

Cooling The Performance Horse

By Wendy Barker



photo by Dr Warwick Vale



photo by Hoofbeats

Riders, trainers and officials in equine sport need to be well-informed about the welfare and performance issues of training and competing in heat and humidity.

There is an urban myth in the world of performance horses. The myth is that in heat and/or humidity, the only horses whose health could be at risk are those that work anaerobically - like eventers, polo, polocrosse and race horses. The fact is that performance horses in almost any discipline can be at risk of anhydrosis (non sweating syndrome) in heat and/or humidity. In the heat, effort can produce heat overload in the horse, and this effort can be derived from either intensity - for example, a two minute gallop at a turf club - or from duration of work, such as a six minute Federal Equestre Internationale (FEI) Dressage Test. There have been instances of horses dying or requiring intensive veterinary care following dressage competition or clinics in hot and /or humid conditions in Australia.

Horses standing in the sun without shade or wind flow in temperatures above 33°C start to accumulate heat. Horses that are worked in the sun without wind flow at or above 33 °C are at risk. Rather like the Coolgardie Safe - an early bush 'refrigerator' where cooling was achieved by air flow through damp material, air moving over a horse's wet coat is the primary cooling mechanism in hot conditions.

In the heat, sweating is essential, and once a horse stops moving its temperature will rise rapidly unless there is air flow to cool it. At a major international event, dressage horses that were not aggressively cooled immediately after their tests in the heat, had body temperature spikes over 40°C within minutes of finishing. Aware of this potentially lethal temperature spike after effort, serious trainers in most equestrian sports now strip off all gear as soon as a horse finishes work and immediately apply cooling methods such as hosing, scraping, ice, fans, shade etc. Horses also have their own mechanics of dealing with heat overload and a partial solution, like camels, is for them to shunt a certain amount of the heat into fluid situated in their hindgut (heat sink), for later heat shedding.



ANHYDROSIS

also called *Drycoat, Non-sweating Syndrome* or 'The Puffs'

Inability to sweat – often caused by repeated heat overload – the horse's cooling system has broken. Usually this occurs in hot, humid climates such as India, South East Asia and Australia.

'The puffs' - unlike dogs, horses are not designed to pant. When a horse does 'pant' it is called 'the puffs', which indicates it is suffering heat stress, and requires immediate cooling.

Some degree of anhydrosis may affect up to 25% of horses in hot climates, according to experts. However, horses usually recover their ability to sweat when they move to a cool climate.



The COMFORT INDEX

Wet Bulb Globe Temperature (WBGT)

WBGT is now the most widely used index of heat stress in the world. The Wet Bulb Globe Temperature (WBGT) is a composite temperature used to estimate the effect of temperature, humidity, wind speed and solar radiation on humans and equines. It is used by scientists, athletes, and the military, including all Australian Defence Forces, to determine appropriate exposure levels to high temperatures. It is derived from

T_w = Natural wet-bulb temperature (humidity indicator)

T_g = Globe thermometer temperature (measured with a globe thermometer, also known as a black globe thermometer, to measure solar radiation)

T_d = Dry-bulb temperature (normal air temperature)

It was first used to control serious outbreaks of heat illness in training camps of the United States Army and Marine Corps.

Horse Cooling System continued...

Heat production in a horse during and after exercise can be 60 times higher than in a horse at rest. Many variables influence how long this heat production continues – ambient temperature, relative humidity, the horse's hydration level, its electrolyte depletion, fitness, coat colour, surface area to body mass ratio, previous history of anhydrosis, to name just a few. The horse's cooling system needs to be highly efficient to keep its temperature at a stable 38°C. When its body temperature goes up by a 1 1/2° or 2° the horse may be at serious risk. This is why riders and performance horse trainers interested in the welfare of horses should be aware of the 6 Minute Threshold.

Heat Overload

Combinations of high heat and humidity impact severely on the horse's main cooling mechanism – sweating and evaporation. The 6 Minute Threshold is when horses that have just had a strenuous workout, either being trained or performed, for 6 to 6.5 minutes in the heat and humidity are at risk of suffering a dangerous temperature hike and heat overload. In a heat stressed horse, this can cause collapse, it can even be fatal.

