

# **ASSESSING THE PHENOMENON OF POSTACTIVATION PERFORMANCE ENHANCEMENT IN THE CONTEXT OF SELECTED INDICATORS OF LOWER LIMB MUSCLE POWER PRODUCTION**

The aim of this dissertation was to comprehensively investigate the phenomenon of Post-Activation Performance Enhancement (PAPE) in relation to selected muscle power parameters of the lower limbs in various sports contexts. A series of three studies was conducted, incorporating both experimental methodology and a systematic analysis of existing scientific literature with meta-analysis. The first study involved a systematic review and meta-analysis of 19 studies involving 286 combat sports athletes to evaluate the overall effect of PAPE. The research method consisted of a systematic literature review with meta-analysis conducted in accordance with PRISMA guidelines. The primary hypothesis posited that PAPE protocols in combat sports significantly enhance explosive capabilities (e.g., jump height, punch power), with greater effects in speed-strength disciplines and dependent on protocol specifics. The results demonstrated a moderate but significant positive effect of activation protocols on athletes' explosive capabilities, with intervention effectiveness strongly dependent on the protocol's specifics and the sport discipline. These findings suggest the need for standardization of PAPE protocols to optimize their effectiveness in combat sports.

The second experimental study analyzed the impact of a unilateral isometric "overcoming" exercise (involving maximal force development against an immovable resistance) on power production parameters related to single-leg drop jump in volleyball players of varying skill levels. The study was a randomized, double-blind crossover experiment. Twenty healthy male volleyball players were recruited—10 elite and 10 amateur. The main hypothesis assumed that the isometric activation exercise would significantly improve jump parameters in the activated limb compared to a no-stimulus condition, with the effect being localized, i.e., no significant improvement (and potentially deterioration) in the contralateral non-activated limb. A clear localized effect was observed—elite players exhibited significant increases in jump height and reactive strength index in the activated limb, while the effect in amateurs was minimal or insignificant.

The third comparative study evaluated the effectiveness of an isometric warm-up based on the PAPE protocol compared to a traditional aerobic warm-up on a treadmill in team sports athletes. The experiment compared the impact of an isometric warm-up based on PAPE (high-intensity exercises with 5-second maximal tension) with a traditional

aerobic warm-up (jogging) on jump height in 24 team sports athletes. It was hypothesized that the high-intensity isometric warm-up based on PAPE would enhance jump height more than the traditional aerobic warm-up in team sports athletes. The results showed no significant differences in jump height improvement, suggesting that a traditional warm-up may often be sufficient for optimizing pre-exercise arousal in team sports.

The results of the entire research cycle indicate that the PAPE effect, while promising, depends on multiple factors, including the type of exercise, stimulus intensity, rest duration, and athletes' training level. These findings have significant practical implications for coaches, who can tailor pre-exercise protocols to the specifics of a given sport. Concurrently, the study highlights limitations in current research methods and the need for further studies on standardizing activation protocols and exploring mechanisms to maximize PAPE benefits.

**Keywords:** *post-activation enhancement, combat sports, team sports, meta-analysis, single-leg jump, isometric warm-up, neuromuscular performance.*