

WHAT ARE THE EFFECTS OF POST ACTIVATION POTENTIATION ON LOWER LIMB STRENGTH AND POWER IN WELL TRAINED INDIVIDUALS?

INRODUCTION

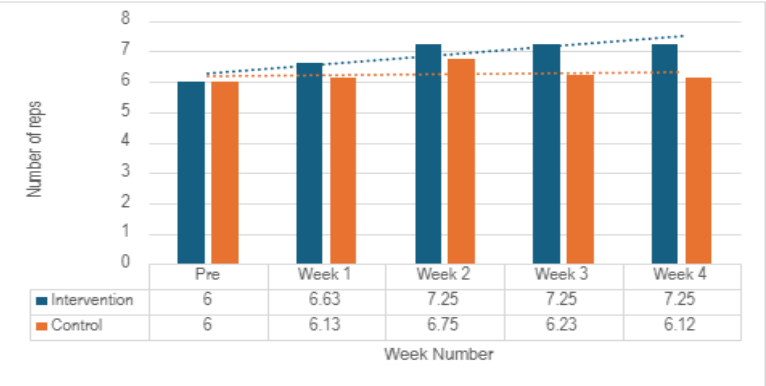
Post Activation Potentiation (PAP) refers to a short-term enhancement in muscular performance following high-intensity exercises. It is frequently used by strength coaches and therapists to boost power output, particularly during warm-ups or late-stage rehabilitation (Prieske *et al.*, 2020; Lorenz, 2011). PAP works by increasing myosin light chain phosphorylation in type II muscle fibers, enhancing cross-bridge cycling and force production (Blazevich & Babault, 2019; Xenofondos *et al.*, 2010). While some research supports a neural role (Wallace *et al.*, 2019), others refute this (Bergmann *et al.*, 2013). Its effectiveness depends on rest intervals, fatigue, and training status—trained athletes typically benefit more than novices, who may experience decreased performance (Kilduff *et al.*, 2007; Masel & Maciejczyk, 2023). PAP may also enhance long-term training outcomes by increasing total work output (Alves *et al.*, 2021). Used across sports such as rugby, football, cycling, and basketball, PAP can improve sprint and jump performance (Altieri *et al.*, 2021; Tobin & Delahunt, 2014), though findings are mixed (Lim *et al.*, 2013; Iacono *et al.*, 2016). This study investigates both acute and short-term (four-week) adaptations to PAP in well-trained individuals.

AIMS AND METHODS

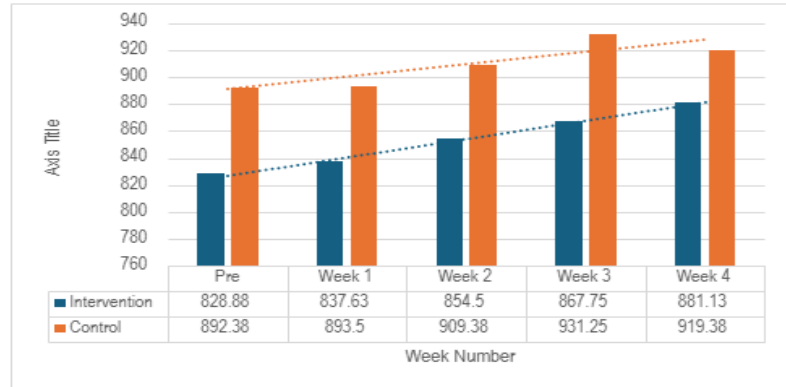
This study investigates the acute and four-week effects of PAP on lower limb performance. Specifically, it examines whether vertical jumps (VJ) enhance leg press performance and 6-second peak power output on a Wattbike. It hypothesizes that PAP significantly improves strength and power, particularly in well-trained individuals. Sixteen male participants (age: 28 ± 8 years) with at least two years of resistance training experience were divided equally into control and experimental groups. Participants were athletes from rugby, triathlon, and endurance sports. After screening and familiarisation, testing protocols included PAP via VJ followed by leg press at 85% 1RM and a 6-second Wattbike sprint. All sessions followed strict warm-up, dietary, and rest guidelines. Standardised instructions and rest intervals controlled for variability, and performance metrics were compared to baseline to assess PAP effectiveness in both short-term and extended interventions.

RESULTS

A paired sample t-test revealed a significant improvement in strength within the PAP intervention group, with repetitions increasing from 6.00 to 7.25 ($p=0.002$, $d=1.77$), indicating a strong effect. The control group showed no significant change ($p=0.685$). An independent t-test confirmed a significant difference between groups post-intervention ($p=0.011$, $d=1.45$), supporting the effectiveness of PAP in enhancing lower limb strength.



The intervention group showed a significant increase in power output from 837.63 W to 881.13 W ($p=0.020$, $d=0.51$), indicating moderate effectiveness of the PAP protocol. The control group also improved from 892.38 W to 919.38 W ($p=0.032$), but with a small negative effect size ($d=-0.56$), suggesting limited impact. Despite both groups improving, no significant difference was found between them post-intervention ($p=0.134$, $d=0.16$), and baseline power levels were also similar ($p=0.081$).



DISCUSSION

This study found that PAP significantly improved lower limb strength, with a large effect size supporting its effectiveness for trained individuals. The intervention group performed more repetitions at 85% 1RM post-PAP, aligning with literature suggesting enhanced neuromuscular efficiency through mechanisms like increased myosin light chain phosphorylation. While power output also improved significantly in the intervention group, there was no significant difference between groups, indicating that short-term PAP may not be sufficient for enhancing explosive power performance. Power development appears more variable and may require longer interventions, alternative conditioning activities (CAs), or exercise types (e.g., plyometrics or ballistic movements). Findings suggest that PAP benefits are task-specific, particularly for force-dominant actions, while high-velocity movements may need more specialised programming. The study reinforces PAP's use in strength training for athletes and rehabilitators but highlights the need for tailored protocols considering individual factors like training background and rest intervals. Limitations include a small sample size, short duration, and uncontrolled variables (e.g., sleep, hydration), which may have influenced results. Future research should explore extended PAP protocols, different CAs, and larger, diverse populations to optimise strength and power outcomes. Additionally, the study recommends investigating PAP's potential in musculoskeletal rehabilitation. Given its neuromuscular benefits, PAP may help improve strength, proprioception, and motor control in clinical settings, especially in chronic rehab stages such as ACL recovery or tendinopathies. Research should assess exercise selection, rest timing, and safety for effective clinical application.

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