance-Potential-Double-Model (PerPot DoMo; Perl & Pfeiffer, 2011) incorporates a second input variable and is compared to the existing performance models regarding its simulation and predictive accuracy.

Methods

Internal training load and performance of four elite rowers (17-25y, 2f/2m) was monitored for 16 weeks. The heartrate derived modified TRIMP (Garcia-Ramos, A. et al., 2015) was used as a sole input for the Fitness-Fatigue-Model (FF-Model) and the Performance-Potential-Model (PerPot), whereas the training duration (volume) and TRIMP per minute (intensity) functioned as inputs for the PerPot DoMo. Performance was assessed via mean velocity of a weekly 1000m all-out trial on a rowing machine ergometer and used as the output variable for all three models.

Mean absolute percentage error (MAPE) and coefficient of determination (r^2) of the simulated versus empirical performances were computed to estimate the model-fit of (i) overall data set, (ii) initial ten weeks (calibration) and (iii) last six weeks (prediction on the basis of the calibration).

Results

Resulting mean MAPE±SD and mean r^2 for the FF-Model, PerPot and PerPot DoMo correspondingly were: (i) 0.74±0.46% / .46; 0.39±0.18% / .66; 0.32±0.17% / .76; (ii) 0.64±0.35% / .56; 0.32±0.28% / .83; 0.18±0.15% / .95 (iii) 0.87±0.55% / .37; 1.07±0.63% / .31; 0.82±0.69% / .38.

Discussion

All three models obtain excellent model-fits for phases (i) and (ii), while precision declines regarding the prediction of future performances (iii). Two separate inputs (volume/intensity) enable PerPot DoMo to model performance slightly more precisely than with one input (FF-Model, PerPot) for (i) and (ii). Additional research is required to refine the models further to improve their predictive abilities, which includes the interpretation as well as technical details of the model's parameters.

References

» Clarke, D. C., & Skiba, P. F. (2013). Advances in physiology education, 37(2), 134-152
» Garcia-Ramos, A. et al. (2015). European journal of sport science, 15(2), 85-93
» Perl, J. & Pfeiffer, M. (2011). Int J Comp Sci Sport, 10 (2), 85-92
» Taha, T. & Thomas, S. G. (2003). Sports Medicine, 33(14), 1061-1073

[OP-SH15] Mental fatigue and recovery (08.07.2017, Start: 09:45, Lecture room: "L/South") Chair: Markus Raab

Monitoring sleep of the german junior rowing team during the world rowing junior championships following westward travel

Kölling, S., Kellmann, M.

Introduction

In elite sports, optimal sleep is crucial for recovery and readiness for upcoming events, while it is reported to be impaired before competitions (Erlacher et al., 2011). Transmeridian travel prior to international competitions might be associated with jet-lag and, thus, an impeding factor to performance (Kölling et al., 2016). There is a paucity of research among elite athletes regarding sleep during world championships as well as the effect of time-zone transitions preceding these events. This study aimed at monitoring sleep parameters of the German Junior National Rowing Team before and during the World Rowing Junior Championships (WRJC) in Rio de Janeiro, Brazil.

Methods

Seventeen members of the team (9 males, 17.6±0.7y, 184.5±11.3cm, 82.4±13.6kg) were monitored via actigraphy (SenseWear Armband™, Bodymedia, USA) during the training camp in Germany before travelling to Rio de Janeiro (GER, 3 nights) as well as before WRJC (3 nights, pre-WRJC) and during WRJC (3 nights). The journey took >24h and sleep was not monitored during the overnight flight (11h). The westward travel caused a time delay of 5h. To examine the change in sleep parameters, 3 nights of each episode were averaged and analysed via repeated measures ANOVA.

