

Potential of sprint cycling performance: the effects of a high-inertia ergometer warm-up

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Abstract

Background: Individual response to acute post-activation potentiation (PAP) stimulation is affected by factors such as the conditioning protocol design, training status, and biomechanical similarity of the conditioning activity to the goal movement. **Purpose:** This study tested the effect of a biomechanically comparable PAP conditioning activity on various aspects of standing start sprint cycling performance. Optimal conditions for observing PAP were provided by utilising highly-trained sprint cycling-athletes and a commonly successful protocol executed on a specially built high-inertia cycle ergometer.

Methods: Employing a randomized, counterbalanced, cross-over design with repeated measures, four male and two female national and international competitive sprint cyclists (19.2 ± 3.2; mean ± s yrs; height 175.2 ± 7.0 cm; body mass 75.5 ± 9.8 kg; training years (sprint cycling) 4.0 ± 1.5 years; training years (strength) 3.5 ± 1.2 years; peak isometric pedal torque 255.9 ± 37.8 Nm) executed multiple sets of short maximal conditioning contractions (CC) on a custom-built high-inertia ergometer prior to metered sprint performance. Three trial conditions were completed on three separate days: a standardised warm-up followed by either dynamic (DYN: 4 x 4 complete crank cycles), or isometric (ISO: 4 x 5-second MVC) CC, or a control condition (CON) with active rest for the total equivalent time post-warm-up. Performance was assessed in a short (~6 seconds) maximal acceleration from standing start to maximum velocity on an inertial-load ergometer at baseline (Pre), 4 (Post4), 8 (Post8) and 16 (Post16) minutes following the CC protocol. Torque-cadence and power-cadence relationships were derived from crank data. Performance time, and peak and average biomechanical measures were assessed over four discrete sprint segments. Outcomes were assessed using 2-way repeated measures ANOVA and magnitude-based inferences.

Results: Only in DYN Post4 was performance time improved, affecting a 3.9 ± 3.7% (92% likelihood of exceeding smallest worthwhile change (SWC)) decrease in time over the first segment of the sprint. Biomechanical improvements in this trial were predominantly on the ascending limb of the power-cadence relationship, increasing peak torque by 6.2 ± 5.9% (94% SWC) and increasing average power during initial acceleration by 4.0 ± 6.5% (87% SWC). Conversely, ISO Post16 enhanced performance over the descending limb of the power-cadence relationship, affecting an increase in optimal cadence (82% SWC) and augmenting average power (76% SWC) during the maximal velocity phase of the sprint.

Discussion: The dynamic and isometric trials contrasted in potentiating opposite extremities of the torque-cadence relation at distinct recovery-times post-CC. Results suggest the predominance of different PAP mechanisms in each trial condition.

Conclusion: This study provisionally suggests merit in including a high-inertial component in the sprint warm-up. Performance improvements may include improved starting acceleration or finishing speed, where compromise in gear and pedal length selection strategies would, otherwise, impose limitations on performance.

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