THERMAL RESPONSES DURING STANDING AND WALKING AT DIFFERENT AIR VELOCITIES IN COLD

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The aim of this work was to study how different air velocities affects thermal responses during standing and walking in cold. Eight young (21-25 years) male subjects were stabilized for 60 minutes at 20°C. During the 30 min cold exposure the subjects either stand still or walked on the treadmill (2.8 $km \cdot h^{-1}$) towards the wind by two different exercise intensity. Exercise intensity was adjusted by changing the inclination of the treadmill between 0° (lower exercise intensity, metabolic rate 124 $W \cdot m^{-2}$, LE) and 6° (higher exercise intensity, metabolic rate 195 $W \cdot m^{-2}$, HE), thus keeping the speed of the body movements unchanged. Temperature in the wind tunnel was -10°C and air velocity was 0.2 ("still air", NoWi), 1.0 (Wi1) or 5.0 (Wi5) $m \cdot s^{-1}$ in separate measurements. The subjects wore Finnish military winter clothing with the basic insulation of ca. 2.2 clo. Skin (15 sites) and rectal temperatures, heat flux from the skin (8 sites), and oxygen consumption were measured. Wind increased convective heat loss, which was significantly higher, both at rest and during exercise, at Wi5 in comparison to NoWi and Wi1. At rest the heat flux increased already at Wi1 in comparison to NoWi. Walking increased convective heat loss only at NoWi in comparison to standingt. Exercise intensity did not affect the mean heat flux at any air velocity. During exercise, mean skin temperature (Tsk) remained at higher level than during standing in all air velocities. The differences between the walking and the standing at the end of cold exposure were 0.6 (NoWi), 1.0 (Wi1) and 1.1°C (Wi5) at LE, and 1.3, 1.6 and 1.7°C at HE, respectively. The higher exercise intensity increased Tsk only at NoWi and Wi1 in comparison to LE. Both during rest and exercise, Tsk decreased significantly more at Wi5 than at NoWi and Wi1. Air velocity did not affect a periheral cooling rate, judging from the finger temperature, at rest or at LE. At the end of HE the finger temperatures were significantly higher at NoWi and Wi1 than at Wi5. Oxygen consumption increased significantly during Wi5 at standing in comparison to NoWi and Wi1. The present results suggest that in windy conditions, during standing and walking at studied exercise intensities, the convective heat loss is dependent only on air velocity. The exercise-induced increase in Tsk is not accompanied by a higher heat flux. Increase of oxygen consumption during Wi5 at standing was probably due to shivering induced increase in metabolic rate.

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