When the Wet Bulb Globe Temperature (WBGT) - a composite temperature used to estimate the effect of temperature, humidity, wind speed and solar radiation -reading (see details on left) is high then 6 to 6.5 minutes of continuous hard work can be pivotal in causing heat stress. Higher level dressage horses work extremely hard in both the warm up and in their tests, according to Dr Nigel Nichols, FEI Veterinary Delegate at three very hot Olympic Games – Sydney, Athens and Beijing (Hong Kong). When questioned on this, Dr Nichols reiterated that dressage horses do work extremely hard in both the warm up and in their tests. It was noted that for showjumpers the effort may be under 6 minutes, however for dressage, endurance and cross-country, horses are at risk in adverse heat, because the effort



Photo by Wendy Barker



Hoofbeats photo

expended will generally exceed the 6 Minute Threshold.

Comprehensive research shows the best way to evaluate the risk is to check the WBGT reading before working. The FEI refers to WBGT as the 'Comfort Index.'

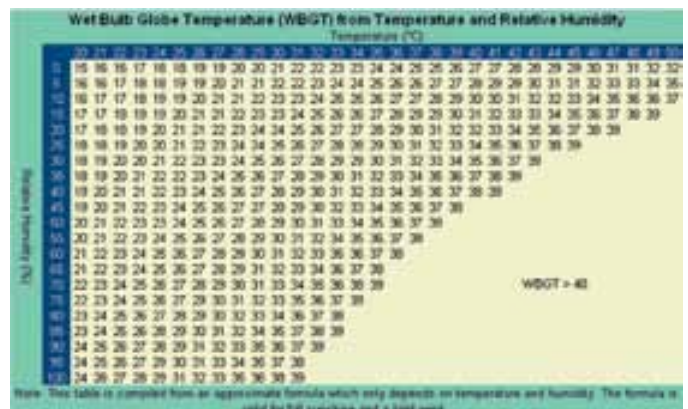
'Broken' Cooling System

Some people think when a horse's coat is dry or has only patchy sweat when worked on a hot day, that this indicates it is coping well with the heat. In fact, a dry coat should be cause for great concern – the horse could be losing the ability to sweat (anhydrosis) - indicating it has a faulty or a completely 'broken' cooling system. The consequences could be heat stroke, collapse, multiple organ failure and death.

When a car's cooling system breaks, the faulty hose or radiator is replaced. But when a horse's cooling system 'breaks',

The charts below shows the FEI Guidelines (appropriate where excellent cooling facilities are available) and the Wet Bulb Globe Temperature (WBGT) reading where the FEI believes events should be cancelled. The WBGT can be checked on the Bureau of Meteorology website <http://www.bom.gov.au/>.

WBGT Reading	Example C: %RH	Recommendations
Less than 28	30:45	No changes to the FEI recommended format for the Three Day Event competitions should be necessary.
28-30	29:60	Some precautions to reduce heat load on horses will be necessary. Additional precautions to those above to limit overheating of horses will be necessary.
30-32	30:65	Additional precautions to those above to limit overheating of horses will be necessary.
32-33	30:75	These are hazardous climatic conditions for horses to compete in and will require further modifications to the competition.
Above 33	32:60	These environmental conditions are probably not compatible with safe competition. Further veterinary advice will be required before continuing



Right: Riders also need to be aware of the temperatures and humidity and ensure they maintain their water intake while working horses.



Photo by Katrina Partridge

Left: Ice boots can be put on after exercise while the horse is being cooled with hosing and scraping. While there are various styles and brands, generally cold packs are slipped into the pockets inside the boots and these packs can be kept in the freezer when not in use. Spare cold packs are usually supplied with the product to ensure a continuous application.

it is not something that can be replaced. If it is permanently damaged, there may be a need to buy a new horse..... Like cars' cooling systems, horses' cooling systems can deteriorate incrementally over a period of time, with the owner often not noticing the changes, until something goes seriously wrong.

Humidity and heat – a dangerous mix

Heat overload (heat stress or even heat stroke) occurs when an individual horse cannot shed sufficient heat to maintain a normal core temperature of 38°C, which puts its health at risk. Combinations of high heat and humidity impact severely on the horse's main cooling mechanism – sweating and evaporation. A breeze or wind flow can dramatically reduce heat overload (heat stress) by significantly increasing evaporation, the main cooling mechanism for both horses and humans. Horses standing in the sun without shade or wind flow, in temperatures above 33°C, cannot shed as much heat as they accumulate. Those working in the sun without wind flow at or above 33°C are at risk.

