Ventilated evaporative cooling as a preventive measure when confronted with a hot climate

Gao, Chuansi; Wang, Faming; Sakoi, Tomonori

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Introduction: 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 environments 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.

Methods: A heated thermal manikin with 17 zones was used for the measurement. The manikin surface temperature was controlled constant 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 skin. A short sleeve jacket made of polyester and equipped with two small fans driven by batteries (AA x 4) for ventilation was worn on top of the “skin”. Cotton pants were also used in combination of the ventilation jacket. Three conditions were measured: 1) sweating skin, 2) sweating skin, ventilation jacket (fan-off) and pants, 3) sweating skin, ventilation jacket (fan-on: high) and pants. Heat losses of the manikin were recorded at a 10-second interval. Chest, back, stomach and buttock were included in the calculation for the torso heat loss (cooling effect).

Results: 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 that of the “nude” sweating manikin.

Conclusions: The findings indicate that the personal ventilated evaporative cooling increased evaporation capacity in the hot environment with moderate humidity and air velocity compared with “nude” and clothed manikin. The method can be used as a personal preventive strategy when confronted with hot climates.