EFFECT OF LEVEL OF HEAT PRODUCTION OF HUMAN SKIN THERMORECEPTOR FUNCTION

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An increase in heat production due to the intake of food simultaneously with elevation of the body temperature lowers the level of thermoreceptor function, especially of those sensitive to heat. The number of functioning thermoreceptors becomes maximal 1.5 h after taking food, returning to their initial level after 2 h.

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The role of thermoreceptors in body heat regulation is important, as many investigations into the effect of peripheral temperature stimulation on thermoregulatory processes have shown [3-6, 8]. However, the connection between heat regulation in the body and the level of skin thermoreceptor function has not yet been adequately studied.

There is evidence to suggest [1, 2, 5, 7] that the cold-receptor system is the predominant system in thermoregulation. It responds more rapidly and adequately to changes in the external environmental temperature than the heat-sensitive system [4, 7].

Changes in the intensity of heat production and associated changes in the internal human body temperature can be regarded as an adequate stimulus for physiological adjustment of the thermoreceptor system. The object of the present investigation was to study their relationship.

EXPERIMENTAL METHOD

The method chosen to study this problem was investigation of the functional mobility of cold and warmth receptors in the skin of the volar surface of the subjects' forearm. Ten points responding clearly to localized cold stimulation, applied by a cold thermoesthesiometer, were marked on the skin surface of one forearm of a fasting subject. In the same way, using a warmth thermoesthesiometer, ten warmth spots were localized on the other forearm. All points were marked with ink, and then at intervals of 2 min the initial background of function of the cold and warmth receptors was determined by touching each spot in succession. To increase the heat production and internal body temperature, the specific dynamic action of food was utilized. The number of functioning thermoreceptors in the subsequent stages of the investigation was determined immediately after taking food and 1.5 and 2 h later.

Simultaneously with establishment of the level of mobilization of the thermoreceptors, the body temperature of the subjects was measured in the axilla and the basal metabolic rate was measured from the degree of oxygen utilization in a metabolimeter.

Observations were carried out on 7 apparently healthy subjects (5 women and 2 men) aged 20-25 years. Each subject was tested 10-12 times. Altogether 80 observations were made.

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EXPERIMENTAL RESULTS

Immediately after the taking of food a slight increase in body temperature from 36.7 ± 0.05 to 36.9 ± 0.06° and an increase in oxygen consumption (from 236.5 ± 5.1 to 262.02 ± 4.9 ml/min; $P < 0.01$) were observed. Meanwhile the level of thermoreceptor function was lowered, particularly in the case of warmth receptors (before taking food 7.3 ± 0.38, after taking food 4.9 ± 0.33; $P < 0.001$).

The changes reached their maximum of intensity 1.5 h after the taking of food. Simultaneously with a more marked increase in oxygen consumption (to 289.2 ± 5.4 ml/min) and increase of body temperature (to 37.1 ± 0.07°), the number of functioning thermoreceptors reached a maximum. The level of mobilization of the warmth receptors showed the greatest increase (9.5 ± 0.79; $P < 0.001$). By the end of the second hour after eating, the investigated parameters had returned almost to their initial values.

It can be concluded from analysis of these results that the increase in heat production, with the consequent rise in the internal body temperature, under normal conditions evokes a response reaction of the thermoreceptor systems. The changes in the level of mobilization in this situation were greatest in the warmth receptors, the cold receptors being much more inert. Consequently, warmth receptors can be considered to give information primarily of temperature changes taking place in the body itself, while cold receptors, according to previous observations, provide information of changes in the external environmental temperature.

The small decrease in the level of mobilization of both warmth and cold receptors observed immediately after the taking of food can evidently be explained as a special case of the orienting reaction.

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