

THERMOREGULATORY RESPONSES OF CHILDREN AND YOUNG ADULTS IN A HOT ENVIRONMENT

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Because of their greater body surface area (BSA)-to-Body mass (BM) ratio, children have physical advantage for heat loss than adults. Some researchers reported that children tend to depend on dry heat loss rather than evaporating cooling under hot thermal conditions. There are, however, few detailed descriptions of the mechanisms of children's thermal responses. Our study includes 29 children (16 boys and 15 girls: 7-10 of age; children group) and 16 students (8 males and 8 females: 20-24 of age; adults group). A consent form was signed by each students and children's parents. They were placed in a pre-room set at 28°C, 50%RH, after that, they were moved to an exposure room set at 30°C, 70%RH, where they immersed their legs in a 42°C-water-bath during the last 40 minutes. Measured during the experiments were rectal temperature (T_{re}), skin temperature at 7 sites, local sweat rate on the back ($L_{sw,b}$) and forearm ($L_{sw,f}$), forearm skin blood flow (FSBF) and body weight loss (as total sweat rate). Mean skin temperature (T_{sk}) was calculated the following equation: $T_{sk} = (7 \times T_{forehead} + 18 \times T_{chest} + 17 \times T_{back} + 15 \times T_{forearm} + 5 \times T_{hand} + 25 \times T_{thigh} + 13 \times T_{foot}) / 100$. At the onset of sweating, forearm skin temperature ($T_{forearm}$) decreased slightly for the adults groups. In contrast, it increased for the children group. The FSBF of the children group increased significantly greater than in the adults group during the immersion. Hence the linear regression line between FSBF and $T_{forearm}$ was up for the children group, and down for the adults group. A similar tendency was observed the relationship between $L_{sw,f}$ and $T_{forearm}$. On the other hand, there were no such differences on the back between the children group and adults group. During the immersion, T_{sk} of the children group was kept at higher level than the adults group, while that of the adults group was gradually decreased. As for T_{sw}/BSA and T_{sw}/BM , there were no significant differences between the groups. Still, the adults group had greater increase in T_{re} than the children group. These results suggest that the children have an advantage in preventing the rise of T_{re} , despite the fact that the adults had more efficient evaporative cooling. Because there were no differences in T_{sw}/BSA and T_{sw}/BM among the groups, it was supposed that the children's efficiency of sweating was approximately equal to the young adults. Therefore, the relationship between FSBF and $T_{forearm}$, $L_{sw,f}$ and $T_{forearm}$ may indicates that the children's higher skin temperature was caused by greater forearm skin blood flow rather than by less $L_{sw,f}$ and/or $L_{sw,b}$. Since the children kept their T_{sk} at a higher level, dry heat loss may work effectively for them under the thermal conditions of the exposure room (30°C, 70%RH). In conclusion, the children may have advantage to inhibit rising their T_{re} compared to young adults under a hot thermal conditions, which dry heat loss works effectively than evaporative cooling, for their greater responses on skin blood flow.

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