While exertional heat illness is rare and most common in race horses, owners and riders should know it can affect any high-performing equine under extreme conditions. *WINHORSE/ISTOCK PHOTO*

Too Hot To Handle

Exertional heat illness can cause a cascading series of problems for your horse, and quick diagnosis is crucial.

By **CHRISTINA KEIM**

You finish your conditioning ride and lead your horse into the barn. You noticed he felt a little underpowered towards the end of your last gallop set, but you chalk that up to the unseasonably hot and humid weather. He wasn't even sweating that much, you think, so he must be OK.

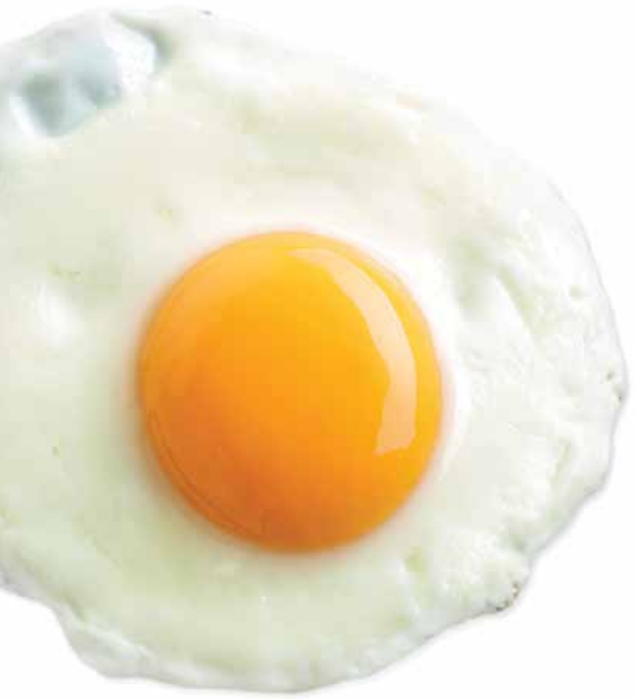
Once you get him into the barn, however, he starts first shaking his head and then kicking out with a hind leg. He seems irritable, so you look all over for the fly that must be bothering him, but you can't find it. His skin feels extra hot when you touch it, so you try and get him into the wash rack as quickly as possible to hose him off. His behavior continues to deteriorate, however, and soon he's trying to bolt away from you, acting panicked and confused, then running over you like he can't even see.

Then, he collapses. You yell for another rider's help and grab your phone to call your veterinarian—not yet aware that it might already be too late to help your horse.

Exertional heat illness is a complex phenomenon that may occur when an organism's temperature controlling (thermoregulatory) mechanisms fail to respond effectively to a rapid and sustained increase in core body temperature (hyperthermia). Although its incidence and treatment have been well-documented in the human medical realm, EHI appears rarely in equine veterinary literature, leading to a lack of education and awareness of the condition in the veterinarians, trainers, riders and caretakers most likely to be on the front lines of an acute attack.

Meg Brownlow, BVSc, MVSc, DipVetAnaes, MNurs, MPH, MBMSc, MANZCVs, an Australian-based researcher, spent more than three decades working with Thoroughbred race horses at the hottest tracks in New South Wales. She observed that after racing under extreme environmental conditions, some horses displayed various types of unusual behavior, including kicking out for no apparent reason, ataxia and confusion, and sudden collapse.

Upon reviewing the literature, she concluded these horses were suffering from a disorder similar to EHI in humans. In 2016, she received a research grant from Racing Australia to collate observations and measurements taken from horses racing in extreme weather. Her work was published in the Australian Veterinary Journal in 2021, and it has helped to better define the environmental conditions under which EHI might occur, as well as establish best practices for treatment and prevention.



"Heat is toxic to all cell membranes," said researcher Meg Brownlow. "Dr. Ollie Jay, one of the human pioneers in [Australia] in the arena of human heat illness reminds us, 'You can't uncook an egg.' This is a sobering reminder of the effect of heat on body tissues." *MAGONE/ISTOCK PHOTO*

Brownlow's team concluded that EHI is a complex illness that may occur when metabolic heat caused by intense exercise, combined with extrinsic and intrinsic variables, sets off a cascade of dysfunction within the body. EHI has been documented most often in Thoroughbreds during the post-race recovery phase, and its varied symptoms can mimic signs of other, better known conditions, leading to misdiagnosis and a delay in treatment. Unfortunately, without both prompt pharmacological intervention and immediate efforts to rapidly reduce core body temperature, EHI can be a life-threatening condition. EHI is most common in race horses and endurance horses, and it is a distinct condition from the more common problem of heat exhaustion, but it can happen in other disciplines under extreme conditions.