Surface area to body mass (SA:BM)

Horses in Olympic disciplines tend to have larger body mass than endurance, racing and western equestrian sports. Within the Olympic disciplines, dressage horses tend to be heavier than show jumpers or eventers. This means that dressage horses are particularly compromised in their ability to reduce their heat load during hot/humid conditions.

As body mass increases, relative surface area decreases. An 80 kg rider will have a SA:BM = 1:40, but a 500kg horse has a SA:BM = 1:100. Surface area to body mass ratio impacts negatively on a horse's ability to shed heat through evaporation. Greater muscling in dressage horses lowers their SA:BM ratios and makes them less effective than other equine athletes at shedding heat.

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Horse Cooling System continued...

Sweating is vital

Under severely hot and/or humid conditions, horses rely on evaporation from sweating for 80-90% of their cooling mechanism, therefore horses with a healthy cooling system sweat prodigiously in hot conditions. When horses' cooling systems begin to fail, their sweat response becomes poor, sweating will be patchy and they may get the 'puffs' (*see Anhydrosis inset*) A worst case scenario is where the horse completely stops sweating and has a dry coat when worked in heat and/or humidity. Poor sweating or non-sweating should set off alarm bells for the owner who should immediately stop working the horse and commence aggressive cooling.

To keep its cooling system healthy, a horse must shed enough heat to maintain a normal healthy temperature of 38°C. If its temperature starts to rise, immediate aggressive cooling is the answer.

Horses have very differing capacities to cope with heat load so individual horses within a breed will respond differently to heat and humidity. Racetrack Veterinarians give accounts of some Thoroughbreds suffering from heat stroke when the temperature in the shade is only 29°C or 30°C, and handlers struggle to control the horses as they back flip, capriole or collapse in convulsions, making it almost impossible to effectively apply cooling strategies unless they are sedated or even anaesthetised. Many factors, including hydration levels, body mass, coat condition and colour, genes within any breed, and fitness, impact on the way a horse handles the heat on any given day. Challenging a horse's ability to keep cool by working it in heat and/or humidity increases the load on its cooling system and may predispose it to anhydrosis – and its cooling system 'crashing' and the horse being unable to sweat.

On the advice of some of the world's best equine veterinarians, during the Beijing (Hong Kong) Olympics, all dressage competition ceased at 11.00am and did not recommence until 5.00pm.

Competition Comfort Index

The peak international equestrian body – the Federation Equestre Internationale (FEI), bases its Comfort Index for safe climatic conditions for equestrian events on the Wet Bulb Globe Temperature (WBGT). Where heat and humidity may impact on the welfare of the horse, the FEI requires equine veterinarians and cooling facilities of a very high standard to be in place at FEI events. These include: multiple wash bays, unlimited ice and misting fans in shade.

However, it would be rare for competitors to have access to ice or veterinary monitoring at many events run under the Equestrian Australia banner. Many local event grounds do not have even basic heat



Photo courtesy, Dr Warwick Vale

Above: The misting tents at the Beijing Olympics (Hong Kong) offered cooling fans and fine misting, along with large tubs of readily available ice and water. Below: An industrial fan will help create a cooling breeze.



Photo by Wendy Barker

Below: Hosing the horse's light rug before a float trip, combined with the ventilation flowing through the float, will help it stay cool during the journey.



Photo by Wendy Barker

management tools such as shade for horses or sufficient wash bays for aggressive cooling to be carried out effectively.

In Australia, several state branches of Equestrian Australia have introduced some form of heat policy. At present several states rely on the Bureau of Meteorology (BOM) air temperature forecast the night before an event. However, Dr David Marlin, who is based at the famous Hartpury College in Gloucestershire, UK, has completed extensive research on horses in heat and humidity and has demonstrated that WBGT forecasts (also provided by BOM) are the best gauge of potential heat stress, as WBGT takes all key factors - air temperature (in the shade), humidity, solar radiation and wind speed

into account when predicting the risk to horse welfare.

The FEI discourages events or clinics from being held when the WBGT reading is over 33°C and, after careful research, has put in place clear guidelines in a table (*see page10*), which is based on the best scientific data available.

