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# The use of optimised heating trousers and the role of the blood flow on the reduction in muscle temperature post warm up

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Activities that are highly dependent on power output can benefit from increases in muscle temperature ( $T_m$ ) in terms of work done and skeletal muscle power output. When athletes experience a significant delay between active warm up and performance,  $T_m$  declines. Previous studies have demonstrated that using heated trousers during a period of inactivity can attenuate this decline, with a greater peak power output as result [1,2]. However, in these studies, the reduction in  $T_m$  was not completely eliminated. Thus, in the current study we aimed to optimise the heating procedure, in order to eliminate the reduction in  $T_m$  post-warm up. Furthermore, to understand the reason of this reduction, the effect of the blood flow in the cooling process of the leg was studied.

**Method**

Ten male cyclists participated in this experiment. The heating garment was applied during 30 minutes of passive recovery following 15 minutes of active warm up. The heating procedure was optimised by using water perfused trousers with an adjusted water temperature of 43 °C. The effect of the blood flow was observed during the recovery period using full restriction of arterial and venous blood flow in one leg (OCCLUDED), while the other leg was used as control (CONTROL).  $T_m$  of the *vastus lateralis* was measured at three different depths beyond the muscle fascia: 5 mm, 15 mm and 25 mm.

**Results**

During the passive recovery, blood flow significantly reduced ( $p < 0.05$ )  $T_m$  in CONTROL compared to

OCCLUDED condition by 0.33(0.3) °C. In the CONTROL condition the heating procedure significantly increased  $T_m$  ( $p < 0.05$ ) by 1(1.3) °C at 5 mm depth and there was only a small reduction ( $p < 0.05$ ) in  $T_m$  of 0.1(0.8) °C and 0.1(0.3) °C at 15 mm and 25 mm, respectively. The use of the optimised heating trousers coupled with the removal of the blood flow resulted in a  $T_m$  increase ( $p < 0.05$ ) of 1.8(1.6) °C, 0.6(0.7) °C and 0.2(0.3) °C at 5 mm, 15 mm and 25 mm depth, respectively. Compared to the previous muscle warming method, the current approach resulted in a 0.61 °C warmer muscle (15 mm depth) at the end of the recovery period.

**Conclusion**

By optimising the heating procedure, using water perfused trousers with temperature of 43 °C, it is possible to maintain  $T_m$  during period of inactivity following an active warm up. Blood flow was identified as a contributor to the earlier observed reduction in  $T_m$  post warm up.

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**References**

1. Faulkner SH, Ferguson RA, Gerrett N, Hupperets M, Hodder SG, Havenith G: Reducing muscle temperature drop after warm-up improves sprint cycling performance. *Medicine and science in sport and exercise* 2013, **45**(2):359-65.
2. Faulkner SH, Ferguson RA, Hodder SG, Havenith G: External muscle heating during warm-up does not provide added performance benefit above external heating in recovery period alone. *European journal of applied physiology* 2013, **113**(11):2713-21.

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