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ORIGINAL ARTICLE

# Effect of the electrostimulation during the tapering period compared to the exponential taper on anaerobic performances and rating of perceived exertion



*Effet de l'électrostimulation lors de l'affûtage et de l'affûtage par exponentiel sur les performances anaérobies et l'échelle de perception de l'effort*

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## KEYWORDS

Muscle strength;  
Taper;  
Electrical stimulation;  
Vertical jump;  
Rating of perceived exertion

## Summary

**Objective.** – The purpose of the present study was to assess the effect of exponential taper and electrostimulation training during two weeks of tapering on anaerobic performances after resistance training program.

**Methods.** – Twenty-eight healthy male (age:  $17.7 \pm 0.8$  years; height:  $187.1 \pm 3.9$  cm; weight:  $76.7 \pm 6.6$  kg, and body mass index:  $21.9 \pm 1.6$  kg·m<sup>-2</sup>) were divided into three groups: control group, exponential taper group and electrostimulation taper group. During resistance period, all groups followed the same training program during 5 weeks (3 sets  $\times$  10 repetitions with 2 min of rest; intensity = 10 repetition maximum). At the taper period, control group continued with the same program. In contrast, both exponential groups had a diminution of training volume.

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**MOTS CLÉS**

Renforcement musculaire ;  
Affûtage ;  
Électrostimulation ;  
Détente verticale ;  
Échelle de perception

Participants were tested in three periods (i.e., before and after the resistance training and after the tapering phase) for the determination of maximum repetition, squat jump and countermovement jump. Subjects answered to questionnaire of rating of perceived exertion after every training session.

**Results.** – Resistance training showed a significant improvement of muscle strength and power in the three groups. However, in response to tapering phase, vertical jump performances and maximum repetition increased significantly only in both tapering groups. No significant difference was showed between exponential taper group and electrostimulation taper group after two weeks of taper.

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**Résumé**

**Objectif.** – Étudier l'effet de la stimulation électrique pendant deux semaines d'affûtage sur les performances anaérobies en comparaison avec l'affûtage de type exponentiel chez des jeunes sportifs.

**Méthodes.** – Vingt-huit hommes sains (âge :  $17,7 \pm 0,8$  ans ; taille :  $187,1 \pm 3,9$  cm ; poids :  $76,7 \pm 6,6$  kg et indice de masse corporelle :  $21,9 \pm 1,6$  kg·m<sup>-2</sup>) ont été répartis de façon aléatoire en trois groupes : groupe témoin, groupe d'affûtage exponentiel et un groupe d'affûtage avec électrostimulation. Lors de la première période d'entraînement, les trois groupes ont suivi le même programme durant cinq semaines (3 sets  $\times$  10 répétitions séparées de 2 minutes ; intensité = 10 répétitions maximales). Pendant la période d'affûtage, seul le groupe témoin a poursuivi le même programme d'entraînement. Cependant, les deux groupes expérimentaux ont subi une diminution du volume d'entraînement. Le groupe d'électrostimulation a subi en plus une stimulation électrique à une fréquence de 80 Hz. Un questionnaire de perception d'effort a été rempli par les sujets après chaque séance d'entraînement. Les participants ont réalisé trois tests d'évaluation (i.e., avant et après l'entraînement de force et après la phase d'affûtage) afin de déterminer la répétition maximale lors de l'exercice de demi-squat et la détente verticale (i.e. *squat jump* et *countermovement jump*).

**Résultats.** – L'entraînement de renforcement musculaire a induit une augmentation significative de la force et la puissance musculaires chez les trois groupes. Par contre, suite à la période d'affûtage, les performances en *squat jump*, *countermovement jump* et répétition maximale ont été améliorées seulement dans les deux groupes expérimentaux. Aucune différence significative a été observée entre le groupe d'affûtage exponentiel et le groupe d'affûtage avec électrostimulation, après la phase d'affûtage.

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**1. Introduction**

Coaches and athletes are always looking to develop their training program in order to achieve the optimal performance at the right time of the season, especially during competitions [1]. In this context, recent studies have observed improvements in athletic performance in response to reducing training volume during the previous competition days [2,3]. This period is referred to as tapering. In fact, taper has been defined as reduction in training load in order to reduce fatigue accumulated issue to the succession of high intensity training sessions [4–6]. Significant improvements have been reported after tapering in swimmers, cyclists, rowers and triathletes [2,3,7]. Moreover, Izquierdo et al. [8] and Chtourou et al. [5] have shown that taper actuate to increase maximal strength and muscle power after resistance training program.

According to Mujika and Padilla [9], there were four types of taper patterns; linear taper, exponential taper with slow or fast decay, and step taper. In a meta-analysis of the literature, Bosquet et al. [4] reported that higher performance

improvements were observed after a progressive taper compared to the step taper. Likewise, the exponential taper with fast decay is the greatest tapering strategy for the improvement of athletic performance comparatively to the step taper (4% vs 1.2%, respectively) [10]. Similar results were found by Banister et al. [11]. Authors showed a greater improvement in performance after the fast decay exponential taper compared to the slow decay exponential taper (6.3% vs 2.4%, respectively). Following several studies that looked at the duration of the taper, we can conclude that the best tapering strategy is using 41–60% of reduction in the training volume using exponential taper type for 2 weeks without changing or with slight improvement of the training intensity [4].

In the other hand, there are many other training methods leaded to performances improvement [12–14]. Among these methods we cited the electrical stimulation (ES) training. In fact, the ES is an old method of building muscle results in a recruitment of different motor units compared to voluntary contraction [15]. Babault et al. [16] showed that isolated ES training on quadriceps femoris, gluteus maximus and triceps

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