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Ventilated evaporative cooling as a preventive strategy when confronted with heat waves

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Climate change and heat waves pose a threat to workforce, the general public, particularly vulnerable groups such as elderly people and people with chronic diseases. Protective measures are needed to cope with hot climate and to mitigate adverse impacts on society. The objective of this study was to investigate the effectiveness of personal cooling with ventilation clothes in a hot environment.

Method

Thermal manikin temperature was controlled at 34 °C in a climatic chamber ($T_a=34$ °C, $RH=60\%$, $V_a=0.4$ m/s). A wet and tight fit cotton coverall was worn on the manikin to simulate sweating. A short sleeve jacket made of polyester and equipped with two small fans driven by batteries (AA x 4) was worn on top of the “skin”. Three conditions were measured: 1) sweating skin only, 2) sweating skin, ventilation jacket (fan-off) and trousers, 3) sweating skin, ventilation jacket (fan-on: high) and trousers. The chest, back, stomach and buttock were included in the calculation of the torso heat loss (cooling effect).

Results and conclusion

The torso heat losses in the three test combinations were 131.9, 62.6 and 149.7 W/m². When the clothes were worn, the torso heat loss was reduced about 50%. However, when the ventilation fans were switched on, the evaporative cooling rate increased 139% and was higher than the cooling rate of the “nude” sweating manikin.

The findings indicate that the ventilation clothes enhanced evaporative cooling in the hot environment compared with “nude” and clothed manikin. The ventilation clothes can be used as a personal preventive measure in similar conditions when confronted with hot climates.

