RESEARCH TO PRACTICE 2018
27-29 MARCH 2018
BRISBANE, QUEENSLAND

YOUNG INVESTIGATOR AWARD SPORTS SCIENCE FINALISTS

Tuesday, 27 March 2018
1:30pm – 3:00pm

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Pain-free vs pain-threshold rehabilitation following acute hamstring strain injury: A randomised controlled trial

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Introduction & Aims: Conventional guidelines recommend that hamstring strain injury (HSI) rehabilitation should only be performed & progressed in the complete absence of pain, despite lack of scientific comparison to alternative approaches. This study aimed to investigate whether performing & progressing rehabilitation up to a pain-threshold alters time from HSI to RTP clearance, hamstring muscle structure & function & re-injury compared to remaining pain-free.
Methods: Forty-three men with an acute HSI were randomly allocated to either a pain-free (n=22) or pain-threshold (n=21) rehabilitation group. All participants completed a fully supervised progressive rehabilitation protocol twice per week. Pain had to be rated 0 on a 0-10 scale during exercise in the pain-free group. Participants in the pain-threshold group were permitted to perform & progress rehabilitation if they rated pain ≤4 on a 0-10 scale during exercise. Biceps femoris long head fascicle length (FL), isometric (ISO) and eccentric (ECC) knee flexor strength were objectively monitored during rehabilitation. Days from HSI to RTP clearance & re-injuries in the following 6 months were reported.
Results: No clear difference was seen in the number of days from HSI to RTP clearance (*d*=-0.1, 95%CI=-0.8 to 0.5) between the pain-free (15±4) and pain-threshold (16±6) group. Large FL improvements were seen in the pain-free (*d*=2.7, 95%CI=2.5 to 2.9) & pain-threshold (*d*=2.1, 95%CI=1.9 to 2.3) group from initial assessment to RTP clearance. The pain-threshold group had greater ISO (*d*=0.6, 95%CI=0.4 to 0.8) & ECC (*d*=1.2, 95%CI=1.0 to 1.4) at RTP clearance compared to the pain-free group. In the 6 months following RTP clearance, two re-injuries occurred in the both the pain-free & pain-threshold group.
Conclusion: Allowing exercise to be performed and progressed up to a pain-threshold, results in greater knee flexor strength compared to conventional pain-free rehabilitation, in equivalent time from HSI to RTP clearance.

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What is the game style that has a 5000:1 team win the English Premier league (EPL)?

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Introduction & Aims: In the 2015/16 EPL season a 5000:1 team won the league. Soccer teams adopt playing strategies that result in observable and repeatable playing patterns referred to as a team's 'game style'. This study quantified game styles among EPL teams to determine the types of styles and the relationships to finishing position.
Methods: All 760 EPL games (20 teams x 38) were analysed. Raw data were provided by OptaPro sports analytics. 100 game-related variables were compared among teams, z-score transformed and coded into 5 discrete 'moments of play'. Moments were categorised as set pieces (SP), established offence (EO), transition to offence (TO), transition to defence (TD), and established defence (ED). The game-specific mean z-score for the five moments of play were used as k-means cluster analysis inputs. The relationship between game style clusters and finishing position was investigated using chi square.
Results: Three clusters were identified: (1) strong in EO and SP and characterised by team's finishing in higher positions (games n=249); (2) moderately favouring ED and prevalent among lower ranked teams (n=270); (3) dominated by TO and TD (n=241) and exclusively over-represented by the EPL champions.
Conclusion: Moments of play analysis show success is associated with dominance in TO and TD periods. These moments involve short but critical phases for asymmetries in player number, location and structure, and winning 50:50 contests. If transition moment style is less successful, control of EO and SP is demonstrated by higher ranked teams. Relegated team games clustered for poor performance in all moments except a moderate strength in ED illustrating the way better teams enforce their game style. Exploring other data sets for factors impacting game styles (match context, playing personnel) will broaden our understanding of game style.

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Environmental temperature deception does not alter perceived exertion during fixed-intensity cycling in the heat

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Aim: This study examined the impact of environmental temperature deception on perceived exertion (RPE) and physiological variables during 30 min of fixed-intensity cycling in the heat.
Methods: Eleven trained male cyclists ($\dot{V}O_{2max}$: 52.7 ± 6.1 mL·kg^{-1}·min^{-1}; peak power: 382 ± 66 W) completed a $\dot{V}O_{2max}$ test, and four experimental trials. Trials consisted of 30 min cycling at 50% $\dot{V}O_{2max}$, once in 24 °C (CON) and three times in the heat (33 °C). In the hot trials, participants were provided with accurate temperature feedback (HOT), or were deceived to believe the temperature was 28 °C (DEC_{LOW}) or 38 °C (DEC_{HIGH}). During cycling, RPE was recorded every 5 min. Rectal and skin temperature, heart rate and oxygen consumption were continuously measured. Neuromuscular function of the right knee extensors was examined pre- and post-cycling. Linear mixed model analysis in a Bayesian framework was used to determine significant differences. Magnitude based inferences were determined using Cohens *d*, and the probability that Cohens *d* exceeded the smallest worthwhile change (0.2) was also calculated.
Results: All participants reported they were unaware of the deception. RPE was higher in the heat compared to CON, but not statistically different between the hot conditions [mean (95% credible interval); DEC_{LOW}: 13.0 (11.9, 14.1); HOT: 13.0 (11.9, 14.1); DEC_{HIGH}: 13.1 (12.0, 14.2)]. Heart rate was significantly higher in DEC_{HIGH} [141 (132, 149) b·min^{-1}] compared to all other conditions [DEC_{LOW}: 138 (129, 146); HOT: 138 (129, 145) b·min^{-1}] after 10 min; however, this did not alter RPE. Rectal and skin temperature were not different between the hot conditions.
Conclusion: Participants were under the impression they were cycling in different environments; however, this did not affect RPE. Thermoregulatory variables were not different between the hot conditions, and therefore, these data might suggest that in this context, subconscious afferent feedback is the strongest modulator of RPE.

