Overview

- Physiology of Heat Stress
- Causal factors
- Heat Disorders & Health Effects
- Control

Physiology of Heat Stress

- During both rest and activity, the human body tries to maintain an internal temperature of 98.6°F.

Physiology of Heat Stress

- Hot weather, heat sources, and hard work raise the body's core temperature.
- Heated blood is pumped to the skin's surface, where body heat transfers to the environment, if cooler.
- If heat has to be shed faster, sweat can be used to cool the body.

Physiology of Heat Stress

- After 2-3 hours, a person is likely to:
  - Lose endurance
  - Become uncomfortable
  - Feel hot
  - Become thirsty

Physiology of Heat Stress

- The longer a body sweats, the less blood there is to carry essential nutrients and oxygen
- After 3 hours of dehydration, a person may experience:
  - Headaches
  - Muscle fatigue
  - Loss of strength
  - Loss of accuracy and dexterity
  - Heat cramps
  - Reduced alertness
  - Nausea
Causal Factors

- Age, weight, degree of physical fitness
- Degree of acclimatization, metabolism
- Intercurrent illnesses (e.g., HTN)
- Drug therapy (phenothiazines, diuretics, alcohol)
- Type of clothing
- Prior heat injury predisposes an individual to additional injury

Acclimatisation

- Occurs over a period of weeks
- Adaptive mechanisms:
  - Stimulation of the sweating mechanism with increased sweat volume and reduced sweat sodium content
  - Sec. hyperaldosteronism to maintain body sodium balance

Heat Disorders & Health Effects

- Heat Stroke
- Heat Exhaustion
- Heat Cramps
- Heat Collapse
- Heat Rashes
- Heat Fatigue

Output & Productivity

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<th>Loss In Work Output (%)</th>
<th>Loss In Accuracy (%)</th>
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HEAT STROKE

- Occurs when the core body temperature rises above 40°C
- This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict
- Heat stroke is a medical emergency, severe and life threatening condition

- Headache, nausea, vomiting
- Coarse muscle tremor
- Confusion; aggression; LOC; convulsions
- Loss of sweating (due to failure of thermoregulatory mechanisms), hot and dry skin

Heat stroke - complications

- Hypovolaemic shock
- Lactic acidosis
- Disseminated intravascular coagulation
- Rhabdomyolysis
- Hepatic and renal failure
- Pulmonary and cerebral oedema

Heat stroke - Treatment

- Should be managed in ICU
- Rapid cooling by spraying with water, fanning, and ice packs in the axillae and groins
- Cold crystalloid iv. fluid replacement with monitoring
- Sedation with benzodiazepines may be required
- Investigation done to assess the complications

HEAT EXHAUSTION

- Core body temperature is between 37°C and 40°C
- Occurs after prolonged exertion in hot and humid weather, profuse sweating and inadequate salt and water replacement

Heat Exhaustion

- Signs and symptoms
  - Headache, nausea, vertigo, weakness, thirst, tachycardia, irritability, fatigue
### Heat exhaustion - Treatment

- Removed from the hot environment
- Fluid replacement eg. oral rehydration solution (both salt and water) – adult patients may require 5 litres or more positive fluid balance in the first 24 h
- Active cooling eg. cool sponging
- Untreated heat exhaustion may progress to stroke

### Heat cramps

**Treatment:**
- Symptoms usually respond rapidly to salt replacement

**Prevention:**
- Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments

### Heat cramps

- Painful muscle contractions, most commonly in the legs of young people following vigorous exercise and profuse sweating in hot weather
- No elevation in core temperature
- Mechanism: extracellular sodium depletion

### Heat syncope

- Similar to vasovagal faint
- Related to peripheral vasodilatation
- The brain does not receive enough oxygen because blood pools in the extremities
- The onset of heat collapse is rapid and unpredictable

### Heat Rashes

- Most common problem in hot work environments
- Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive
**Heat Rashes**

- Prickly heat occurs in skin that is persistently wetted by unevaporated sweat.
- Heat rash papules may become infected if they are not treated.
- In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

**Heat Fatigue**

- A factor that predisposes an individual to heat fatigue is lack of acclimatization.

**Heat fatigue Signs & Symptoms**

- The signs and symptoms of heat fatigue include impaired performance of skilled sensorimotor, mental, or vigilance jobs.

**Heat fatigue - Treatment**

- There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

**Control**

- The five major types of engineering controls:
  - Ventilation
  - Air cooling
  - Fans
  - Shielding
  - Insulation