THE, INFLUENCE OF AIR VELOCITY ON THE, ELDERLY IN THE, SUMMER

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INTRODUCTION

The ability to regulate body temperature declines together with age (1). Hypothemia as a thermal handicap occurs sometime in the elderly (2). Although some studies are available concerned with the preferred ambient temperature in the elderly (3,4,5), it is yet unknown what the proper and comfortable thermal environment, especially the air velocity is for the elderly. Therefore, we try to study the influences of the air velocity on the thermophysiological and psychological reactions in the eldeily in the summer. In order to make clear their characteristic in the elderly, the middle-aged and young adults were also served as subjects.

METHODS

Experiments were carried out in a climate chamber (D 5.3 m x W 5.8 m x H 2.5 m) at Nara Women's University where two sets of fan *apparatus* (H 1.4 m x W 0.7 m, H 1.7 m x W 0.8 m) were placed. It could regulate the air velocity at a position 0.8 m away from the subjects, with two subjects tested simultaneously. The experiments consisted of two series (Experiments I and II).

Exueriment I. The combination of the ambient temperatures (Ta) and air velocities used were 28°C and 0.4 m/s, 30°C and 1.0 m/s, 32°C and 1.2 m/s, respectively. Relative humidity was always kept at 50 %. The air stream temperature and the mean radiant temperature were equal to the Ta. The subjects were 17 active elderly men and women aging 73.9 ± 2.9 (mean ± SD), 15 middle-aged men and women aging 49.8 ± 4.5 and 16 female young adults aging 22.4± 3.6. The subjects wearing summer clothes (0.48 clo) sat on a chair throughout the 60 minutes experimental period. The skin temperature at 14 points over the whole body surface area were measured using thermo couples, and the mean skin temperature ($\overline{Ts}$) was calculated with the weighted mean formula by Hardy & DuBois. The heat flow rate was measured on the forehead with heat flow meter. The subjects were asked to report the general and local thermal sensation vote of the body surface area using the 9 category scale every 10 minutes.

Exueriment II. Ta used was 28°C, 30°C, and 32°C for the elderly and 26°C, 28°C, and 30°C for the young adults. The subjects were 10 active elderly men aging 72.7 ± 3.4 and 8 healthy young adults aging 19.4± 0.7. The subjects were instructed to regulate the air velocity at will throughout the 60 minutes experimental period as they felt comfortable at any time.
The experiments were carried out in July and August from 1989 to 1991.

RESULTS

Experiment I. The skin temperature of the chest (trunk) was lower in the elderly male than for the young and middle-aged male subjects, and the drop of the skin temperature due to the air flow was larger in the elderly subjects compared with that in the middle-aged and the young subject. At the shin (periphery), the skin temperature of the elderly male was higher than the young and middle-aged male subjects, and its decrease due to the air flow was smaller in the older subjects. In the female subjects, similar tendency was seen. It took longer times in the elderly for the skin temperature to become steady-state after the exposure to the experimental conditions mentioned above than in the other two groups. The elderly felt either cooler or more comfortable than the other two groups under the same thermal environments. Most of the young subject felt uncomfortable at 32°C and 1.2 m/s, while the elderly felt comfortable. The air velocity and the uniform air flow used in Experiment I seemed to be felt too slow and unpleasant after 60 minutes exposure for the young group, while they seemed to be nearly appropriate for the elderly. Most of the subjects whose $\overline{Ts}$ was below 34.5°C felt either cool or comfortable. There existed a strong

positive correlation between $\overline{Ts}$ and the vote in the middle-aged and the young subjects, while the correlation between both parameters was ambiguous in the elderly. When the Ta was **28°C** .the drop of the chest **skin** temperature of the subjects from age **20s** to **60s** were at most **0.7°C** and there was **no** significant difference between the middle-aged and the young adults group. However, in the subjects older than **65** most **of** the drop became nearly **1°C. On** the contrary, at the **shin** the drop became smaller with advancing age.

Experiment II. The preferred **air** velocities at each ambient temperature were **0.41 ± 0.18 m/s** at **28°C,** 0.80 **± 0.23 m/s** at **30°C** and **1.08± 0.32 m/s** at **32°C** in the elderly, **0.46 ± 0.22 m/s** at 26°C, **0.84 ± 0.33** m/s at **28°C** and **1.37± 0.27 m/s** at 30°C in the young subjects. The values were significantly higher at **28°C** and **30°C** in the **young** subject than in the elderly. As Ta increased by **2°C ,**the air velocities became faster by about **0.4m/s** in both groups. The higher the Ta became, the higher the $\overline{Ts}$ became in both gronps. However, $\overline{Ts}$ was significantly lower in the elderly **than** in the young subjects at identical Ta. $\overline{Ts}$ of the elderly was **almost equal** to that of the young at a **2°C** lower **Ta** The forehead **skin** temperature was lower in the elderly **than** in the young subject, and its drop was smaller in the elderly. Like in the Experiment I, the **skin** temperature of the chest was lower in the elderly than in the young subject, and affected in greater extent by Ta change in the elderly. The **skin** temperature of the shin was higher in the elderly than in the young subject and its drop was smaller in the elderly. The higher the Ta became, the higher the thermal sensation vote was. The thermal sensation vote before being exposed to preferred air movement adjustment differed, depending **on** there different Ta. while the young felt comfortable in all three Ta after the preferred air velocity was selected.

CONCLUSIONS

Thermophysiological and psychological responses to different air velocities under various **Ta** . were compared among the elderly, the middle-aged, and the young subjects. The major conclusions **are:**

1) In the same thermal environment, $\overline{Ts}$ of the elderly dropped bigger than other groups of the age by the air flow. But the drop of the elderly's **shin** temperature was smaller than that of the younger groups, and it indicates that the elderly decrease their abilities of cutaneous vasoconstriction at the extremities.

2) The elderly preferred slower **air** velocities than the young in the same Ta. Thus, the thennophysiological and psychological responses differed among the three groups. These suggest that the special attention should be required for an indoor room environments to be adjusted properly and comfortably for the elderly, compared with that for the middle-aged and the young subject.

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