INVESTIGATION OF KEY THERMOREGULATION PARAMETERS IN RELATION TO THE THERMAL STATE OF AUTO REPAIR WORKSHOP WORKERS DURING THE WARM SEASON

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Abstract. *This study investigates the main indicators of thermoregulation in relation to the thermal state of auto repair shop workers during the warm season. The research was conducted to assess the effect of elevated air temperatures and unfavorable microclimatic conditions on the body's thermoregulatory mechanisms. Skin temperature was measured at five body surface points (forehead, chest, hand, shin, and foot) using a TPEM-1 medical electric thermometer, while body temperature was recorded in the axillary region. The results revealed a significant increase in both body and skin temperatures during the working day, particularly in the distal areas of the limbs. A reduction in the proximal–distal temperature gradients indicated overheating and strain on the body's thermoregulation systems. Despite the relative stability of core temperature, the observed physiological changes demonstrate a state of thermal stress caused by heat exposure. These findings highlight the importance of optimizing microclimatic conditions in industrial environments to maintain workers' health and efficiency.*

Keywords: *thermoregulation, microclimate, heat exposure, skin temperature, thermal state, industrial workers, auto repair workshop.*

The microclimate of industrial premises primarily influences the thermal state of the human body and its heat exchange with the surrounding environment. Although the parameters of the workplace microclimate may vary considerably, the human body temperature remains constant at approximately 36.6 °C. The normal course of physiological processes in the organism is possible only when the heat produced by the body is continuously dissipated into the surrounding environment [6, 7, 9].

Optimal microclimatic conditions ensure a sense of thermal comfort throughout the working shift, do not cause adverse health effects, and help maintain a high level of work efficiency [1, 3, 8, 10].

Acceptable microclimatic conditions should not lead to health disorders; however, they may cause sensations of thermal discomfort, impose additional strain on thermoregulation mechanisms, impair overall well-being, and reduce work capacity [2, 4, 5]. These considerations formed the basis for conducting the present study.

Materials and Methods

To study the thermoregulatory function of the human body, the skin temperature of workers in the auto repair workshop was assessed during the warm season.

Measurements were carried out using a medical electric thermometer of the TPEM-1 type at five points on the body surface: the forehead, chest, hand, shin, and foot. In parallel, body temperature was measured in the axillary region using standard medical thermometers.

Results and Discussion

Significant changes in the thermoregulatory systems of the body occur under conditions of an intense work rhythm and exposure to an unfavorable microclimate. It was found that the body temperature of all workers in the auto repair workshop during the hot months of the warm season was slightly lower than in the cold and transitional periods. When performing outdoor work, where the process of thermoregulation completely depends on the ambient temperature, the workers' body temperature increased more noticeably, rising significantly by 0.7–0.8 °C ($P < 0.05$). By the end of the working day, it reached 37.1 ± 0.54 °C.

Thus, despite working in conditions of elevated air temperature, the body temperature of workers remained relatively stable, indicating a steady adaptation that ensures thermal balance between the organism and the environment. However, under a heating microclimate, disturbances in thermoregulation cannot be ruled out, which was confirmed by measurements of skin temperature.

As is well known, skin temperature serves as an objective indicator of the state of thermal comfort or discomfort of the human body. Under normal conditions, skin temperature varies across different body areas; it is higher on the extremities (hands and feet) than on the forehead, chest, and back. Our findings showed that in the auto repair workshop, the skin temperature of the forehead, chest, hands, and feet during the warm season was higher compared to the cold period. Furthermore, the mean weighted skin temperature increased by the end of the working shift.

It was revealed that in the first half of the working day, the skin temperature of the forehead and chest increased significantly by 0.6 °C, of the hands by 1.6 °C, and of the feet by 0.8 °C ($P < 0.05$). By the end of the shift, skin temperature continued to rise: on the forehead by 0.8 °C, on the chest by 0.3 °C, on the hands by 0.9 °C, and on the feet by 0.7 °C. As a result of the considerable rise in skin surface temperature in the distal parts of the limbs, the temperature topography changed notably.

The temperature gradient between the skin of the trunk and the extremities tended to decrease throughout the working shift in all seasons, with the most pronounced changes observed during the cold period. The difference between the chest and foot temperatures was particularly distinct. In the warm season, this "chest–foot" temperature difference gradually decreased, averaging 2.0 °C, 1.9 °C, and 1.9 °C at different observation times. These data indicate a leveling of skin temperature topography, which reflects the strain of heat dissipation mechanisms and the accumulation of heat within the body.

Conclusion

Thus, during the warm season, a marked increase in skin temperature throughout the working day was observed among employees of the auto repair workshop enterprise, whose working conditions are associated with exposure to heated air. In addition, the proximal-distal temperature gradients were reduced, indicating overheating of the workers' bodies. Moreover, the indicators of the body's thermal state show that the work performed causes shifts in these physiological systems and is of a strenuous nature, which inevitably affects the overall condition of the organism.

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