Thermoregulation

Thermoregulation

- This is a set of physiological and psychophysiological processes and mechanisms that are aimed at maintaining a relative constancy of body temperature.

Temperature

- It can have a damaging effect on the body.
- It changes during physiological and pathological processes.
- It provides optimal enzymatic reactions.

Temperature

- The surface temperature of the body (shell) is the temperature of the skin and surface mucous membranes.
- The temperature of the deep tissues (core) is the temperature of the blood and internal organs.

Skin Temperature

24.4 – 33.5° C

It depends on:

- Perfusions,
- Environment temperature,
- Subcutaneous fat,
- The presence or absence of clothing.

Rules for Measuring Temperature

- The temperature is measured on the places of the lowest heat transfer.
- The temperature is measured on places close to large vessels.
- Measurements are made in a state of physical and mental rest.
- Measurements are made at a strictly defined time of day.
- Measurements are made at room temperature.

Methods for Studying Body Temperature

- Thermometry
- Thermovisiography

Temperature Depending on the Place of Thermometry

- Rectal temperature – 37.2 – 37.5°C
- Sublingual temperature – 36.8 – 37°C
- Axillary temperature – 36.4 – 36.9°C

- In newborns, the temperature is measured in the inguinal fold.

Factors That Affect Body Temperature

- Time of day (daily temperature fluctuations are 0.5-0.7°C).
- Phase of the menstrual cycle.
- Psychoemotional state.
- Muscular work.
- Phase of sleep.

Heat Balance

- This is the balance between heat production and heat transfer.

Mechanisms of Regulation of the Heat balance

- Chemical thermoregulation (heat production).
- Physical thermoregulation (heat transfer).

Mechanisms of Chemical Thermoregulation

- Non-contractile thermogenesis
- Contractile thermogenesis (tremulous)

Non-contractile Thermogenesis

- This is an increase in the metabolic activity of internal organs (liver, lungs, kidneys, gastrointestinal tract).
- In newborns, the most intense heat production is in the brown adipose tissue.
- In an adult, brown adipose tissue is almost absent.

Factors Affecting Non-contractile Thermogenesis

- The value of the main exchange.
- Specific dynamic action of food.
- The intensity of metabolism in the internal organs.

Contractile Thermogenesis (Tremulous)

- This is an increase in heat production in the muscles as a result of their contraction.

Types of Contractile Thermogenesis

- Involuntary
- Voluntary

Involuntary Contractile Thermogenesis

These are involuntary muscle contractions of slow motor units (increased muscle tone) and tremors.

Voluntary Contractile Thermogenesis

These are voluntary muscle contractions due to rapid motor units that lead to an increase in motor activity.

Mechanisms of Physical Thermoregulation

- Radiation
- Conduction
- Convection
- Evaporation

Radiation

- This is the transfer of heat from a warmer body to a colder one using infrared rays.
- This is the main way of heat transfer at rest.
- **Radiation depends on:**

- from the surface area of the body,

- from the difference in temperature of the skin and the environment.

Conduction

- This is the transfer of heat to solid objects or liquids by direct contact.
- **The conduction depends on:**

- temperature differences of the contacting bodies,
- contact areas,
- contact time,
- thermal conductivity of the contacting bodies.

Convection

- This is the return of heat to the surrounding air.
- **Convection depends on:**

- air temperature,
- the presence of wind.

Evaporation

- This is the return of heat from the surface of the body due to the transition of water from a liquid state to a gas.
- This is the main way of heat transfer during physical activity and at high temperature of environment (30-37°C).
- **Evaporation depends on:**

- air temperature,
- air humidity.

The Thermoreceptors

- Receptors of the skin and subcutaneous vessels.

It is dominated by the cold receptors.

They respond to a temperature of 15-34 °C.

- Receptors of internal organs and the Central nervous system.

It is dominated by the thermal receptors.

They respond to a temperature of 34-43 °C

Thermoregulation Center

- The center is located in the hypothalamus.
- It consists of 3 groups of neurons.

Group 1 is a temperature-sensitive (sensory neurons).

These neurons receive impulses from receptors.

Group 2 is the neurons of the «installation point» («set point»).

These neurons store information about the proper temperature (normally 37.1-37.2 °C).

Group 3 is efferent neurons.

These neurons are responsible for regulating the processes of heat production (posterior hypothalamus) and heat transfer (anterior hypothalamus). If the body temperature does not match the programmed ideal temperature, efferent neurons are activated.

Hyperthermia is an increase in internal temperature above 38 °C.

Hypothermia is a decrease in the internal temperature to 35 °C.

Fever

- This is a condition in which the center of thermoregulation stimulates an increase in body temperature.
- This is because the set temperature (the" setting point") is shifted towards higher values.
- This occurs as a result of the action of special substances (pyrogenes) that can be produced by pathogenic microorganisms.

After studying the lecture, you need to be tested using the Google form service. Please fill in the fields full name, faculty and group number.

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