The FEI guidelines are appropriate where excellent cooling facilities are available, however, where inferior cooling facilities or no cooling facilities exist, much greater precautions should be taken.

When is a horse most vulnerable?


While a horse is moving there will be some air flow assisting with evaporation and heat shedding, however it is most vulnerable directly after exercise. While standing to be untacked the horse's temperature may escalate very rapidly to dangerous levels, therefore, riders need to be aware of aggressive cooling practices and the importance of implementing these on horses after strenuous exercise in heat and/or humidity.

To keep a horse's cooling system in good shape during the hottest months, riders can ensure the horse is well hydrated before being worked. Keeping water in the shade so it is cool and palatable may encourage a horse to drink more. Tempt a horse to drink by adding apple or carrot juice, or a small amount of molasses to the water. Holding a water bucket encourages some horses to drink more.

Administer a solution of electrolytes (common salt (Sodium chloride) + Potassium + Magnesium) orally before and after work if the horse will not take these in drink or feed.

Pre-cool the horse by hosing it before a workout – do not scrape the excess water off at this stage, as a wet coat saves the horse having to sweat to commence the

Continued




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Horse Cooling System continued...



Photo courtesy Dr Warwick Vale

At the Beijing Olympics (Hong Kong) teams used aggressive cooling techniques after events, with liberal application of readily available ice and water, with one applying and the second person on each side scraping heated water off.

cooling process. Use a short warm up to lighten the load on a horse's cooling system; ride in shade and in the cooler hours of the day, whenever possible.

After working, use aggressive cooling until the horse's temperature stabilises at 38°C - through hosing, scraping and ice. If facilities are available also use a shaded area with misting fans.

Riders should also consider their own health when riding on hot/humid days, as they need to be in a fit state to cool their horses immediately after riding. Maintaining hydration, wearing 'summer dress' - no jackets or vests - can assist in avoiding heat stress.

Aggressive Cooling

Aggressive cooling should be used where a horse's temperature is elevated after any demanding exercise such as dressage or cross country where the WBGT reading is high. It includes the use of ice boots, repeatedly applying bucketfuls of ice cooled water, and/or repeatedly hosing and immediately scraping water off the horse as, if left it warms on the horse's body, which actually raises the horse's temperature instead of decreasing it.

Key areas to apply cooling to are the jugular vein (underside of the neck), the femoral arteries (between the hind legs) and the heat sink (lower abdomen). Aggressive cooling should not cease until the water is no longer heating up on the horse, or until temperature checks show it is back to a healthy 38°C, rather than heading up to a dangerous 40°C. This may take considerable time.

For the best outcomes in aggressive cooling, five people should attend one horse. Two work on either side of the horse, one each side continually hoses or applies ice or cold wet towels, while one on each side continually scrapes the water off as it heats up, which strips the heat out of the horse. The last person is responsible for rectal temperature monitoring. If the horse is so distressed that it has seizures, sedation by a vet will be necessary so the cooling can be carried out safely and effectively.

Hosing and Scraping

Just before commencing exercise, hose, but do not scrape, the horse. As it walks and trots, the air moving over its wet body will help it to stay cool through evaporation while it loosens up. After exercise, if the horse will be standing still, scrape water off after hosing, so the water does not act like an insulating 'blanket'. Walking the horse in shade will move air over its body and may help to cool it down, except perhaps when it is very tired and stressed.



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Signs Of Heat Stress

Signs that will alert riders to a horse suffering heat stress may include:

- Patchy sweating or no sweating.
- 'The puffs' - panting is normal in dogs but is cause for alarm in a horse.
- Sub-optimal performance - when a horse is lethargic, sluggish, and generally under-performing, or unusually anxious or nervous. Atypical behaviour could well indicate that the horse is in heat overload.
- Slow capillary refill - the gums should return to their normal pink colouring within two seconds of a finger depressing the skin.
- Poor skin elasticity - pinch test.

Which horses cope best?

Lighter framed horses can shed heat much more easily than heavily muscled horses that have low surface area to body mass ratios. Those that have been clipped or have fine coats, cool quicker, and light coloured horses reflect more heat than black or other dark colours.

Fit horses cope with heat and/or humidity better than unfit horses, as they sweat sooner and more efficiently, their sweat is clearer, more watery and evaporates more readily.

