

SEASONAL DIFFERENCES OF PHYSIOLOGICAL RESPONSES DURING THE COMBINED CONDITIONS OF HEAT AND NOISE

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PURPOSE

The purpose of this study is to investigate time response of the human physiological reactions and heat balance between the humans and their environment during the combined conditions of heat and noise, in order to obtain in-situ evaluation of daily environment that the officers and the habitants usually live in.

METHODS

Ten Japanese male students were exposed to twenty-five combined conditions of operative temperature (27, 30, 33, 36, 39°C) and noise (46.8, 59.2, 73.1, 80.0, 95.4 L_{Aeq}) in summer and eight of them were also exposed to twenty combined conditions of operative temperature (19, 22, 25, 28°C) and noise (46.6, 58.5, 72.9, 79.9, 95.5 L_{Aeq}) in winter. The skin and oral temperatures, metabolic rate, sensible heat transfer rate were continuously measured.

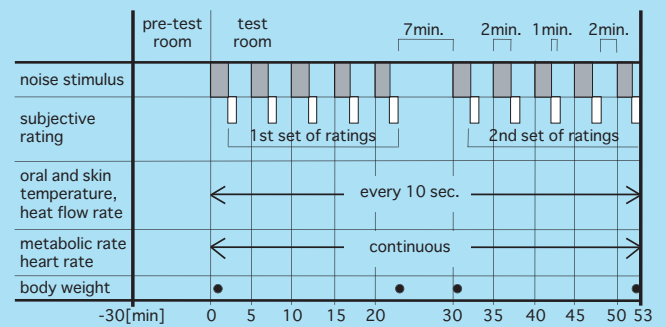


FIG. Time schedule

RESULTS and DISCUSSION

As it was obvious that noise does not affect measured physiological responses, thermal and seasonal effects were analysed. Mean skin temperature fell gradually with time in 19-25°C conditions, and was stable in another hotter conditions. Sensible heat rate fell down gradually for 19 and 22°C conditions. The changes in mean skin temperature were consistently similar to the changes in sensible heat loss at the 19-22°C conditions. At 19 to 28°C conditions of the winter experiments, metabolic rates were 40 to 45 W/m^2 , whereas 45 to 50 W/m^2 at 27 to 39°C conditions of the summer experiments.

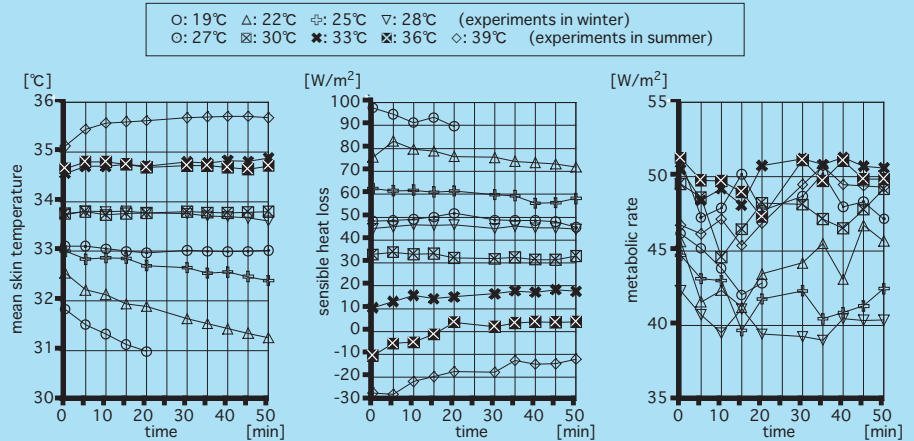


FIG. Changes with exposure in mean skin temperature, sensible heat loss and metabolic rate

In thermally neutral conditions, which are 27°C in summer and 28°C in winter, there is no difference between two seasons in radiative, convective and evaporative heat losses. However, metabolic rates in summer were 5 to 10 W/m^2 larger than in winter. Ogawa et al. (1975) showed that metabolic rates in winter were higher than in summer, and Yoshimura et al. (1966) showed that there was no seasonal difference on basal metabolism of Canadians living in Japan. However, Gonda et al. (1999) and Ishigaki et al. (2001) showed metabolic rates in summer were higher than in winter. Thus, the findings of this study support recent studies for Japanese subjects, but not the previous studies conducted several decades before for Canadian and Japanese. It may probably be due to a change of diet and controlled temperature in dwellings between generations and nations.

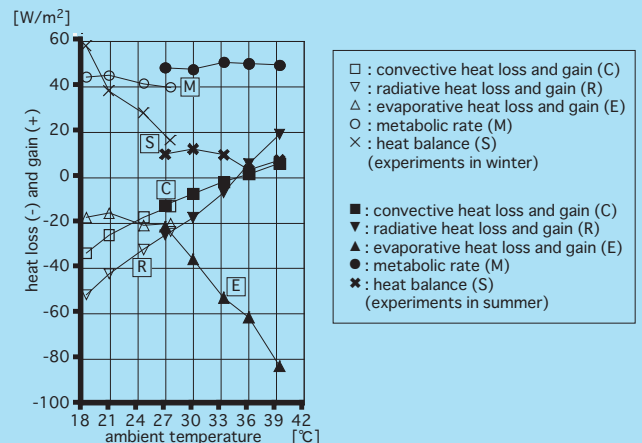


FIG. Heat loss and gain, and heat balance of the human body with ambient temperature