

# Vertical and horizontal ground reaction force post-activation potentiation following flywheel eccentric overload half squat exercise

Stuart McErlain-Naylor and Marco Beato

University of Suffolk, Ipswich, United Kingdom  
s.mcerlain-naylor@uos.ac.uk  
@biomechstu

The utility of flywheel devices and eccentric overload protocols for inducing post-activation potentiation (PAP) is only recently beginning to be understood. The aim of the study was to determine PAP effects on vertical and horizontal ground reaction force parameters following flywheel eccentric overload half squat exercise with both medium (M-EOL) and high (H-EOL) flywheel inertia. Eleven healthy males (age:  $22 \pm 2$  years; mass:  $82.6 \pm 12.5$  kg) participated in this investigation. A within-participants randomised controlled crossover design was utilised. Participants performed a countermovement jump (CMJ), standing broad jump (SBJ), and 180° change of direction (COD) test in a control condition and six minutes following three sets of six repetitions of M-EOL ( $0.0291 \text{ kg}\cdot\text{m}^2$ ) or H-EOL ( $0.0611 \text{ kg}\cdot\text{m}^2$ ) flywheel half squats. A fully Bayesian inferential statistical approach was used in this study. After 6 min of passive recovery, a meaningful improvement was found in CMJ peak vertical force following H-EOL (Bayes factor  $[\text{BF}_{10}] = 33.5$ ; *very strong*; Effect Size  $[\text{ES}] = 1.656$ ; credible interval  $[\text{CI}]$ : 0.666, 2.695) and CMJ peak vertical power following M-EOL ( $\text{BF}_{10} = 3.65$ ; *moderate*;  $\text{ES} = 0.932$ ;  $\text{CI}$ : 0.110, 1.877), as well as an overall improvement in CMJ peak vertical rate of force development ( $\text{BF}_{10} = 4.35$ ; *moderate*). No meaningful effects in favour of  $H_1$  were reported for any within SBJ resultant kinetic parameters or COD horizontal kinetic parameters ( $0.247 \leq \text{BF}_{10} \leq 0.712$ ) or any between (inertia:  $0.223 \leq \text{BF}_{10} \leq 0.569$ ) or interaction (time x inertia:  $0.100 \leq \text{BF}_{10} \leq 0.883$ ) effects. This study for the first time reports that H-EOL and M-EOL can enhance vertical ground reaction force parameters during the CMJ, but not resultant or horizontal parameters during the SBJ or COD. However, the two EOL exercises showed no between inertia differences in PAP response, so should be considered equivalently effective. Researchers and practitioners should therefore consider the directional nature of the required acute kinetic PAP response in order to make evidence-based decisions regarding the programming of PAP-based training or competition interventions.