Horses with no history of anhydrosis also cope better with heat and humidity. The more a horse's cooling system is



Photo by Liz Tollazzo

Dressage horses do work extremely hard in the warm-up and competition, and require fluids with an electrolyte composition similar to sweat to rehydrate.

compromised, the more vulnerable to anhydrosis it will become.

Encourage Fluid Intake

After any activity that causes dehydration whether it be exercise or even floating the horse, fresh clean water and water spiked with electrolyte solutions and molasses can be offered. In the case of floating, do this immediately after unloading the horse,

as is a great way to replace fluid losses. Ensure continual access to palatable water in the stable and paddock at all times, and take water from home to shows if the horse is reluctant to drink 'foreign' water. If encouragement to drink is required try flavouring with molasses or apple juice.

At a show, offer the horse water in a quiet area, where it will not be disturbed by all the action around it. For some horses, holding a bucket up after competition will encourage them to drink more.

Feeding well-soaked hay can make a real impact on fluid consumption. Endurance riders take advantage of this by feeding horses soaked hay before long rides. One well-soaked flake of hay can absorb 3-7 litres of water.

Rehydration

Effective recovery from exercise will only occur if oral rehydration fluids contain electrolytes with a composition similar to that of equine sweat. It must be stressed that these remedies must be FLUIDS - water loss must be replaced in a dehydrated horse. Electrolyte pastes alone, without concurrent water replacement, may not achieve recovery and must not be given alone to a dehydrated horse.

In mammals, the thirst reflex is normally stimulated by changes in blood osmolality - the loss of sweat causes decreased blood

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HEAT

POLICIES

QUEENSLAND

Dressage Queensland Hot Weather Policy:

It is suggested that in the months of January and February Organising Committees should only hold dressage events/competitions in the late afternoon when the weather conditions are cooler and these are to be cancelled if the weather report on the ABC 7pm News the night before the event/competition predicts a forecast of 35°C degrees or higher for the area where the event is being held.

If there is high humidity experienced, as on the East Coast, the OC should consider cancelling the event/competition.

OCs are also reminded that Rule 2.7 allows for riders to remove their coats in hot weather conditions, at the discretion of the OC.

SOUTH AUSTRALIA

There is no state Dressage Committee policy however, dressage clubs generally have a policy where an event will be cancelled if the weather report on the ABC 7pm News the night before predicts a forecast of 36°C degrees or more for the area where the event is being held.

NORTHERN TERRITORY

Darwin Dressage Club do not have a formal written and approved Heat Policy for events. The old 'common sense will prevail' method is used! They have approached Dressage WA re adapting their policy for the NT.

NEW SOUTH WALES

Any competitions in January are scheduled early in the day to be finished by lunchtime but events are not generally run in January, except for a YDH qualifier held on the last weekend. The first event is held about the 12/13/14th February, which usually doesn't have the same intense humidity as does the month of January, even so, February events finish early afternoon.

WESTERN AUSTRALIA

Dressage WA has submitted a policy to the EWA Board of Directors, which it hopes will be approved for 2012. This is based on data used for the FEI Comfort Index, and Dr David Marlin's recommendations in 'The effect of thermal environmental conditions on the health and performance of horses':

- Alteration of time of day or time of year at which an event is run
- Reduction in overall effort (shorter distance, less jumping efforts, etc)
- Education of riders, grooms and officials
- Provision of shade
- Provision of adequate means of cooling horses.

In brief the guidelines are:

In January and February, Event Organisers are encouraged to run events between 7.00am and 11.00am, and/or after 5.00pm.

In January and February, Event Organisers who choose to hold events when Wet Bulb Globe Temperature (WBGT) readings are highest, between 11.00am and 5.00pm, will be required to provide cooling facilities similar to FEI standard cooling facilities:

At least two wash bays for each arena running tests - so horses can be aggressively cooled. Free ice - ad lib - an abundance of bags of ice for ice boots or for riders to add to water to cool horses after exercise. A shaded area with misting fans for recovery and an equine veterinarian present for the duration of the event.

Cooling System continued...

Right: The thirst reflex can be inhibited after a massive loss of sweat and electrolytes.

Below: Endurance riders understand the importance of hydration, and water is offered to the horses at every possible opportunity.