Results

During the flight, self-reported sleep was 0 to 520 min (M=252.9±162.3). Upon arrival in the morning, 9 rowers reported no sleep, while 5 slept 30 to 105 min. Pre-WRJC (21:37±0:24h) and during WRJC (21:32±0:24h), bedtime reduced compared to GER (22:31±0:14h, $p<.001$, $np^2=0.75$), while wake after sleep-onset (WASO) increased (pre-WRJC 73.5±50.0 vs. GER 49.8±38.3 & WRJC 64.8±46min, $p<.01$, $np^2=0.28$). Total sleep time (TST) increased pre- and during WRJC (397.0±65.8, 388.9±58.3 vs. GER 364.1±56.8min, $p<.05$, $np^2=0.22$). Sleep-onset latency (SOL) showed a reduced tendency pre-WRJC (7.5±6.6 vs. GER 18.5±17.8 & WRJC 12.2±9.2min, $p<.05$, $np^2=0.22$). Awakenings during WRJC slightly increased (14.0±4.4 vs. GER 11±3.3 & pre-WRJC 12.8±3times, $p<.05$, $np^2=0.2$).

Discussion

As hypothesized, early bedtimes, reduced SOL and increased WASO pre-WRJC indicate signs of jet-lag due to forced phase-delay, while extended TST suggests increased need for recovery and alleviate sleep debt. The schedule should offer sufficient time to adapt and recover from strenuous journeys and dissuade from late-night activities. More frequent awakenings during WRJC might indicate slightly disturbed sleep caused by the demands of the event. However, overall performance of the team was apparently not impaired as indicated by 11 of 13 top 3 placings.

References

» Erlacher, D., Ehrlenspiel, F., Adegbesan, O.A., El-Din, H.G. (2011). J Sports Sci, 29, 859-866

» Kölling, S., Ferrauti, A., Pfeiffer, M., Meyer, T., Kellmann, M. (2016). Dtsch Z Sportmed, 67, 35-38

Influence of match demands on recovery/stress states in elite youth football players

Pelka, M., Schneider, P., Kellmann, M.

Introduction

Intensive games, travelling, and short regeneration phases add to high physical and psychological pressures in football (Laux et al., 2015). Professional teams acknowledge this fact and focus on physiological recovery after competition. However, as recovery and stress are multidimensional processes (Kellmann, 2010), focus should be on mental and emotional states after competition as well. Changes in affective states and general well-being have already been described as being sensitive to weekly training manipulations (Gastin et al., 2013). The aim of this study was to examine whether matches affect physical, mental, and emotional states as well.

Methods

A total of 25 Under 19 (U19) football players (Mage: 17.5 ± .5 years, MBMI: 22.67 ± 1.57) of an U19 Junioren Bundesliga team participated over the entire 6-month assessment period. The players completed the Short Recovery and Stress Scale (SRSS, Kellmann et al., 2016) twice a week on Monday and Friday mornings between 7 and 9am. To allow for a sophisticated analysis, the team was divided in those who played more than 60 min in a match and those who played less than 60 min.

Results

Wilcoxon signed rank tests revealed significant main effects for changes from Monday to Friday ratings in players who played more than 60 min (group 1) and less than 60 min (group 2). However, different items were relevant for the two subgroups groups.

For example, group 1 was more stressed after matches, i.e., Muscular Stress (Z = -3.06, p = .002, r = -.88) and Overall Stress (Z = -3.06, p = .002, r = -.88). Taking group 2 into account yielded a different pattern. This group experienced a higher Negative Emotional State (Z = -2.35, p = .019, r = -.68) and Lack of Activation (Z = -2.71, p = .007, r = -.75) when comparing Mondays' and Fridays' recovery scores.

Conclusion

The present study examined the impact of matches on subjective ratings of physical, mental, and emotional recovery/stress states using the SRSS. Results revealed that matches affect those who played more than 60 min differently compared to those who played less than 60 min. This was the case not only for the physical recovery/stress rating but also for mental, emotional and overall self-reports. Therefore, to be holistic and potentially more effective, recovery after matches should adopt a multidimensional approach.

