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ENGINEERING METHODOLOGIES FOR MEDICINE AND SPORT

Title

Nanotechnology Devices in Sport: Taopatch® and Its Impact on Efficiency and Metabolic Control

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Extended Abstract (3000 chars maximum)

Using emerging technologies to support athletic performance is a growing area of scientific interest. One such technology is Taopatch® (Tao Technologies, Vedelago, Italy), which uses nanotechnology to modulate neuromuscular activity and improve motor efficiency. Despite its increasing use in sport, there is limited scientific evidence on its performance and metabolic effects. This study aimed to evaluate the effects of Taopatch® application on trained subject who regularly perform multimodal training by analyzing performance and metabolic parameters in an integrated manner. To this end, 30 athletes were recruited and divided into a experimental group (EG), who received Taopatch® application at specific landmarks, and a control group (CG). All participants performed an incremental step test (IST) on a rowing ergometer structured in four stages with progressive 10% increases in power output, obtained from a preliminary two-minute all-out test. During the various test sessions, the acute physiological response to exercise was assessed through the combined analysis of metabolic and mechanical parameters. Specifically, power output was measured using both peak power, defined as the highest average power reading recorded each second, and mean power, calculated from the average of all values acquired in each stage, which allowed for a detailed characterization of performance and the neuromuscular load sustained during the test. To assess the metabolic response, a capillary blood sample (approximately 0.5 µL) was collected and analyzed using a portable lactated and glucose analyzer (Accutrend® Plus Glucose and Accutrend® Plus BM-Lactate, Roche), at baseline (T0), immediately after the test (T1), and during recovery at 15 (T2) and 30 (T3) minutes. The highest lactate and glucose level measured between T1 and T3 was considered the peak value. This integrated approach enabled us to correlate metabolic variations with changes in power output, providing a more thorough evaluation of performance profiles and the mechanisms of exercise-induced fatigue. By comparing mean times at different stages of the IST, we observed a tendency for the experimental group (EG) to demonstrate greater performance efficiency, covering a greater distance in the same time at the same subjective intensity compared to the control group (CG), suggesting a possible improvement in movement economy. In parallel, differences in lactate kinetics showed differences between groups, which may reflect different metabolic load management. Overall, the results indicate that Taopatch®, through neuromodulatory mechanisms and optimized load management, can help modulate lactate kinetics and improve subject's performance response.