

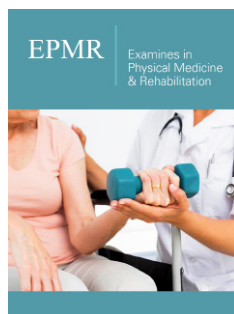
The Use of PAPE to Enhance Sports Performance

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Introduction

In the last years the Post-Activation Performance Enhancement (PAPE) has gained attention in the scientific community. Basically, the PAPE refers to the temporary improvement in muscle performance following a conditioning activity, usually involving a high-intensity or maximal contraction. The phenomenon is often utilized in sports training to enhance strength, power and speed during subsequent activities (e.g., weight throw; Olympic weightlifting). PAPE differs from Post-Activation Potentiation (PAP) in that PAPE is more related on performance improvements over a longer period (several minutes) rather than immediate neural excitability changes [1]. The mechanism of PAPE is based basically in three principles:

- i) Increased muscle temperature that means conditioning exercises increase muscle temperature, leading to enhanced metabolic reactions, increased muscle fiber conduction velocity, and improved force output;
- ii) Increased muscle and tendon stiffness that is explained by the contractile elements within the muscle turns more efficient by better force transmission, improving power output;
- iii) Enhanced muscle activation and calcium sensitivity that means heavy contractions increase the sensitivity of muscle fibers to calcium, leading to greater force production in subsequent movements (myosin light chain phosphorylation) [2-4].

Earlier, the time window for PAPE was described and it showed to be dependent of innumerable factors such as athletes' training level, type of conditioning exercise, intensity exercise, rest intervals, etc., [5]. The peak PAPE effects typically last between 3 to 10 minutes after the conditioning activity [6,7]. In some cases, the benefits of PAPE may endure up to 12 minutes, especially in well trained athletes [8]. More recently, Kasicki et al. [9] described in their systematic review study the only short term positive effects of PAPE. Other recent study, a systematic review and meta-analysis) showed improvement of PAPE lasting 8-12 minutes when the condition activity was heavy ($\geq 80\%$ one repetition maximum) for ballistic upper movement, and 3 minutes when the weight was implemented in weight throw before the competition (by $\sim 1.7-8.5\%$) [10]. These studies rely on the importance of use high-intensity condition activity to generate longer PAPE. Overall, the studies relating to understand the intensity of the condition activity to generate PAPE demonstrate that intensity from 60-87% one repetition maximum (bench press) and 85-90% (back squat) may generate PAPE in selective sports such as rugby, artial marts, sprinters, soccer, basketball, track and field athletics [11-16].

Although the research about PAPE has been explored in different condition activities and individuals, the exactly mechanisms of the potentiation remain unclear and the individualized approaches in the application of PAPE. Moreover, while PAPE shows promise in enhancing performance across various sports, its effectiveness may be inconsistent, necessitating tailored approaches for individual athletes and specific sports contexts. A proper balance between fatigue and potentiation is crucial for optimal results. Here, is proposed the term for PAPE, "What does not fatigue tends to become more potentiated".

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