References

» Gastin, P.B., Meyer, D., Robinson, D. (2013). J Strength Condit Res, 27(9), 2518-2526
» Kellmann, M. (2010). Scan J Med Sci Sports, 20 (Suppl. 2), 95-102
» Kellmann, M., Kölling, S., Hitzschke, B. (2016). The Acute and the Short Recovery and Stress Scale for Sports - manual. Sportverlag Strauß, Hellenthal, Germany
» Laux, P., Krumm, B., Diers, M., Flor, H. (2015). J Sports Sci, 33(20), 2140-2148

The effect of recovery-stress imbalance on emotional exhaustion in German Coaches

Schaffran, P., Altfeld, S., Zepp, C., Kleinert, J., Kellmann, M.

Introduction

Coaches have to deal with a multifarious range of demands. For example, they have to cope with inconvenient work hours, high workload, traveling, short contracts, job insecurity, role conflicts, and media pressure (Olusoga et al., 2010). In this complex, dynamic, and turbulent environment, coaches have to manage their own physical and emotional state using self-regulation strategies and personal recovery to perform at their optimal level. A growing imbalance of coaches' stress and recovery could lead to emotional exhaustion (Raedeke, 2004), which is widely accepted as the key symptom of burnout. The aim of this study was twofold. First, to examine the prevalence of emotional exhaustion in German coaches. Second, to investigate the impact of recovery and stress on emotional exhaustion.

Methods

A total of 233 coaches (M = 37.3 years, s = 13.6 years, 72.5% male) of various sports and performance levels participated and responded to an online survey. Emotional exhaustion was measured using the coach-specific German adaptation of the Maslach Burnout Inventory (Maslach & Jackson, 1996), whereas recovery and stress were measured using the Recovery-Stress Questionnaire for Coaches (RESTQ-Coach; Kellmann, Kallus & Altfeld, 2016).

Results

The results showed mean scores of 1.38 (s = 0.79) for Emotional Exhaustion, suggesting low to medium levels of burnout.

However, according to the standard values of Maslach and Jackson (1996) 12.9% of the coaches can be categorized as highly emotionally exhausted. Multiple regression analysis demonstrated a significant impact of the RESTQ-Coach dimensions Overall Stress (ß = 0.29, $p < .001$), Overall Recovery (ß = -0.15, $p < .05$), and Coach-Specific Stress (ß = 0.31, $p < .001$) on Emotional Exhaustion.

Discussion

The results suggest, that every eighth German coach is affected by burnout. Moreover, monitoring the recovery-stress balance of sport coaches over the course of a competitive season could help identify coaches' burnout risk.

References

» Kellmann, M., Kallus, K.W., Altfeld, S. (2016). The Recovery-Stress Questionnaire for Coaches. In KW Kallus & M Kellmann (Eds.), The Recovery-Stress Questionnaires: User Manual (pp. 132-157). Frankfurt am Main: Pearson

» Maslach, C., Jackson, S.E., Leiter, M.P. (1996). Maslach Burnout Inventory Manual. Palo Alto, CA: Consulting Psychologist Press

» Olusoga, P., Butt, J., Maynard, I., Hays, K. (2010). Stress and coping: A study of world class coaches. Journal of Applied Sport Psychology, 22, 274-293

» Raedeke, T. (2004). Coach commitment and burnout: A one-year follow-up. Journal of Applied Sport Psychology, 16(4), 333–349

[OP-BN19] Muscle damage and foam rolling (08.07.2017, Start: 14:00, Lecture room: "Brüssel/West") Chair: Jan Cabri & Sebastien Racinais

Effects of foam rolling on muscle architecture, EMG-activity and submaximal isometric strength

Döweling, A., Gabler, N., Ferrauti, A.

Introduction

Foam-rolling (FR) and roller massage (RM) have become a common practice with warm-up or recovery from exercise. It is believed to promote soft-tissue extensibility, improve muscle function, and enhances blood flow. However, it is not known if RM directly alters muscle properties. Therefore, the aim of this study was to determine if RM has an immediate effect on muscular architecture and EMG-activity during an isometric endurance strength testing protocol.

Methods

In a randomized repeated-measures design (n = 14) the acute effects of a RM intervention on pennation angle and fascicle length of the vastus lateralis as well as EMG-activity of the vastus lateralis, vastus medialis, rectus femoris and biceps femoris during a sustained submaximal isometric knee extension at 60% MVIC until failure were investigated. Each participant completed two allocated tests (FR-Intervention/Control) which were separated by at least 48 hours. The RM-Intervention consisted of 3 x 90s bouts of rolling massage of the quadriceps femoris (7/10 numeric pain scale).

