

## How post-activation performance enhancements affect semi-tethered swimming kinetics

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**Introduction:** When an action induces acute fatigue, it may be followed by a period of potentiated force production capability, termed as Post-activation Potentiation (PAP). One of the training philosophy principles PAP is based on is *complex training*, which consists on providing a resistive conditioning exercise as similar as possible to the real action before performing a sport-specific activity involving similar muscle groups. Nevertheless, a key criticism of inducing PAP in swimming is that the conditioning exercises applied in dry-land conditions may reduce the stimulus intensity or effectiveness. This study aimed to test if muscular performance might be elevated in semi-tethered swimming test by using a specific dry-land resistance warm-up simulating the arm-stroke pull of swimming. **Methods:** Ten competitive swimmers conducted an incremental semi-tethered swimming test on a Smith Machine adapted through a pulley system. Six minutes of rest were given between every maximal swimming effort (to 15m). Kinetic variables were obtained through a linear encoder connected to the Smith Machine's bar, which allowed to individually identifying the related results according to the load that maximized maximal power output. On a different day, a trial with the same aforementioned load was performed after the experimental warm-up (3 arm-stroke repetitions at 85% 1RM). Statistical differences between the variables were determined using a repeated measures 1-way ANOVA. **Results:** The values were better when obtained during incremental testing, rather than obtained after PAP; the Intracyc Acceleration Variation delivered to the load was lower after PAP warm-up ( $p = 0.012$ ;  $6.08 \pm 1.32$  vs  $4.68 \pm 1.25$  m/s<sup>2</sup>), mainly because the Force and Impulse applied per stroke were lower ( $p = 0.013$ ; -20.71%;  $p = 0.002$ ; -21.72%, respectively). Swimming Velocity ( $p = 0.001$ ;  $1.20 \pm 0.14$  vs  $0.99 \pm 0.15$  m/s) and Swimming Power ( $p = 0.002$ ;  $51.35 \pm 15.43$  vs.  $42.33 \pm 13.03$  W) were lower after PAP and kinematic variables were also negatively affected. **Conclusion:** A dry-land warm-up may not be an efficient approach to stimulate performance skills on swimming. Possibly an attenuation effect is obtained on muscle fibers from a high-resistance isokinetic exercise performed at low speed. Nevertheless, is worthy of review that maximal swimming power output was achieved at 56% of the maximal load. It meant that at least 1 to 3 efforts were performed by every subject prior the execution of the selected trial. As fatigue impairs performance, more fatigue accumulation was expected to occur during that trial in comparison to the only trial performed after PAP; however it did not happen. Possibly, the combination of specific in-water resistance exercise and the time of rest given between trials constituted an effective way to get recovered from fatigue while potentiation still existed. Future studies should consider if

swimmers may benefit of semi-tethered low loaded swimming as a way to induce PAP.  
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