DEPENDENCE OF HUMAN PHYSIOLOGICAL STATUS ON BIOPHYSICAL PARAMETERS.

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Annotation. *The dependence of the physiological state of man on biophysical parameters, the application, importance and change of thermodynamic parameters in the human body are described.*

Keywords: *Thermodynamic parameters, thermoregulation, energy balance, heat transfer, heat warfare, application of the first and second laws of thermodynamics to the human body.*

Due to the fact that the body is in constant contact with the external environment, changes in environmental factors have a significant impact on the body. Human body temperature is normally 36.2-36.8 oC and is almost constant. Any change in the temperature of the environment affects the function of homeostasis in the human body, and a response is formed to this change.

People living in high-temperature areas (Africa, deserts, deserts) are anatomically and physiologically adapted to high temperatures. An example of anatomical adaptation is body color, which helps keep them warm. Examples of physiological adaptation are the ability of the visceral organs to adapt to high temperatures, as well as the thickening of the skin.

This begs the natural question: What is the energy balance of the body? We know that the food consumed by the human body is spent on: tissue regeneration, reserve formation, growth in the young organism, and so on. However, the food consumed by the body is mainly used to compensate for the energy expenditure that occurs during the body's life activities. This energy is basically the heat needed to maintain body temperature and replace the heat dissipated into the environment, as well as the heat equivalent to the mechanical energy expended in various activities that take place in the body, including human performance. In the human body, the energy balance is taken in relation to the state of the body, ie the state in which the body has energy expenditures and these energy expenditures are adjusted to the amount of heat released during digestion. In this case, the first law of thermodynamics in relation to the organism is defined as follows: The amount of heat released in the body during digestion is used to replace the part of the heat released to the environment and the work done by the organism.

It is not difficult to measure the mechanical work that a person can do under certain conditions. These measurements are carried out in accordance with the laws and formulas of physics. However, it is much more difficult to determine directly how the organism gives off heat to the environment.

The process that keeps body temperature relatively constant in humans is called thermoregulation. Thermoregulation is mainly divided into chemical thermoregulation,

which is related to heat generation, and physical thermoregulation, which is related to the transfer of heat to the environment.

The body transfers heat to the environment through thermal conductivity, convection, radiation, and heat wastage in evaporation. The ratio between them depends on the temperature, humidity and movement of the environment around the body, when all other conditions are the same. In this case, the environment is not only the environment that directly affects the body (for example, air, water, etc.), but also objects at a certain distance (for example, room walls, appliances, etc.) that can participate in heat exchange through radiation.) should also be understood.

Convection heat loss is usually caused by air. The thermal conductivity of air is very small, but convection can significantly increase heat transfer. In addition, air convection helps moisture to evaporate from the skin's surface. Attempts are made to limit the possibility of air movement to reduce convection. To do this, a person wears clothes and insulates the walls of the dwelling with porous materials, and porous materials have inert air.

The outer layer of the environment, which is directly adjacent to the skin, is also important for storing heat inside the body, because it is in this layer that the body's main heat exchange with the surrounding environment takes place. In humans, this layer is the body's main heat shield, along with the air between the skin and clothing. The temperature on the surface of human clothing drops to 15-18 ^{o} C.

Heat loss through radiation is mainly from the surface of clothing and some exposed areas of the body. Heat is usually radiated to the surfaces of surrounding objects at slightly lower temperatures. This is because, according to the second law of thermodynamics, in heat transfer, heat always passes from higher to lower bodies.

Moisture evaporates from the skin and lungs. On average, a person emits about 350 grams of water vapor per day, along with the air he breathes. When sweating is normal, about 500 grams of sweat evaporates from the surface of the skin (ambient temperature 16-18 ^{o}C) per day. These numbers increase significantly when the ambient temperature rises or the muscles work hard.

When the ambient temperature is low, the heat transfer increases mainly due to radiation. When the ambient temperature is high, the loss through thermal conductivity and radiation is reduced. Under these conditions, heat is provided by the evaporation of perspiration, which increases significantly. If this is not enough, thermoregulation will be disrupted. This condition is called heat warfare.

When the body temperature rises too high, the body's heat output increases and heat production is temporarily balanced. As the temperature drops, the heat released from the body increases.

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