BOOK OF ABSTRACTS Open Access

Low Cadence, High Resistance Creates More Muscle Breakdown than High Cadence, Low Resistance in Well Trained Cyclists during High Intensity Interval Training

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Abstract

Purpose: Research by Laursen (2005:Journal of Strength and Conditioning Research, 19, 527-533) demonstrated the positive effects of High Intensity Interval Training on cycling performance concluding that peripheral (muscular) adaptations were the likely cause of increase in performance. Research also shows the relationship between cadence and gross efficiency in cycling (Ansley, 2009: European Journal of Sport Science, 9, 61-85) however there is no research to determine whether a cadence that has been deemed 'efficient' (least metabolic cost) produces an optimal training stimulus (measured as the breakdown of muscle). This research sought to provide cyclists and coaches insight into how they can manipulate cadence during HIIT to obtain a desired acute training response.

Methods: 7 well trained cyclists who compete at least 10 times per year and can sustain at least 4.0 watts per kilogram at maximal aerobic power underwent a high intensity interval training (HIIT) protocol where they maintained 125% Functional Threshold Power (381 ± 56 W) for 40 seconds followed by 20 seconds recovery in a set of 10 repetitions. The participants repeated the test at 3 different cadences, 70, 90 and 110 revolutions per minute (RPM) with at least a 24 hour gap between tests. Before each test, creatine kinase (CK) levels were measured at baseline and immediately at the end of the test. Participants were asked to grade each workout on the pain they felt in their legs on a visual analogue scale (VAS) as well as score a representative perceived effort (RPE) score to represent their overall feeling of effort on every second interval.

Results: Significant difference ($p = 0.038$) in creatine kinase measurements before and after all the HIIT protocols. The paired T-tests reveal that the difference lies between the 70 and 90RPM protocols ($p=.040$) with the mean (+48.85) indicating that 70RPM produced the greatest increase in CK levels. There were no significant differences in RPE between the different cadences at any point during the tests: 2 minutes ($p=.956$), 4 minutes ($p=.878$), 6 minutes ($p=.304$), 8 minutes ($p=.199$) and 10 minutes ($p=.140$). There were no significant differences between protocols in relation to VAS scores: 2 minutes ($p=.325$), 4 minutes ($p=. 247$), 6 minutes ($p=.382$), 8 minutes ($p=.326$) and 10 minutes ($p=.304$) suggesting that the participants did not deem any particular cadence to provide a greater sensation of workload.

Conclusion: A study by Formenti et al (2015: Physiological Reports, 3, 1-10) considered the validity of the American College of Sports Medicine recommended equation for calculating work rate (power) on a cycle ergometer in relation to cadence. The study presented the notion that given a 6 metre distance per pedal revolution, whether an individual pedals at a resistance of about 53 N (product of resistance) and cadence of 30 RPM, or at a resistance of about 13 N and cadence of 120 RPM, the equation would present exactly the same work rate of 160 W, whereas the two physiological responses to exercise would be very different. This research has found there to be an advantage to conducting HIIT at a lower cadence with an increased resistance at 125% of FTP in order to provide greater muscle breakdown in well trained cyclists. This concurs with Ansley et al (2009) who established there to be a difference in gross efficiency when cycling at different cadences in relation to muscular stress, energetic cost and perceived effort however unlike Ansley et al this research found no difference in perceived exertion between the cadences. Although this research has not taken any measurements of energetic/metabolic cost of different cadences, existing research studies (Brisswater, 2000: International Journal of Sports Medicine, 21, 60-64) have been presented within this area and demonstrate a higher metabolic cost to cycling at a higher cadence.

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