

HOT WEATHER FLYING

HEALTH HAZARDS OF HEAT AND HUMIDITY

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HEAT STRESS

- Heat exchange $>$ Heat loss
- Causes distortion of physiology
- Interferes with functional capacity for work

HYPERTHERMIA

- Occurs in ambient temperatures of $>90^{\circ}\text{F}$.
- Ambient humidity $>75\%$ increases occurrence of hyperthermic stress
- Occurs due to decreased capacity for thermal exchange

THERMAL EXCHANGE

- Basal heat production = 65kcal/hr
- Causes 2.2°F./h rise in core temperature
- Heat dissipated via:
 - Radiation (60%)
 - Sweat evaporation (22%)
 - Conduction/convection (18%)

ENVIRONMENTAL FACTORS

- Radiation decreases if $\text{Temp}_{\text{air}} > \text{Temp}_{\text{skin}}$
- Radiation/convection requires air movement
- Sweating occurs to offset imbalance
- Sweating dissipates 650 kcal/hr through evaporative cooling
- Sweating inefficient in humid conditions
- Inefficient sweating causes excessive water loss and dehydration

THERMOREGULATION

- Mediated by:
 - Cardiac output
 - Peripheral blood flow
 - CNS (hypothalamus)
 - Endocrine system

EFFECTS OF THERMAL STRESS

- As core temperature rises:
 - Heart rate, respiratory rate and metabolic rate all increase
 - Gastric function, renal function decrease
 - Work capacity/tolerance decreases
 - Stress susceptibility increases
 - Fatigue threshold is lowered

EFFECTS UPON AVIATOR PERFORMANCE

- “Downstream” effects of Benzinger reflex:
 - Dilation of skin blood vessels/sweating
 - Drop in central blood volume
 - Increased stress response
 - Decreased GI tone...increased nausea
 - Change in vestibular function...increased motion sensitivity

AVIATOR EFFECTS CONTINUED...

- Decreased venous return to heart
- Heart rate increases in compensation
- Cardiac output fluctuates leading to hypoperfusion...decreased CNS bloodflow (decreased reaction time, confusion)
- Increased baroreceptor response...nausea
- Peripheral vasoconstriction leads to cold sweats, decreased muscle reaction

FACTORS ADVERSELY AFFECTING HEAT STRESS TOLERANCE

- Obesity
- Lack of physical fitness
- Alcohol
- Inadequate/irregular salt, food intake
- Under hydration
- Illness

PREVENTION

1. Assessment:

- Evaluate temperature/humidity
- Get Wet Bulb Globe Thermometric (WBGT) reading if possible
- Utilize Heat Index as guide

ACTIVE PREVENTION

- Hyper-hydrate: 8-20 oz. cold water every 30-60 minutes in temps $>90^{\circ}\text{F}$. for two hours before peak heat onset/exposure
- Maintain hydration: 8-10 oz. cold water every 30-60 minutes of heat exposure
- Avoid sugared/caffeinated beverages
- Electrolyte replacements not necessary

PREVENTIVE RELIEF

- Seek shade, breeze, AC at 30-60 minute intervals
- Use cold compresses on neck, forehead and wrists
- Avoid direct exposure to sunlight and/or unventilated confined spaces
- Wear light, ventilated clothing

ACCLIMATIZATION

- Achieved within 7-14 days
- Must have sustained exposure with 200-300 kcal/hr work load for 1-2 hours
- Strain cannot be excessive
- Gradually increase work time in heat starting with 30 minutes, increasing by 15 minutes first week, 30 minute increases second week

ACCLIMATIZATION EFFECTS

- Sweating becomes more “efficient” (1500 mL/h vs. 700 mL/h non-acclimatized)
- Decreased loss of electrolytes (diminished loss of sodium in sweat)
- Plasma volume preserved
- Cardiac output maintained
- Decreased stress response(s)

HOT WEATHER FLYING TIPS

- “Preload” water before flying
- Take cold water with you, drink often
- Ventilate cabin as much as possible
- Use cold compresses if necessary
- Avoid salty foods, sugary drinks/snacks
- Cool off often (wash face, wrists)
- Dress to maximize ventilation
- Eat frequent, light meals