"Heat illness is a concern for sport horses," said Fernando Marqués, DVM, DACVIM, DACVSMR, of Palm Beach Equine Clinic in Wellington, Florida. "It's a significant problem in areas where the environment is really hot and humid, and the intensity of the exercise is high, like in endurance racing."

"Cells cannot function in high temperatures, and they start suffering. It's not just one body system; it's every body system that will suffer from heat shock."

—DR. FERNANDO MARQUÉS

WHEN A GOOD SYSTEM GOES BAD

During periods of intense exercise, the metabolic activity required to activate muscles produces more heat than a horse's body can dissipate; this heat will be stored internally until the animal returns to either lower intensity exercise or rests completely. How effectively the horse will be able to dissipate this excess heat will be impacted by external variables, such as air temperature, humidity levels and movement of air over the skin.

"If you think of the physiology aspect of it, there is a lot of energy that goes into intense exercise," said Marqués. "You have to remove that heat from the body in order for cells to function."

Fortunately, the horse has developed several highly efficient thermoregulatory mechanisms to draw stored heat from the body's core and release it into the surrounding environment, thereby returning the body to homeostasis.

"The main mechanism of heat loss is evaporative cooling through sweat," said Marqués. "The sweat has to evaporate to release the heat from the body."

Under ideal conditions, the horse's ability to sweat heavily over the majority of their body can eliminate 65-70% of excess heat, giving the horse a powerful tool to help cool down after intense exercise. Additional heat is dissipated through the mucous membranes of the upper respiratory tract in a process called respiratory evaporative heat loss.

Additionally, when exercise ceases, blood flow dramatically shifts toward the skin, pulling heat away from the core and releasing it into the surrounding air; this also results in the appearance of "popped veins" on the skin's surface. At this stage, the horse's skin may feel hot to the touch, a sign of thermoregulatory activity.

Unfortunately, these natural processes can be compromised when environmental conditions are such that heat exchange is stalled or stopped. Researchers have determined that when the air is still, when absolute humidity (a measure of the actual amount of water vapor in the air) is elevated, when the horse is in direct sun, and/or when the ambient air temperature is high, the horse's natural mechanisms alone may not be adequate to compensate for the increased heat produced by intense exercise. Instead, it remains trapped in the horse's body, causing the core temperature to keep rising and increasing the risk for EHI.

"Heat is toxic to all cell membranes," said Brownlow. "Dr. Ollie Jay, one of the human pioneers in [Australia] in the arena of human heat illness reminds us, 'You can't uncook an egg.' This is a sobering reminder of the effect of heat on body tissues."

When the horse is hyperthermic, blood flow remains directed toward the skin surface and away from other body systems, including the gut and the brain. This sets the horse up for further serious complications such as systemic inflammatory response syndrome (SIRS) and profound central nervous system dysfunction. Prolonged exposure to high core body temperature can rapidly destroy cellular structure and function throughout the body, leading to cellular death and extensive, irreversible damage to internal organs.

"Cells cannot function in high temperatures, and they start suffering," said Marqués. "It's not just one body system; it's every body system that will suffer from heat shock."

The good news is that in most cases, horses afflicted with EHI can fully recover, but only if early symptoms are correctly recognized and treatment started promptly.

"We must be prepared at any horse event where we have evaluated it to be high risk to have the infrastructure in place to deal with multiple hot horses,"

said Brownlow. "Most importantly, the workforce must be educated to recognize early symptoms, to understand the principles of cooling, and to be able to manage and monitor horses with clinical manifestations of EHI."

UNDERSTANDING EHI SYMPTOMS AND TREATMENT

All horses with EHI will show some degree of central nervous system dysfunction, and this is considered a diagnostic criterion. Researchers have grouped EHI symptoms into levels 1-4, each corresponding to particular manifestations of central nervous system dysfunction; a horse's first symptoms may present at any level.

- **Level 1:** The horse seems irritable, restless or agitated, in a manner atypical for that animal. It may nod or shake its head. The horse cannot or will not stand still and is hard to restrain.

- **Level 2:** Neurological dysfunction intensifies. The horse may kick out, for no apparent reason; this kicking can be violent and either continuous or intermittent. The horse's irritability and agitation increases. These symptoms are often mistaken for colic.