Results

A two-way repeated measures ANOVA revealed no statistically significant main effects or interactions (roller massage intervention x testing) regarding EMG-Activity, pennation angle, fascicle length or submaximal-isometric-test performance.

Discussion

This data suggests that a single bout of RM had no effect on EMG-activity or muscle architectural properties. Furthermore, submaximal isometric performance testing remained unaffected by RM. Based on the present research; RM may not predominately affect muscle architecture nor alter neuromuscular properties.

Mini-Oral Presentations

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[MO-PM02] Training and testing: endurance (06.07.2017, Start: 14:00, Lecture room: "Panorama/West") Chair: Anton Wagenmakers & Andrew Lane

Influence of training induced-fatigue on performance indicators in cyclists

Schwindling, S., Skorski, S., Pfeiffer, M., Ferrauti, A., Kellmann, M., Meyer, T.

Introduction

Performance testing can interfere with an athlete's training schedule by the necessity of complete recovery prior to the test. Due to a nature of elite athletes training regimes, it remains unsure whether complete recovery is ever achieved. Thus, target parameters, which are independent from recovery status of an athlete, appear attractive. Therefore, the aim of this study was to detect the influence of training-induced fatigue on established maximal and submaximal performance indicators determined.

Methods

23 trained cyclists (29 ± 8 y, 180 ± 6 cm, 74 ± 8 kg, VO2max 59.4 ± 7.4 ml/min/kg) completed a 6-day highly fatiguing training camp. Before, directly after the camp and after 2 days recovery (no exercise, no specific interventions) they performed a 40-km-time-trial (TT), a 30-second-Wingate-Sprint (WT) and a stepwise incremental test until exhaustion (IXT). The lactate thresholds (LT) were calculated according to the concepts of Stegmann et al. (1981), Dickhuth et al. (1991), Dmax (Cheng et al., 1992) and 4-mmol (Mader et al., 1976) on the basis of measurements during IXT. All tests were performed on the same day with 2 hours separating them. Statistical testing for significant effect on performance and strain parameters was conducted by means of a repeated measured ANOVAs and post hoc Scheffé testing.

Results

Overall TT performance (TT1: 3942 ± 212 s; TT2: 4008 ± 201 s; TT3: 3929 ± 219 s), WT mean power output (701 ± 58 W; 679 ± 65 W; 696 ± 69 W) and the maximal power output in IXT (338 ±30 W; 327 ± 31 W; 347 ± 30 W) were significantly reduced after the training camp ($p < 0.01$) and increased after 2 Days of recovery ($p < 0.01$). The entire course of lactate values from IXT was not different between test days ($p = 0.16$). No changes were found for LTDickhuth (268 ± 32 W; 265 ± 30 W; 270 ± 33 W; $p = 0.34$) and LT4-mmol (295 ± 34 W; 295 ± 31 W: 297 ± 33 W; $p = 0.69$). LTStegmann was significantly higher 2 days post (270 ± 28 W; $p = 0.03$) compared directly after the training camp (264 ± 30 W). Dmax was significantly reduced directly after the training camp (256 ± 27 W) compare with before (265 ± 29 W; $p < 0.01$) and after 2 days of recovery (269 ± 29 W; $p < 0.01$).

Discussion

The study indicates that there is no influence of accumulated fatigue over several days without glycogen depletion on the submaximal lactate thresholds according to Stegmann, Dickhuth and 4-mmol in cyclists. The Dmax-threshold however seems to be responsive to such short-term fatigue. This is in agreement with a negative fatigue effect on maximal physiological measurements, which are relevant for Dmax determination.

[MO-PM10] Training and testing: Basketball and rugby (07.07.2017, Start: 15:00, Lecture room: "Rheinland/South") Chair: Hans-Christer Holmberg

Monitoring a preseason preparation period in semi-professional basketball

Welsch, S., Schneider, C., von Fintel, J., Ferrauti, A.

