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COMBINED EFFECTS OF COLD *AND* WIND ON MUSCLE TEMPERATURE IN SUBMAXIMAL PHYSICAL ACTIVITY

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The knowledge about the effects of cold on physical performance is scanty. However, it seems that cold has no influence on $\dot{V}O_{2max}$ in contrast to the findings for significant reduction in endurance performance. The decrement seen in performance may result directly from the muscle temperature (T_m) drop affecting muscle performance and muscle strength. Low muscle temperature probably has a disadvantageous effect on oxidative activity in muscle and also on nervous conduction, resulting in a decrease in motor coordination.

This study aimed to assess the effect of cold and wind on temperature in the rectus femoris muscle during prolonged submaximal physical activity. Six healthy males volunteered for this study, which is part of a comprehensive project on designing functional cold protective clothing for work and leisure time. The experiments were conducted in a climatic chamber under controlled cold and windy condition (T_a -17°C, v_a 10 ms^{-1}, Wind Chill -38°C). The subjects wore a typical cross-country ski clothing ensamble of I_{cl} 0.6 clo (pants, thermal long underwear (Dunova) and a stretchable ski overall (Lycra), gloves, cap, socks, and shoes) and performed two 30-min sub-maximal work bouts on treadmill (10 kmh^{-1}, incline 5°) separated by 5-min pauses for T_m measurement. The cardiovascular workload was about 80 % of the maximum approximated by the heart rate. Continuous monitoring included heart rate, rectal temperature (T_r) and skin temperatures (T_{sk}) at 14 sites. T_m in the rectus femoris of both legs was measured with a hypodermic probe (YSI 524) for five minutes before the exposure, after 30-min running, and at the end of the exposure. Subjective thermal and perceived exhaustion ratings were given every 10 min.

The T_r increased from the mean resting level of 36.9°C continuously during the exposure, even up to 38.7°C on average. The drop in mean skin temperature was 5.0°C on average. The lowest single T_{sk} values (7-13°C) were registered on hand, thigh and abdomen. T_m in rectus femoris increased from the mean resting value of 36.2°C up to the mean working value of 38.0°C. During the 5-min measurement T_m decreased rapidly. The mean drop in T_m was 0.8°C varying from 0.5°C to 1.7°C. The lowest T_m measured was 34.7°C. There was no significant difference in T_m between right and left.

This study indicates that despite intense heat production and T_r increase in submaximal work at low ambient temperatures, the cooling effect of wind may decrease T_m lower than core temperature. In addition, during short breaks the muscles cool very rapidly. This may impair physical performance during prolonged physical activity in a cold and windy climate. Without satisfactory protection against cold and wind, there may be risk of hypothermia during prolonged rest periods.