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Timing of post-exercise hot water immersion to maximise acute physiological responses for heat acclimation

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Introduction & Aims: Immediate post-exercise hot-water immersion (HWI) after training in temperate conditions can induce heat acclimation in athletes. The effect of interval length between running exercise and HWI administration on the magnitude (during HWI) of change between mean core temperatures relative to baseline values (MCTR) and other physiological and perceptual responses were determined.
Methods: With a cross-over design, nine male recreational runners completed three trials separated by 7-14 days. Each trial had the same 40-min treadmill run in a laboratory (18 deg.C, relative humidity 65%) and 30-min HWI (39 deg.C, room humidity 75%), but with three different time intervals between the run and HWI: 10-min (C0), 1-h (C1) and 8-h (C8). Core temperature, heart rate, sweat loss, thermal sensation, and thermal comfort were measured during the trials.
Results: Core temperatures and heart rates were similar across all exercise bouts. MCTR during HWI was lower in C1 (0.43±0.25 deg.C; effect size (ES) =1.30; very large effect) and similar in C8 (0.80±0.29 deg.C; ES=0.24), compared to C0 (0.86±0.25 deg.C). The total sweat loss during HWI was lower in C1 (0.44±0.27 L; ES=0.54) and higher in C8 (0.63±0.25 L; ES=0.16), compared to C0 (0.59±0.27 L). Mean heart rate was lower during both C1 (108.0±35.2 bpm; ES=0.97) and C8 (99.7±29.7 bpm; ES=1.26; both very large effects) compared to C0 (137.4±15.3 bpm). There were very small differences in thermal sensation or thermal comfort between trials.
Conclusion: Larger changes in mean core temperatures and sweat losses occurred when HWI was conducted 10 minutes, or 8 hours after training compared to one hour. Athletes may maximise core temperature and sweat responses (necessary for heat acclimation) by immersing directly, or 8 hours after training (in the afternoon) rather than waiting an hour after exercise, to initiate adaptations. Future research could examine the role of circadian rhythm on such physiological responses.

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Data mining with Performance Indicators in Australian Rules Football - Methodological Considerations

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Introduction & Aims: Sport scientists are increasingly using data mining methods to analyse sporting performance, but important methodological considerations in this context are underexplored. The aim of this study is to demonstrate and critically evaluate the application of common data mining techniques, with game style 'era identification' in Australian football serving as the use case.
Methods: Team performance indicators (PIs) from the 2001—2016 Australian Football League seasons were gathered from 3,145 matches. This consisted of 54 match aggregate raw team PIs and a further 49 relative and derived. Relative PIs represent a team's PI value compared to an opposition and derived PIs are those which were divided or summed together. To identify whether eras existed in the 16 years, changepoint and segmented regression analyses were used. These methods used a single 'universal PI' expressed as a z-score. Feature selection was applied to rank the importance of each PI by an averaged weight using four methods: correlation, gini index, information gain, and gain ratio.
Results: Changepoint and segmented regression analyses identified 2007 and 2010 as breakpoints, respectively. 2008 was selected as a compromise breakpoint, allowing for an equal number of years in each era, and in turn, balanced data sets. The feature selection process was then applied to each era separately. In the era 2009—2016, the most important PIs include; metres gained relative, time in possession relative, kicks relative, inside 50s relative and disposals relative.
Conclusion: Our results demonstrate that analysing a larger range of PIs can provide more insightful results from performance modelling. Typically, the relative form of PIs were more important than the absolute form. The relationships between PIs and match outcomes varied between the two eras. Our findings will be of particular interest to those employing data analytics in team invasion sports.

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Myogenic, atrophic, and inflammatory response in muscle to lower-limb hypertrophy focussed training and hot water immersion

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Introduction: Heat therapy improves recovery following muscle trauma in animal models and increases muscle growth and strength when used with low-intensity resistance training in humans. Furthermore, heat therapy (e.g. microwave diathermy) may induce these benefits by increasing the expression of genes and proteins associated with key hypertrophy regulatory pathways. Little research has evaluated the effects of hot water immersion (HWI) on these myogenic factors. The aim of the current study was to investigate whether HWI could enhance the myogenic response following resistance exercise.
Methods: Resistance trained participants (13 males, 3 females) completed one session of lower-body resistance exercise, followed by recovery; either 10 min of 45°C HWI (lower sternum depth) (n=7) or passive recovery (PAS) (n=9). Muscle biopsies were collected before exercise (Pre), and at 2, 24 and 48 hrs post recovery. Changes in protein and mRNA expressions were analysed by Western blotting and real-time polymerase chain reactions.
Results: There were no differences between PAS and HWI in the expression of proteins and genes associated with muscle growth (e.g. p70S6k, 4EBP1 and myogenin). PAS demonstrated significant time effects for genes associated with atrophy such as MuRF1 (increased at 48 hrs compared to Pre (p=0.008)), and atrogin-1 (decreased at 24 hrs (p=0.001) and 48 hrs (p=0.004) compared to Pre). But there were no group differences for these genes. Cytosolic expression of heat shock protein αB-crystallin (αB-C) decreased from Pre at 2 hrs after HWI (p=0.01), whilst cytoskeletal expression of αB-C increased from Pre at 2 hrs after PAS (p=0.012).
Conclusion: HWI did not improve the post-exercise myogenic response investigated in this study. As HWI covered a large body area compared to other heat therapies (specifically up to the lower sternum in this study), this may have exacerbated the stress response, in turn suppressing the hypertrophic response.