

# Heat Illness Prevention & Hydration



*The body adapts well to high-heat and heavy exertion when properly trained and hydrated. As long as you are hydrated with proper electrolyte balance, can sweat and evaporate your sweat to decrease elevated core temperature, and "Fit for Duty" (acclimated to your physical exertion workloads), you should be able to avoid most if not all heat-related problems.*

**Heat Terms:** Here are the range of conditions from mild to severe, but remember in extreme situations, your status can change in minutes—not hours!

- Heat Cramps: Mild illness from large fluid & salt loss; easily treated.
- Heat Exhaustion: Moderate illness after continued exertion & dehydration; can be *accumulative* over many days. \*This is your body's "safety brake!"
- Heat Illness: Serious medical conditions of cramps, exhaustion, syncope, & stroke.
- Heat Stroke: Serious illness; *rapid increase in core temp* beyond ability to control; medical emergency.
  - Classic Heat Stroke=Dehydration present
  - Exertional Heat Stroke (EHS)=Dehydration NOT a factor!
  - EHS Heat Storage: Over half of heat can remain after 60 minutes!
  - EHS Full Recovery Window=60 minutes to return to normal range!!!
- Signs: Mental (disoriented, confused, dizzy, irrational, irritable, unusual behaviors) and Physical (poor balance/muscle function, collapse, hyperventilation, vomit, diarrhea, seizure, or coma).

**Environmental Risk Factors:** There are *MANY* ways to get into heat trouble beyond dehydration! Make sure to also factor in the environment.

- Air Temperature
- Humidity
- Radiant Heat (sun, objects, engines)
- Conductive (ground, objects)
- Wind
- Exertion & Duration
- Clothing & PPEs

**Heat Generation:** Heat is generated in multiple ways—not just with working hard or being in the open sun.

- Radiative: Sun
- Physical Activity: Exercise, Work
  - Muscle "work" *creates* metabolic heat which must be *transferred out* of body to maintain proper operating temperature.
- External: Hand Warmers, Fire, Liquids

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**Mechanisms of Heat Loss:** *There are MANY ways to decrease heat in your body—take advantage of some as appropriate to keep yourself safe!*

- Evaporation: Liquid changes to vapor
- Conduction: Transfer from warm object to cooler one
- Convection: Wind pulls heat off
- Radiation: Infrared emissions lessened by darkness
- Respiration: Ambient air takes inner heat & humidity

**Heat Acclimatization:** *It takes the body time to adjust to high heat. You are at greatest risk with a rapid increase in air temperature or extreme increase of exertional work in a short amount of time.*

- Heat acclimatization is best-known protection against exertional heat stroke & heat exhaustion.
- Acclimatization requires gradual increase of duration & intensity.
- *Break in period 4-14 days* (up to 12 weeks) of regular work in heat at least 2 hours per day.
- *Most critical period is first 4 days!!!*

**Hydration Basics:** *Remember—as long as you are hydrated, sweating, and able to evaporate the sweat within your fitness level, you will probably avoid heat problems.*

- Drink before thirsty.
- Urine should be nearly clear or light yellow.
- Replace what is removed.
- Find taste you like that works for hydration.
- Cooler is better than room temperature.

**Hydration Fluids:** *For most people, drinking plain water will be fine, but note in extreme conditions for over one hour, electrolyte balance becomes more important and even critical.*

- Plain Water: Fine for <60 minutes @ in low to moderate conditions
- Fitness Water: Promotes more drinking/hydration due to flavor
  - ↑Flavor = ↑Drinking
  - Some have too many calories!
- Sport Drinks: (Glucose + Electrolytes)
  - High energy for athletes & extremes
  - Sodium primary electrolyte
- Specialized Sport Drinks: ↑ concentration rates

**Dehydration Effects:** *Excessive fluid loss starts shutting down your protective cooling system which means the situation can go from bad to dangerous FAST!*

↓ ability to lose heat, exertion intensity, blood volume

↑ blood thickness/viscosity, heart rate, perceived exertion

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**Hydration Complications:** Many factors beyond air temperature and how much you drink can complicate your hydration levels—be aware of them!

- Diuretics: Promotes fluid loss
- Rx Drugs: Can promote fluid loss
- Caffeine: Not major factor with “normal” use
- Metabolic Enhancers: Raises body temperature
- Alcohol: Promotes fluid loss

**Summary:** The thermoregulatory system is both complex and amazing, but here are the fundamentals you need to understand and apply to stay safe in the heat.

- **Stay Hydrated:** If you are drinking enough, you keep sweating. If you are sweating and evaporate the sweat, you will decrease your inner core temperature which regulates your heat.
- **Acclimate:** It takes days to get used too high heat. *The critical period is the first four days.* You also need to be acclimated to the workload—as in “Fit for Duty” because if you are not used to the extreme metabolic loads and resulting core temperature increases, you can have serious heat issues within one hour or less!
- **Sodium:** Sodium is the driver with heat cramps and the primary electrolyte of concern—not potassium. When people cramp, it will almost always be sodium imbalance along with muscle fatigue.
- **Accumulative Dehydration:** Many people get into heat problems on days 2-3 because on day 1 they did not rehydrate. Don’t come in the 2<sup>nd</sup> or 3<sup>rd</sup> day with dehydration from the day prior!!!
- **Heat Strokes:** You do NOT have to be “dehydrated” to have a heat stroke! Any time you exceed your body’s ability to get rid of high internal core temperature heat, you can have a heat stroke whether this be due to dehydration, or as often the case, you create more heat from hard work faster than your body can dissipate.
- **Multiple Factors:** There are many factors with dehydration and heat illness. Paying attention to the basics will keep most out of trouble, but don’t forget other factors like medications, environmental (clothing, heat from objects, etc.), along with alcohol and excessive caffeine consumption.
- **Put back in what you lose!** It’s that simple.
- **Buddy System:** Watch out for each other. If you see abnormal behaviors or a problem with function, take immediate action for prevention and safety!

\* Ron Jones (7.23.11)