RESPONSE OF HUMAN BODY TO IRREGULAR RADIATION LOAD

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Introduction: The aim of this study was to verify the response of heart frequency, body temperature and skin temperature on irregular thermal load in the course of mental work during experimental conditions in climatic chamber.

Methods: Experiments were held in climate chamber in a group of 20 students (10 men and 10 women). Experimental persons (EPs) were dressed in uniform suit with thermal resistance 0.7 clo. The experiments were divided into three phases according to air velocity: I. v_a=0.25 m.s^{-1}, II. v_a=0.5 m.s^{-1} and III. v_a=1.0 m.s^{-1}. The resultant temperature of the globe thermometer (t_g) was convenient with optimal conditions for mental sedentary work, i.e. 24 °C. The difference between radiation temperature in direction of radiation (t_{rA}) and t_g (Δt_{rA}-t_g) in case of vertical radiation surface was in range from -10°C to +20 °C, in case of horizontal radiation surface in range from +20 to +34 °C (100 - 200 W.m^{-2}). EPs were exposed to the same conditions always for a time of 1 hour. In the course of experiments EPs were sitting next to computer (in case of vertical radiation surface forehead to the source of radiation) and were solving computer games making demands on attention and short term operational memory. In the first and last experiment EPs were exposed to optimal thermal conditions in which dry air temperature (t_a), t_{rA} and t_g were identically 24 °C. In the course of experiments thermal and humidity settings were continually measured in the height of head (110 cm) i.e t_g and stereo temperature (t_{stereo}) measured by globe stereo thermometer Jokl-Jirák and recorded into the computer. Parameters t_a, v_a, t_{rA} a RH were measured by Indoor Climate Analyser type 1213 Bruel a Kjaer. Of physiological parameters heart frequency, skin temperature at six places on body surface and body temperature were continually measured and recorded. At the end of experiment each person filled questionnaire including total temperature sense impressions. Temperature sense impressions were expressed in scale ASHREA (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) in range -3(cold) to +3 (hot).

Results: Significant differences in values of heart frequency and body temperature between individual experimental conditions were not detected. Average skin temperature was under all conditions in phase I and II in the range ± 0.5 SD (Standard deviation), in phase III (v_a = 1 m.s^{-1}) in range -0.5 to less than -1.5 SD. Temperature of forehead was increasing in relation to radiation component from both vertical and horizontal radiation surface from negative values (-0.5 to -1.5 SD) to values +1.5 SD and above whereas temperature of leg was decreasing from average values to values lower than -1.5 SD. Women perceived temperature conditions in climatic chamber as colder and had higher temperature of skin than men. Conditions on cold vertical radiation surface and higher air temperature were perceived as warmer whereas on hot vertical radiation surface and low air temperature as colder. Thermal radiation from ceiling was perceived on the same values Δt_{rA}-t_g better than from vertical radiation surface.

Conclusion: Sense impressions of thermal discomfort due to irregular radiation load caused by negative or positive radiation of surrounding surfaces is given by both difference between intensity of radiation and cooling effect of air velocity and difference of skin temperature of forehead and leg.