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**EFFECT OF PRODUCTION MICROCLIMATE ON FEMALE THERMAL
STATE WITH INCREASED TEMPERATURES AND AIR HUMIDITY**

O. G. Machablishvili

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16. Abstract This is a study of the microclimate requirements, as relates to the effect of high temperatures and relative humidity, for women under varying degrees of physical loads. Parameters for air temperature, relative humidity and air movement are established.					
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EFFECT OF PRODUCTION MICROCLIMATE ON FEMALE THERMAL
STATE WITH INCREASED TEMPERATURES AND AIR HUMIDITY

By
O. G. Machablishvili*

Among the many tasks for improving the working conditions of significant importance is the creation of the most favorable microclimate, since the problem of the vital activity of the workers' bodies under different microclimate conditions continues to remain one of the most important and urgent tasks of industrial hygiene, despite the fact that a large number of studies have covered it (I. S. Kandror, 1966, 1974; V. I. Krichagin, 1966; V. L. Mdivaradze, 1969; M. Ye. Kurashvili, 1970; G. D. Rasulzade, 1972; A. Ye. Malysheva, 1973; G. Kh. Shakhbazyan, F. M. Shleyfman, 1977, et al.; Leman, 1953; Lind, 1960). It needs to be noted that in the extensive literature on physiology of thermal exchange and hygiene of the production microclimate there is still insufficient information about the peculiarities of the thermoregulation in women in the process of labor activity. /96**

All that has been stated determined the need for conducting physiological studies to investigate the peculiarities of the thermal state of women during the effect of high air temperatures and relative humidity with a varying degree of physical loads.

The studies were made in a climate chamber with air temperature 18-38° and high relative humidity (70-80%) with a varying degree of physical load (light, medium, heavy), as well as under production conditions of the textile industry with air temperature 17-33.4°, relative humidity 50-80% and rate of air movement 0.34-1.40 m/s.

* N. I. Makhviladze Scientific Research Institute of Industrial Hygiene and Occupational Diseases of the Georgian SSR Ministry of Public Health (Tbilisi).

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We observed women in age from 20 to 40, the control group consisted of men of the same age.

In order to study the functional state of the thermoregulatory apparatus the following indices were defined: body temperature, skin temperature, moisture losses, (perspiration), pulse rate, weighted average skin temperature, average body temperature, thermal balance, subjective thermal sensations. In the experiment 757 man-days of observations were made on 58 subjects, and in production--2140 man-days of observations on 560 workers.

Based on the conducted studies it was found that under the influence of high air temperatures and high relative humidity in combination with a varying degree of fulfillment of physical loads the state of thermoregulation in women has a number of peculiarities.

It was established that in women the thermoregulatory stress occurs at lower air temperatures and with lower physical loads than in men. With an increase in the air temperature from 18 to 38° the main indices of the thermal state (body temperature, weighted average skin temperature, pulse rate per minute, thermal sensations and accumulation of heat in the organism) in women reaches considerable amounts with an increase in the physical loads. Thus, at temperature 38° and with fulfillment of heavy work the pulse rate reaches 159 per minute. The body temperature is increased to 37.9°, and in individual cases--to 38.2° and more. The increase in the weighted average skin temperature--3.6°. The main percentage of thermal sensations comprise "heat," "hot," "very hot."

In men under the same conditions the indices for the thermal state were lower than in women: pulse rate reached 118 per minute, body temperature--37.2°, /97 and increase in weighted average skin temperature--2.9°.

The effect of increased temperatures of air results in an accumulation of heat in the organism which is indicated by the results of the computation of the thermal balance. In women the accumulation of heat is revealed with lower air temperature than in men. The degree of disorder in the thermal balance of women is also greater (0.85-1.13 kcal/min) than in men (0.60-1.04 kcal/min).

The lower heat accumulation in men is a result in the first place of the more active heat emission by evaporation (from -40.0 to -172.1 kcal/h) than in women (from -30.2 to -125.0 kcal/h).

In women under increased temperature and physical loads the heat emission by convection and radiation is lower: the heat emission by convection is 39.8 or 5.7 kcal/h (in men--49.0; 7.7 kcal/h), and by radiation--81.8;--18.0 kcal/h (in men--96.8;--27.1 kcal/h). This confirms the data that the maintenance of thermal equilibrium in men is reached more completely (Masuko-Kentso, 1958; Khertig, Sardzhen, 1963; Vartinitiski et al., 1969; Vayon et al., 1972).

The heat accumulations that are the same in magnitude are accompanied by considerably more pronounced physiological reactions of the organism of women. Consequently, to preserve the normal physiological state of the female organism it is necessary to create more favorable microclimate conditions and decrease the physical loads.

This conclusion confirms the results of specially conducted studies with the limit time for fulfillment of physical work by men and women under conditions of high environmental temperature. Thus, the time for fulfillment of light physical work with air temperature 37-38° in women was 37 minutes shorter than in men, work of medium heaviness--36 minutes, and heavy--19 minutes 15 seconds.

Despite the shorter limit time of work for women under conditions of high air temperature, the degree of change in certain physiological functions was more pronounced in them.

Consequently, the physiological cost of fulfilling the physical work under conditions of high temperature is considerably higher for the female organism than for the male.

This should be considered in developing norms of microclimate for women who are doing physical work under conditions of a hot climate.

We consider it expedient to recommend reducing the level of permissible air temperatures for those production rooms where women are primarily working. Based on experimental studies the upper limit of permissible air temperature for women fulfilling light work is air temperature 29°, and the optimal--20-22°. With the fulfillment of physical work of average heaviness a level of permissible air temperature 25° is suggested, and for heavy physical work--20°.

As a result of the analysis of the conducted production studies it was established that in women the thermoregulatory shifts occur earlier than in men, under the same physical and thermal loads, which indicates the stress of the thermoregulatory apparatus with lower parameters of the air temperature.

Whereas in working men with light work and air temperature 24.0-26.9° the objective and subjective indices correspond to a comfortable thermal state, in almost 30% of the women a slight stress in the thermoregulatory apparatus is already /98 observed. The indicated difference in the thermoregulatory reactions depending on sex under identical thermal and physical loads that we found in the production conditions completely confirmed the results of experimental studies.

Analysis of the findings with respect to the parameters of the environmental temperature made it possible to isolate the comfortable and permissible temperature zones corresponding to the normal thermal state of the workers in the textile industry with regard for the meteorological conditions required by technology.

In the production rooms of the textile industry in which the main contingent of workers is women, the air temperature 17.0-23.9° corresponds to the comfort zone. Consequently, the comfort zone under production conditions is broader than the zone that we established for women under experimental conditions.

With parameters of the air temperature 24.0-26.9°, relative humidity 60-70% and air mobility up to 0.5 m/s almost in 70% of the working women a comfortable thermal state was observed, and in the others a light degree of stress of the thermoregulation was noted. Based on these data one should consider the air temperature 24.0-26.9° with relative humidity up to 70% and air movement rate up to 0.5 m/s the permissible.

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