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Conference Abstract

The Effect of Infrared Radiation Emitting Garments on Oxygen Uptake Kinetics and Oxygen Cost During Moderate Intensity Cycling

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Abstract

Introduction: Oxygen uptake (V Ȯ2) kinetics are an important determinant of exercise performance (Burnley & Jones, 2007). Speeding V Ȯ2 kinetics can spare anaerobic energy stores at the onset of exercise, consequently enhancing exercise performance (Bailey et al, 2009). Both exercise training (Jones et al, 2011) and dietary interventions (e.g. nitrate supplementation; Vanhatalo et al, 2010) have been shown to alter V Ȯ2 kinetics. KYMIRA garments, powered by Celliant, are a novel infrared (IR) emitting fabric that re-emit absorbed body heat as IR. IR emission has been shown to increase blood flow during exercise (Katsuura et al, 1989) which could increase muscle oxygen delivery, and potentially alter V Ȯ2 kinetics. Indeed, previous work has shown that IR emission using similar garments reduced the oxygen cost of cycling (Worobets, Skolnik, & Stefanyshyn, 2015), although V Ȯ2 kinetics have not been systematically investigated. The aim of this study was to investigate whether KYMIRA garments alter V Ȯ2 kinetics and oxygen cost during moderate intensity cycling.

Materials and Methods: 9 healthy male participants (age: 22 ± 5y; height: 172 ± 5 cm; body mass: 69 ± 5 kg; $\dot{V}O_{2peak}$ 47 ± 5 ml/kg/min) provided written informed consent for this repeated-measures, counter-balanced experiment. Initially, participants performed a ramp test to determine gas exchange threshold (GET) and $\dot{V}O_{2peak}$. Participants visited the laboratory on two further occasions, each separated by at least 14 days. On each occasion, participants donned cycling bib-tights and a t-shirt of either IR emitting fabric (IRF) or similar clothing without any IR emitting technology (SHAM). Garments were worn for 1.5 hours prior to performing standardised bouts of moderate intensity cycling exercise. This consisted of two repeats of a 3-minute 25 W warm-up followed by a square-wave transition to a power eliciting 90% of GET for 6 minutes. Bouts were separated by 5-minutes passive recovery. Breath-by-breath pulmonary gas exchange data were analysed using mono-exponential models with mean response time (MRT) calculated from 0 sec without time delay. Phase II time constant (tau, T) and amplitude were calculated with the first 20 sec of data deleted. Average $\dot{V}O_2$ over the last 30 ($\dot{V}O_{2(30)}$) and 60 ($\dot{V}O_{2(60)}$) sec of exercise was also determined. Data were analysed by paired sample t-test. N=8 for T and MRT and n=9 for all other parameters measured. Statistical significance was accepted at $p<0.05$ and data are presented as mean ± SD.

Results: MRT (40.2 ± 5.6 vs 47.0 ± 4.4 sec; $p<0.001$) and phase II T (23.7 ± 4.2 vs 30.8 ± 8.1 sec; $p=0.036$) were lower in IRF vs SHAM, respectively. Amplitude (670.4 ± 143.5 vs 679.2 ± 179.7 ml.min-1; $p=0.455$), $\dot{V}O_{2(30)}$ (1604.2 ± 153.2 vs 1647.0 ± 200.3 ml.min-1; $p=0.149$) and $\dot{V}O_{2(60)}$ (1618.0 ± 157.3 vs 1640.4 ± 204.9 ml.min-1; $p=0.216$) were not different between IRF and SHAM, respectively.

Conclusion: IR exposure using KYMIRA garments appears to have sped the overall MRT response as well as the phase II response. There was, however, no change in end exercise $\dot{V}O_2$ or amplitude of the response. Mechanisms of action for speeding this response remain to be determined, however use of near-infrared spectroscopy will aid our understanding of whether an increased oxygen delivery and/or extraction are possible explanations. Further study will add to the number of participants in this study. Possible implications to cycling performance are also to be determined.

Keywords: $\dot{V}O_2$ kinetics, Infrared Radiation, Moderate Intensity, Mean Response Time

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