- **Level 3:** The horse begins to display various unusual neurological behaviors. They may have a "spaced out," "glassy-eyed" or "vacant" expression, and/or appear depressed or disoriented. The horse may lean to one side or tilt his head and often shows varying degrees of ataxia. The horse may walk forward, then suddenly stop, rear or even throw himself to the ground. He may run into objects, fences or people. The horse may display what Brownlow calls "broken leg syndrome," in which the horse hops on one hind leg while holding the other in the air, leading to a misdiagnosis of fracture. At this stage, the horse is becoming a danger to himself and to handlers.

- **Level 4:** By now, the horse is showing substantial neurological dysfunction, and his condition is a true emergency. He has become extremely ataxic, disoriented and/or unaware of his surroundings, and may fall and get up continuously. Secondary injuries are common at this stage, and any collapse may lead to a loss of consciousness and death.

To further complicate diagnosis, some horses will appear to have completed a normal recovery, only to experience "rebound hyperthermia" 15-20 minutes later, at which time they begin to show symptoms of EHI. Researchers recommend that after recovery, horses are sheltered in a cool, dry location with moving air, and closely watched for at least 30-45 minutes, particularly when environmental conditions are prime for EHI.

"It's a cascade of events," said Marqués. "Once they start going downhill, they keep going, nonstop. The body has protective mechanisms to maintain homeostasis. But those mechanisms, at some point, are exhausted, and can't keep up that balance in the body."

The quicker treatment begins, the better the prognosis for the horse, and it should always comprise a two-tiered approach of pharmacological intervention and aggressive cooling techniques. Due to the unpredictable behavior of horses with EHI, when treating them the safety of handlers must always be of the highest priority.

Pharmacological intervention for EHI includes the use of both detomidine (Dormosedan) and flunixin (Banamine). Detomidine helps control agitation due to its sedating effect, and it is now routinely used in treating the disorder. Flunixin has proven useful in reducing both gut-related symptoms and the risk of SIRS, and researchers consider its early and routine use in horses with EHI justified.

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>
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But perhaps equally important to the horse's recovery is applying aggressive cooling techniques. Spraying the horse with ice cold water works best, targeting major vessels and saturating as much body surface as possible. Two people can even work on the horse at once, spraying each side of the body in a methodical manner.

"Cooling must be continuous and uninterrupted until all signs of central nervous system dysfunction disappear, and the animal becomes aware of surroundings," Brownlow noted.

Researchers have found dry fans to be a useful adjunctive cooling strategy, particularly in the later stages of recovery. Misting fans can be useful under some circumstances, and Marqués noted they are common at endurance rides in the south. However, they also increase the water content in the air, causing a decrease in its evaporative capacity. Therefore, Brownlow feels they are best used for "short term comfort." To reduce body temperature, misting fans are less effective than spraying high volumes of cold water.

Brownlow has also experimented with a specially designed "cooling collar," filled with crushed ice and secured on either side of the upper neck, directly over the jugular vein and carotid artery. This has proven to be another useful adjunctive cooling strategy during later recovery.

Whatever cooling modality is chosen, according to Brownlow, it must be "practical and capable of achieving rapid cooling rates."

"Organizations that put on horse events need to understand the concept of risk assessment and provide mobile spray units as well as ice for cooling," said Brownlow. "At some race meetings in New South Wales, on a very hot day, we have gone through 100 bags of ice."

IMPLICATIONS FOR SPORT HORSE MANAGEMENT

In humans, EHI risk is considered to be multifactorial, and so far, equine researchers believe the same is true for horses. This could explain why in horses racing under similar environmental conditions, some develop EHI and others do not. Of particular note is that, although EHI is most often seen on days with extremely hot weather, some horses have developed EHI even during cooler weather.

Further, it appears that variables unique to each individual animal—such as acclimatization to the exercise task under the same environmental conditions, fitness, obesity, diet, the gastrointestinal microbiome and even genetics—may also play a role.

"I believe we need to more closely look at the individual animals that become heat affected, and try to understand why," said Brownlow. "There is still a lot to learn."

A horse in intense exercise can, in extreme cases, lose as much as 10 to 12 liters of water per hour in sweat, along with electrolytes. In these circumstances, horses can quickly experience electrolyte imbalances, and their bodies may begin to pull water from the gastrointestinal tract. For these reasons, it is important to ensure sport horses are well hydrated before beginning intense work.

"If you start off with a horse that is mildly dehydrated, then you get into problems faster," said Marqués. "There is a relationship between the amount of water in the body and electrolyte balance with heat loss, because it goes hand in hand with the amount of sweat the horse will lose. Having a good hydration status means they don't get dehydrated in an attempt to lose heat."

Most importantly, EHI is considered preventable—if all the variables are understood.

"Ideally, you don't want to wait until you start seeing the clinical signs, and you see things going wrong, to take action," said Marqués. "You need to do something before that happens."