

The effect of a heat extraction device on recovery and performance in hot and humid conditions

Kylie Hunter^{1,2}, Aron Murphy¹, Aaron Coutts¹, Kenneth Graham²

¹*School of Leisure, Sport and Tourism, University of Technology*

²*The NSW Institute of Sport*

The aim of the current study was to investigate the effect of the Rapid Thermal Exchange (RTX) device on physiological parameters and exercise performance in hot and humid conditions. The RTX is a heat extraction device whereby the user places their hand into a small chamber lightly grasping a 15°C heat sink. The hand is then sealed comfortably air-tight at the wrist and the RTX activated so that there is a slight sub-atmospheric pressure (~40 mmHg) in the chamber. The combined effects of the heat gradient and vacuum are believed to maximise heat extraction from the body. Using a random, crossover design, nine moderately trained male team sport athletes (24.8 ± 4.4 years; 181.8 ± 5.4 cm; 78.4 ± 9.3 kg; VO₂max = 43.2 ± 6.8 mL·kg⁻¹·min⁻¹) participated in two separate experimental trials on a cycle ergometer in a hot and humid environment chamber (33.0 ± 0.6°C; 62.2 ± 1.7% RH). Each trial consisted of a five minute warm-up at 50% work max (W_{max}) immediately followed by 15 minutes cycling at 70% W_{max} (Preload) before five minutes passive recovery (Recovery 1). Subjects then completed a second 15 minute cycling bout at 70% W_{max} (Steady State) followed by 10 minutes of passive recovery (Recovery 2), and finally a 10 minute Time Trial. During both Recovery 1 and Recovery 2 subjects sat quietly on a chair adjacent to the bike in the climatically controlled chamber and used either the RTX device (RTX) or no intervention (CON), whilst consuming 125 ml (Recovery 1) or 250 ml (Recovery 2) of tepid water. Physiological measures of tympanic temperature, mean skin temperature, heart rate (HR), and blood lactate concentration ([BLa]), as well as psychophysical measures of rating of perceived exertion (RPE), thermal sensation (ThS) and thermal comfort (ThC), were recorded at regular intervals throughout the experimental trials. Performance measures of total work and mean power output were also recorded, and total fluid loss and sweat rate were determined from pre and post measures of naked body mass. Results indicated that tympanic temperature was significantly lower in the RTX trial following Recovery 2 when compared to the CON trial (p<0.05). Additionally, HR was lower during both Recovery 1 and Recovery 2 (p<0.05), and mean skin temperature was lower following the Steady State (p<0.05) and Recovery 2 (p<0.01) in the RTX trial. There were no differences in sweat rate, [BLa], RPE, ThS or ThC between trials (p>0.05). In the Time Trial, subjects performed significantly more work and had a greater mean power output in the RTX trial compared to the CON trial for both the whole 10 minutes (p<0.05), as well as the final five minutes (p<0.05). The results of this study show that the RTX device reduced thermal strain which led to improved Time Trial performance. These findings support its potential role as an ergogenic aid for exercise performance in hot and humid environmental conditions. Future studies should further investigate other potential settings in which the RTX may be practically applied.