

METABOLIC HEAT ACCUMULATION IN THE BODY WHEN EXPOSED TO HIGH HEART TEMPERATURE

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Аннотация Температура оказывает существенное влияние на протекание жизненных процессов в организме человека и на его физиологическую активность. Процессы жизнедеятельности ограничены узким диапазоном температуры внутренней среды, в котором могут происходить основные ферментативные реакции.

Abstract: Temperature has a significant impact on the course of vital processes in the human body and on its physiological activity. Vital processes are limited to a narrow range of internal temperatures within which essential enzymatic reactions can occur.

Annotatsiya: Harorat inson tanasidagi hayotiy jarayonlarning borishiga va uning fiziologik faolligiga sezilarli ta'sir ko'rsatadi. Hayotiy jarayonlar muhim fermentativ reaksiyalar sodir bo'lishi mumkin bo'lgan tor ichki harorat oralig'i bilan cheklangan.

High temperatures cause intense sweating, leading to dehydration and the loss of mineral salts and water-soluble vitamins. These processes result in blood thickening, disruption of salt metabolism and gastric secretion, and the development of vitamin deficiencies. The acceptable weight loss due to evaporation is 2-3%. A 6% weight loss from evaporation impairs mental performance, and a 15-20% weight loss results in death. Systematic exposure to high temperatures causes changes in the cardiovascular system: increased heart rate, changes in blood pressure, and decreased cardiac function. Prolonged exposure to high temperatures leads to heat accumulation in the body, which can lead to a body temperature rise of 38-41°C, potentially resulting in heatstroke and loss of consciousness.

Low temperatures can cause hypothermia and hypothermia. When cooled, the body reflexively decreases heat loss and increases heat production. This decrease in heat loss occurs due to vasospasm (constriction) and increased tissue thermal resistance. Prolonged exposure to low temperatures leads to persistent vascular spasm and impaired tissue nutrition. Increased heat production during cooling is achieved by enhancing oxidative metabolic processes in the body (a 1°C decrease in body temperature is accompanied by a 10°C increase in metabolic processes). Exposure to low temperatures is accompanied by an increase in blood pressure, inspiratory volume, and a decrease in respiratory rate. Cooling alters carbohydrate metabolism. Severe cooling is accompanied by a decrease in body temperature and suppression of organ and system function. Б. Ядро и внешняя оболочка тела.

In terms of thermoregulation, the human body can be thought of as consisting of two components: the outer shell and the inner core.

The core is the part of the body that maintains a constant temperature (the internal organs), while the shell is the part of the body that experiences a temperature gradient (the tissues of the 2.5 cm thick superficial layer of the body). Heat exchange between the core and the environment occurs through the shell; changes in the shell's thermal conductivity maintain a constant core temperature. Thermal conductivity changes due to changes in the blood supply and perfusion of the shell's tissues.

The temperature of different parts of the core varies. For example, in the liver: 37.8-38.0°C, in the brain: 36.9-37.8°C. Overall, the human core temperature is 37.0°C. This is achieved through endogenous thermoregulation processes, which result in a stable equilibrium between the amount of heat produced in the body per unit of time (heat production) and the amount of heat dissipated by the body during the same time into the environment (heat loss). Human skin temperature in different areas fluctuates between 24.4°C and 34.4°C. The lowest temperature is observed at the toes, and the highest in the armpit. It is the armpit temperature that is usually used to determine body temperature at any given time.

According to average data, the average skin temperature of a naked person in comfortable air conditions is 33-34°C. There are daily fluctuations in body temperature, which can range as much as 1°C. Body temperature is lowest in the pre-dawn hours (3-4 AM) and highest during the day (4-6 PM).

Temperature asymmetry is also known. It is observed in approximately 54% of cases, with the temperature in the left armpit being slightly higher than in the right. Asymmetry in other areas of the skin is also possible, and an asymmetry of more than 0.5°C indicates pathology.

Heat Exchange. The Balance of Heat Production and Heat Loss in the Human Body.

Human life processes are accompanied by continuous heat production within the body and the release of this heat into the environment. The exchange of thermal energy between the body and the environment is called heat exchange. Heat production and heat loss are determined by the activity of the central nervous system, which regulates metabolism, circulation, sweating, and skeletal muscle activity.

The human body is a self-regulating system with an internal heat source, in which, under normal conditions, heat production (the amount of heat produced) is equal to the amount of heat released into the environment (heat loss). A constant body temperature is called isothermy. It ensures that metabolic processes in tissues and organs are independent of fluctuations in ambient temperature

Thermoregulation can be divided into two main types:

1. Physical thermoregulation:

- Evaporation (sweating);
- Radiation;
- Conduction;

- Convection.
- 2. Chemical thermoregulation.
 - Shrinking thermogenesis;
 - Non-shrinking thermogenesis.

Physical thermoregulation (the process that removes heat from the body) maintains a constant body temperature by changing the body's heat loss through conduction through the skin (conduction and convection), radiation, and water evaporation. The release of constantly generated heat in the body is regulated by changes in the thermal conductivity of the skin, subcutaneous fat, and epidermis. Heat transfer is largely regulated by the dynamics of blood circulation in heat-conducting and heat-insulating tissues. As the ambient temperature increases, evaporation becomes dominant in heat transfer. Conduction, convection, and radiation are passive heat loss mechanisms based on the laws of physics. They are effective only when a positive temperature gradient is maintained. The smaller the temperature difference between the body and the environment, the less heat is lost. At constant temperatures or at high ambient temperatures, these mechanisms are not only ineffective, but also cause the body to heat up. Under these conditions, the body only utilizes one mechanism for heat loss: sweating.

At low ambient temperatures (15°C and below), approximately 90% of daily heat loss occurs through conduction and radiation. Under these conditions, visible sweating does not occur. At air temperatures of 18-22°C, heat loss through conduction and radiation decreases, but the body's heat loss through evaporation of moisture from the skin's surface increases. When the ambient temperature rises to 35°C, heat loss by radiation and convection becomes impossible, and body temperature is maintained solely by water evaporation from the skin surface and the alveoli of the lungs. In high humidity, when water evaporation is impeded, overheating and heatstroke can occur.

A person at rest, with an air temperature of approximately 20°C and a total heat loss of 419 kJ (100 kcal) per hour, loses 66% of the body's total heat through radiation, 19% through water evaporation, and 15% through convection. Chemical thermoregulation (the process that generates heat in the body) is achieved through metabolism and the heat production of tissues such as muscle, liver, and brown fat. This means that it alters the level of heat production by increasing or decreasing the intensity of metabolism in the body's cells. Energy is released during the oxidation of organic matter. Some of this energy is used to synthesize ATP (adenosine triphosphate, a nucleotide that plays a crucial role in energy and substance metabolism in the body). This potential energy can be used by the body for further functioning. All tissues are sources of heat in the body. Blood heats up as it flows through tissue. An increase in ambient temperature causes a reflexive decrease in metabolism, which reduces heat production in the body. A decrease in ambient temperature reflexively increases the intensity of metabolic processes and enhances heat production. Chemical thermoregulation is activated when physical thermoregulation is insufficient to maintain a constant body temperature.

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