Photo by Carol Willcocks



Photo by Christine Maroni Photography

volume and increased blood osmolality. A unique situation occurs in the horse where massive loss of sweat and electrolytes (esp. sodium) decreases blood osmolality and inhibits the thirst reflex (adipsia).

It is important to realise that the horse's electrolyte requirements can differ depending on the activity undertaken. The electrolyte requirements of a racehorse will be different to the electrolyte requirements of an endurance horse. For example, an endurance horse after competition will, in most cases, be in a state of metabolic alkalosis. The endurance horse must not

no outward signs of electrolyte depletion. (*Cummings School of Veterinary Medicine, USA*)

Salt Blocks

A salt lick will provide table salt (sodium chloride), but when a horse sweats, sodium chloride is not enough. Palatability in salt blocks is a complex issue. Studies have shown that some horses fail to take in even the minimal table salt requirements if they are simply given a salt block.


Performance horses need help to be at their best through the heat of Australian summers. The welfare of the horse must take precedence over all other demands on the performance horse, as the FEI and EA Rule Books state. Kentucky Equine Research shows that 25% of all horses in the heat suffer from a degree of anhydrosis or heat stress. This highlights an ongoing need for the dissemination of information to as many riders, trainers and officials in equine sports as possible, to increase the awareness about the welfare issues of training and competing in heat and humidity.

A healthy horse is able to sweat at rates of 15 litres per hour during exercise in hot and/or humid conditions.

be treated with or supplemented with electrolytes containing bicarbonate.

Electrolyte supplementation should be part of the training horse's diet as studies show horses will drink better if electrolyte supplementation is already occurring before exercise. Salt contains sodium and chloride and will therefore only supply part of the electrolytes required. There is a confusing array of electrolyte supplements available so riders should discuss their horse's electrolyte needs with their vet. (*Courtesy Dr Joan Deetman, Silverson Veterinary Hospital*).

Signs of low electrolyte levels may include nervousness, fatigue, muscle tremors, and stiffness. Researchers at Washington State University have recently found out that the body's hormones are still working to recover lost sodium the day after intense exercise - even though the horses showed



About The Author

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Wendy is an FEI 4 PE Dressage Judge, A Level Dressage Judge, Show Horse Judge, Judge Educator, NCAS Level 2 Coach and Coach Educator. Coaching in Singapore, Darwin and Taiwan, and judging in Darwin, Singapore and Malaysia started Wendy on a continuing quest for knowledge about heat overload in horses.*

ELECTROLYTES

Essential for all working horses

All horses that work hard enough to produce sweat will require electrolytes if they are to recover quickly and rehydrate. Electrolytes are essentially salts that play an important role in maintaining osmotic pressure, fluid balance, and normal nerve and muscle activity. The most important electrolytes are sodium (Na+), potassium (K+), chloride (Cl-), and magnesium (Mg++). These are expelled daily through sweat and urine, and are lost in vast amounts when the weather is hot and the horse is working hard. Studies have shown that chloride is lost in the greatest quantities, followed by sodium and potassium, and therefore these are the most important electrolytes to replace.

A horse sweats to get rid of heat generated by muscular work. As sweat evaporates quite quickly in breezy, dry conditions, the magnitude of the loss may not be apparent to the rider and large amounts of sweat running down the neck may not be evident. Replacement of these losses is nevertheless an important part of looking after the horse.

Substantial loss of electrolytes causes fatigue and muscle weakness, and can eventually decrease the thirst response, therefore encouraging further dehydration. By administering balanced electrolytes to the horse after heavy sweating, the salt levels in the blood are raised and trigger the thirst response. Inadequate electrolyte replacement can result in delayed recovery time after work, decreased overall performance, and an increased risk of muscular conditions and tying up.

Travel and stress can also induce heavy sweating - a horse travelling a few hours to a competition on a hot day may lose up to 25 litres of sweat and if these losses are not replaced, the horse may start the competition already dehydrated.

Many commercial products contain excess amounts of glucose (dextrose) to sweeten the electrolyte and increase palatability, and some are filled with yeast and vitamins. Whilst these ingredients may be useful, their inclusion means that each scoop contains less electrolytes. Selecting an electrolyte supplement that contains mainly the four essential minerals horses lose through sweat is essential for ensuring they are replaced in the correct proportions.



About The Author

Kentucky Equine Research (KER)

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