

Heat and Your Internal Engine Personal Performance

It is more serious than you think

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Heat can be deleterious to your health, your driving performance, and indirectly the health of others. It is not just your car engine that gets "drained" on those 90⁰+ days at the track. Being physically fit is just as important to your lap times as is checking those tire pressures. Your internal body temperatures can kill you. You might be surprised to learn that in the U.S. alone, more than 4,000 people die of heat stroke per year, and it is the second leading cause of death in young athletes.

Early recognition, preventative measures, aggressive treatment, can all decrease your risk of this significant health problem. We will discuss the concept of thermoregulation, how heat-related illnesses develop, and the concept of mild to moderate heat exhaustion. Heat illness represents a continuum that can rapidly deteriorate into heat stroke, which is a potentially deadly emergency. Finally we will finish with the best medicine...an ounce of prevention.

The concept of thermoregulation is simple. Your body temperatures is dependent on the balance between heat production and heat loss. If you think about it, your body temp is maintained within an amazingly narrow range. Heat production results from your body's internal engine and absorption of heat from external sources. Simply put, strenuous physical activity can increase your body's heat production from 60kcal/hour to 900kcal/hour! Core body temperature would increase 2⁰F/hour at rest without cooling measures.

So, how does your body lose all this heat? This is important because prevention can start here. There are four major ways your body can dissipate heat. Radiation occurs when the air temp is lower than your body temp and can account for 65% of your cooling! As you can see, when the track temp (98⁰), radiation can be a major source of heat gain. Convection is heat loss to air and to water vapor circulating around your body. It can help 10-15% of heat loss. Again, it does not work as ambient temp rises. It is affected (helped) by wind velocity. Conduction is the transfer of heat from warmer to cooler objects by direct physical contact. This is interesting. Normally, it accounts for 2% of heat loss, but immersion into cooled water can increase heat loss through conduction by a factor of 32. Your COOL SHIRT can really be helpful to your thermoregulation. Finally, evaporation is extremely important. Sweat and "insensible water loss" (doctor talk) can result in 25% of total heat loss. (Panting animals are the best example of the latter and all though not significant for us it is for all those TRACK DOGGIES.)

All these are great except the first three mechanisms require a thermal gradient - i.e. when the outside temp is greater than your body temp, the body's major mechanism of losing heat stops. All you have left is evaporation. Well, throw on that 3-layer nomex suit, gloves, helmet, the internal car temp, and you might as well be in the sauna at your favorite spa. Would you sit there for an hour and a half without relief? I doubt it. It is not very healthy.

In summary, prevention is the best medicine

- Consider heat acclimation before summer driving events. Remember that adaptation can take 7-14 days.
- Ensure appropriate fluids at all times. Drink, drink, drink. At least 6-8 oz. every 15 minutes is recommended with any physical activity in the heat. Thirst is a poor guide to dehydration.
- Drink both water and electrolyte solutions. Increase your dietary salt intake. (Salt tablets are not recommended.)
- Get cooled off. A Cool Shirt is great and visit a friend with air conditioning as often as you can.
- Water in you race car for any track events greater than 30 minutes.
- "SHARE-A-RIDE": be sensible. A one hour Enduro or greater in the heat is not smart by yourself. This is especially true if you have any risk factors mentioned above. (Insulation, medications, lack of acclimation.)
- Stay physically fit.
- Do not drive if you are sick. If you need a Doctor's excuse the Club knows a good one.
- This article will be shortly followed by one on frost bite and hypothermia.

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Heat and the Cold Hard Facts

Can I adapt to heat stress before an event? Yes, but the process of acclimatization occurs gradually over days to weeks. It does not occur in one weekend warrior visit to the track. It is also lost in 4-7 days!

So, how does heat related illness develop? It becomes clear after looking at thermoregulation that there are 3 important variables that affect your body's temp regulation. Any factor that affects one of these can lead in HEAT STRESS.

1. Outdoor temp or environmental heat load predispose to heatstroke epidemics. Just listen to the news every summer. The ability of people to remove themselves for the hot environment can be life saving. Just 2 hours/day in an AC trailer or registration area can dramatically decrease your risk of heat stroke.
2. There are 3 important elements that increase your internal heat production. Your heat burden is dramatically increased if you have a fever, with physical activity, and with certain prescription, recreational, and over-the-counter drugs. Exercise can increase your core temp by 1.8°F every five minutes! That is impressive. Many drugs can increase heat production and make you more susceptible to heat illness, especially aspirin, cocaine, and anti-depressants.
3. Thirdly, there are seven factors that impair your body's ability to dissipate heat, some very important to us.
 - Dehydration increases your body temp big time. You cannot sweat if you are dehydrated. If you stop sweating, you have advanced dehydration, Do not let this be your guide to fluid intake. Trips to the bathroom are a much better indicator.
 - Heart disease (i.e. even high blood pressure), you need a good pump to disperse heat. It is important to note that heat can cause irregular heartbeats, heart attacks, and strokes! All heart medications (blood pressure too) (diuretics, B-blockers, calcium channel blockers, all commonly taken) can blunt your hearts ability to handle heat stress.
 - Clothing: nomex suits prevent evaporation of sweat, a major heat gain problem! "multilayer occlusive garments can cause heatstroke with just a few short heat exposures."
 - Skin disease: sunburn and rashes can decrease sweating.
 - Many drugs including alcohol.
 - "Closed space, no wind."

Many Club members have asked about different heat illnesses, so now is the time for an explanation of the different types you may suffer from. Really, heat illness is a spectrum that starts with minor illness at the one end and merges indistinctly into heat stroke on the other. Heat stroke represents total failure of thermoregulation and is a TRUE EMERGENCY. It may affect anyone, regardless of your fitness level and acclimatization.

MINOR

Heat edema - self-limited, mild swelling of the hand and feet.

Prickly heat - itchy rash found over clothed areas of the body due to blockage of sweat pores. Prevention: light and loose clothes, avoid sweating (cool place) antihistamines (make you sleepy), and chlorhexidine cream.

Heat syncope (fainting) - usually due to dehydration and vasodilatation. Not serious. Drink more fluids.

Heat cramps - painful, involuntary, spasmodic contractions. Occurs in people who are sweating liberally and replace fluid loss with water only. The cause is a loss of both sodium and potassium. Prevention includes adequate dietary salt intake, and commercial electrolyte beverages. Salt tablets by themselves are not recommended. They can irritate your stomach and cause vomiting.

MODERATE

Heat Exhaustion - In its milder form presents with a flu-like illness including muscle and body aches, headache, nausea and vomiting, muscle cramps, weakness, and fatigue. Your core body temp is normal or mildly elevated. Treatment: salt and fluid replacement. Depending on degree may need IV hydration (BIG NEEDLE.) Cooling measures.

SEVERE

Heat stroke - This can mimic heat exhaustion early on. This is a life-threatening emergency and has taken the life of a few good athletes. This disease respects no one. Thermoregulation fails, core body temp rises, mental dysfunction occurs and wide spread organ injury which can all be permanent! Irritability, bizarre behavior, combative, hallucinations, unbalanced gait, seizures, and confusion. Treatment: lower body temperature immediately, rapid transport to the ER.

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