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ORIGINAL ARTICLE

Light-emitting diodes (LED) therapy applied between two running time trials has a moderate effect on attenuating delayed onset muscle soreness but does not change recovery markers and running performance

La thérapie par diode électroluminescentes (DEL) appliquée entre deux essais chronométrés en course à pied a un effect modéré sur l'atténuation des douleurs musculaires différées sans changer les marqueurs de la récupération et de la performance

F.A. Machado*, C.S. Peserico, P.V. Mezzaroba, F.A. Manoel, D.F. da Silva

Department of Physical Education, State University of Maringa, Maringa, Av. Colombo, 5790, 87.020-900 Maringá, PR, Brazil

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Summary
Purpose. — The study aimed to examine the recovery/performance effects of LED therapy applied between two running time trials on blood lactate, creatine kinase (CK), delayed onset muscle soreness (DOMS) and heart rate variability (HRV) in physically active participants.
Methods. — Eleven healthy and young males (26.7 ± 4.8 years) volunteered to participate. Visits in the laboratory were divided into two phases (i.e., two different weeks with four visits each) using the same exercise protocols, but differing randomly in recovering intervention conditions: placebo (PLA) or LED therapy (LED). The minimal and maximal duration for each phase was one and two weeks. On the first day of each phase, the participants performed two (test 1 and test 2) time trials of 40-minute duration with six hours of interval separating the trials.

* Corresponding author.
E-mail addresses: famachado@uem.br, famachado_uem@hotmail.com (F.A. Machado).

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Blood lactate, CK, DOMS, HRV were used as recovery measurements. Variables were compared using two-factor ANOVA for repeated measures followed by the Bonferroni post-hoc test for multiple comparisons. Cohen's effect size (ES) was used to estimate the magnitude of the difference.

Results. — We found that LED therapy had a moderate ES on decreasing how much DOMS increased before test 2, despite no significant effect of LED therapy on CK, lactate concentrations, DOMS and parasympathetic activity (i.e., HRV). No influences were observed in endurance running performance (i.e., mean velocity in the 40-minute time trial). Results suggest LED therapy applied between two running time trials has a moderate effect on attenuating delayed onset muscle soreness but does not change recovery markers and running performance.

MOTS CLÉS
Course d'endurance ;
Récupération après l'exercice ;
Performance ;
Thérapie

Résumé

Objectif. — Cette étude visait à évaluer les effets sur la récupération et la performance de la thérapie par diode électroluminescentes (DEL) appliquée entre deux essais chronométrés en course à pied sur lactatémie sanguine, la créatine kinase (CK), les douleurs musculaires différées (DOMS) et la variabilité de la fréquence cardiaque (HRV) chez des participants physiquement actifs.

Méthodes. — Onze jeunes hommes (26,7 ± 4,8 ans) apparemment en santé se sont portés volontaires. Les visites au laboratoire ont été réparties en deux phases en utilisant les mêmes protocoles, mais en alternant les conditions de récupération : placebo (PLA) ou thérapie DEL (DEL). La durée entre chaque phase variait d'une à deux semaines. Durant la première journée de chaque phase, les participants ont effectué deux essais chronométrés d'une durée de 40 minutes (tests 1 et test 2) avec une pause de six heures entre les essais. La lactatémie sanguine, CK, DOMS et la HRV ont été utilisés comme indicateurs de la récupération. Ces variables ont été comparées avec une ANOVA à mesures répétées suivie du test post-hoc de Bonferroni. La taille d'effet a été évaluée avec le *d* de Cohen.

Résultats. — Nous avons observé une diminution des DOMS avant le test 2 avec une moyenne taille d'effet, malgré l'absence d'impacts sur la CK, la lactatémie et l'activité parasympathique (c.-à-d. la variabilité de la fréquence cardiaque). Aucun effet n'a été observé sur la performance en course à pied (c.-à-d. la vitesse moyenne durant l'essai chronométré de 40 minutes). Les résultats suggèrent que la thérapie DEL appliquée entre deux essais chronométrés en course à pied a un effet modéré sur l'atténuation des douleurs musculaires différées mais ne modifie pas les marqueurs de la récupération et de la performance.

1. Introduction

Muscle damage can be induced by different exercise and sports training regimens, such as high-intensity intermittent, prolonged and continuous, or eccentrically-biased (e.g., plyometrics) efforts. Damage can be manifested by reduction of muscle function, inflammation, elevated serum levels of biochemical markers of muscle damage (creatine kinase, lactate dehydrogenase, myoglobin), oxidative stress and muscle soreness [1,2]. Blood markers of muscle damage and pain symptoms peak between 24 and 48 h after exercise, can take 5—7 days to resolve depending on the severity of tissue disruption, and is often accompanied by impaired physical performance [1,3].

Given the necessity of optimizing exercise performance and post-exercise recovery process, phototherapy that uses red and infrared wave-lengths and both light-emitting diodes (LED therapy) and low-level laser therapy has been used in clinical trials with different exercises, such as repeated contractions, isometric sustained contractions, cycling, and running [4—8]. These studies present evidence supporting the use of phototherapy due to its accelerated recovery process, the anti-inflammatory and anti-algics effects, tissue repairment, and the improvement of exercise performance (e.g., muscle strength, contractile function and increased one maximal repetition) [4—8].

However, there have not been many studies analyzing the potential beneficial effects of LED therapy between two bouts of aerobic exercise. In animals, the administration of LED between two swimming bouts improved the time to exhaustion in the second bout compared to the passive recovery. The first bout had a fixed duration of 45 min, with between-bout interval of 25 min. The histological analysis revealed that LED therapy diminished the post-exercise necrotic areas in the rats muscles [9]. In humans it has already been reported that cold water immersion is associated with improved exercise tolerance in the second bout of endurance exercise [10], with uncertain effects on exercise-induced inflammatory response. Nevertheless, cold water immersion is able to improve autonomic modulation, as measured by heart rate variability (HRV) [11,12]. Maintenance of high values of vagally-mediated HRV indices seems important in order to optimize adaptation responses to

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