Introduction

Due to the different possibilities of monitoring, we investigated a multidimensional monitoring of physiological and perceptual responses in combination with performance markers. The aim of the study was to examine the effect of preseason conditioning on different monitoring parameters as well as the inter-correlations between markers.

Methods

Preseason training mainly consisted of basketball-specific training (80%) with an average of six sessions/week (mean duration: 105 min) and highest training loads in week 3. Pre- and Post-preseason we assessed sport-specific endurance (VIFT) via 30-15 Intermittent Fitness Test, countermovement jump height (CMJ), 20 m sprint performance (20m), submaximal heart rate (HR) and perceived exertion during a 5-min submaximal shuttle-run in eight semi-professional basketball players (25.0±4.5 yrs, 196±7 cm, 97±13 kg, estimated VO2max: 53.0±1.7 ml/kg/min). Weekly monitoring consisted of perceived stress and recovery (SRSS) assessment, with four items each for physical, mental, emotional and overall stress and recovery [1], HR, RPE, CMJ (Wednesday), muscle soreness (DOMS) and serum concentration of creatine kinase (CK, Friday).

Pre-Post differences as well as within-subject correlations [2] between monitoring parameters were analysed using magnitude-based inferences (meaningful effects: d=0.2, r=0.1).

Results

VIFT and HR were clearly improved (VIFT: +1.3 km/h, d=+1.1, p=.019; HR: -16 bpm, d=-1.6, p=.000) at Post-testing while CMJ and 20m changes remained trivial. Weekly HR, CK and DOMS showed continuously decreasing values. SRSS response was highly individual and item-specific without showing clear global patterns. Medium to large within-subject correlations were found between CK & DOMS (r=.57), HR & DOMS (r=.80), CK & muscular stress (SRSS) (r=.46) and DOMS & muscular stress (r=.44).

Discussion

Pre-Post and weekly changes illustrate expectable adaptations, given the sport-specific emphasised training distribution with meaningful changes in endurance related markers, soreness and muscle damage. HR seemed to be largely influenced by muscle soreness, which might result in impaired running economy during the submaximal shuttle run. Response patterns in perceived stress and recovery were highly individual and may reflect temporary effects of training and possibly personal stressors. Furthermore, from a practical perspective DOMS may substitute time consuming and expensive CK assessment, based on their correlation. To further close the gap between monitoring and training prescription, future studies should focus on the development of multidimensional decision support systems.

References

» Hitzschke, B., Kölling, S., Ferrauti, A., Meyer, T., Pfeiffer, M., Kellmann, M. (2015). Z Sportpsychol, 22(4), 146-161
» Bland, J.M., Altman, D.G. (1994). BMJ, 308(6933), 896

Usefulness of a submaximal shuttle-run in weekly monitoring of semi-professional basketball players

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Introduction

Measuring heart rate at submaximal intensity (HRsubmax) is suggested to be of high value in monitoring training due to its time-saving implementation during warm-up [1]. Aim of the study was to evaluate whether HRsubmax monitoring is able to display changes in sport-specific endurance and perceived stress and recovery dynamics to inform about athlete's state during a seven-week preseason period.

Methods

Fourteen semi-professional basketball players (VO2peak 52.1 ± 2.67 ml/min/kg) were tested on a weekly basis during a seven-week preseason period. Sport-specific endurance (30-15 Intermittent Fitness Test) was conducted before (Pre) and after (Post) preseason. Recovery and stress (RS) state was assessed each Wednesday using the Short Recovery and Stress Scale for Sports (SRSS) at the beginning of each training sessions [2]. SRSS contains four different dimensions in both recovery and stress scale (physical, mental, emotional and overall recovery/stress). SRSS was followed by a 5-min shuttle-run (9, 10.5 and 12 km/h for 1, 1 and 3 min respectively) to asses HRsubmax (average of the last 30s). Data were analysed using magnitude-based inferences (correlation and reliability, [3]) and contingency tables (sensitivity, specificity and accuracy).