

# Electrolytes and the Endurance Horse

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Every endurance competitor appreciates that electrolytes are a critical component of a horse's nutritional program. Electrolytes are mineral salts that play an important role in maintaining osmotic pressure, fluid balance, and nerve and muscle activity. During endurance exercise, sodium (Na<sup>+</sup>), chloride (Cl<sup>-</sup>), and potassium (K<sup>+</sup>) are lost in large quantities through sweating. Loss of these electrolytes causes fatigue and muscle weakness, and decreases the thirst response to dehydration. It is vitally important that endurance horses begin competition with optimal levels of fluids and electrolytes in their bodies and that these important nutrients are replaced throughout a ride.

## Sweat Losses

It is important to have some idea of the magnitude of electrolyte loss a horse incurs during exercise before a feeding program can be developed to replace these losses. Because most electrolyte losses in the horse occur through sweating, one method of calculating electrolyte requirements can be based on different amounts of sweat loss. Table 1

contains the levels of Na<sup>+</sup>, Cl<sup>-</sup>, and K<sup>+</sup> required per day by a horse at rest and after exercising hard enough to lose 5, 10, 20, or 40 liters of sweat.

Table 1. Total daily electrolyte requirements (grams/day) as a function of sweat loss.

Electrolyte	Sweat loss (liters/day)				
	Rest	5 liters	10 liters	20 liters	40 liters
Sodium (Na <sup>+</sup> )	15-20	33	50	85	155
Chloride (Cl <sup>-</sup> )	27-33	55	83	139	251
Potassium (K <sup>+</sup> )	40-50	46	52	64	88

The amount of sweat loss will depend on a number of factors such as duration and intensity of exercise, temperature, and humidity. In general, horses exercising at low intensity (12-18 km/hr) will lose between 5 and 10 liters of sweat per hour. During high-intensity exercise (30-35 km/hr), sweat loss levels reach as high as 15 liters per hour. At the 1996 Olympic Games in Atlanta, horses lost an average of 18.4 kg of body weight during the speed and endurance phase (day 2) of the three-day event, and this translates to a sweat loss of around 15 liters.

## Electrolyte Requirements During Training

Daily electrolyte requirements can be estimated by calculating the total amount of mileage logged weekly by the horse, taking into account the environmental conditions under which the training occurs (Table 2). For example, if an endurance horse was logging 50 km of work per week in a cool dry environment, it would require only about 60-120 grams (2-4 ounces) of a well-formulated electrolyte supplement to meet its daily electrolyte requirements. The lower level of supplementation would be adequate if the horse was also receiving adequate forage and a grain mix that contained supplemental salt, as well as access to a salt block. Horses at rest will normally consume around 50 grams of salt per day from a salt lick. As training mileage and environmental temperature increase, so does the

Sweat losses deplete many vital electrolytes from the horse's system.



Photo by Mark Llewellyn



*Electrolyte supplementation is now safe and easy with KER's Endura-Max Plus.*

Photo by Mark Lewellyn

double in hot environments when sweat loss is extensive. A long training ride of 60 km (~4 hours) in moderate temperatures would therefore produce enough sweat loss to require 240 grams (8 ounces) of electrolyte supplementation. This level of supplementation would need to be partially replaced during the ride (60 grams at 20 and 40 km) using an oral electrolyte paste with the remainder of the electrolyte administered after the ride. If the horse will not consume this quantity of electrolyte (120 grams or 4 ounces) in a single meal, then 60 grams can be administered as a paste at the end of the ride. When administering oral electrolyte pastes, it is absolutely essential that the horse have access to water. If the horse refuses to drink, do not administer an electrolyte paste.

### Supplementation During Competition

There is a great deal of controversy about how to administer electrolytes during competition. A number of different strategies have been used successfully by competitors, and the recommendations that will be given here are not necessarily the only way to achieve success.

During competition, sweat losses can be very large. How much water and electrolytes does an endurance horse lose during a competitive ride? Using the sweating rates described earlier, an endurance horse will lose between 45 and 60 liters of sweat during a 160-km ride. This represents electrolyte losses of 460-690 grams. Additionally, 9-14 grams of calcium and 5-8 grams of magnesium will be lost through sweating. It is debatable whether all of the losses can or need to be completely replaced during the competition. Research has shown that endurance horses participating in 80- to 160-km events often have a fluid deficit of 20 to 40 liters despite having access to water and electrolytes during the ride. Canadian researchers have

requirement for electrolyte supplementation. Horses that are training heavily (100 km/week) in a hot environment may need 140-200 grams (5-7 ounces) of supplemental electrolytes.

The recommendations in Table 2 are based on supplementing electrolytes at the same rate daily even though the amount of exercise performed each day will vary. This is probably a reasonable approach to supplementation except for days when the training distance is especially long. For those days, additional supplementation may be warranted. As a rule of thumb, 60 grams (2 ounces) of electrolyte supplementation are required for each hour of exercise in cool climates. This rate of supplementation will

*Table 2. Daily electrolyte requirements based upon workload.*

Electrolyte	Weekly mileage and training environment					
	50 km/wk (cool)	50 km/wk (hot)	75 km/wk (cool)	75 km/wk (hot)	100 km/wk (cool)	100 km/wk (hot)
Sodium (Na+)	24	32	27	40	32	48
Chloride (Cl-)	40	54	47	67	54	80
Potassium (K+)	43	46	44	49	46	51
Daily electrolyte supplementation*	60-120 g 2-4 oz	90-150 g 3-5 oz	75-130 g 2.5-4.5 oz	120-170 g 4-6 oz	90-150 g 3-5 oz	140-200 g 5-7 oz

\*Based on the composition of KER Summer Games Electrolyte. The amount of daily electrolyte supplementation will depend on the amount of electrolyte in the ration and whether the horse has access to a salt block.

shown, however, that endurance horses with less pronounced fluid and electrolyte alterations during a competitive ride were more successful than those with greater changes. Therefore, it is absolutely essential that a large proportion of the electrolytes and water lost in sweat be replaced during the ride.

## Pre-ride electrolyte loading

The endurance horse must start the competition with adequate stores of both water and electrolytes. This can be accomplished in two ways. First, the endurance horse should be on a high level of forage (hay or pasture) intake before a ride. When a horse is fed liberal quantities of forage, it can store extra water and electrolytes in its large intestine. These stores can be called on to replace sweat losses early in the ride. Second, extra electrolytes can be administered the night before and the morning of the ride. The horse's system is finely tuned to balance the amount of electrolytes and water that it stores in its body at rest, so excessive pre-ride electrolyte supplementation should be avoided. Moderate supplementation (60 grams the night before and 60 grams the morning of competition) will insure that the horse has adequate electrolytes within its body and will provide additional electrolyte stores within the gastrointestinal tract.

## Electrolyte supplementation during competition

Electrolytes should be supplemented throughout competition. The type of electrolyte supplement used during competition is slightly different than that which is used during training. This electrolyte should provide additional calcium and magnesium along with sodium, chloride, and potassium. If calcium and magnesium losses are not replaced by mobilization of skeletal stores or by supplementation, metabolic disturbances such as thumps may occur. Electrolytes should be administered to horses at each vet check and at water stops along the trail. The best way to administer electrolytes is in the form of a paste. Pastes are commercially available, or they can be made up fresh at the vet check by diluting an electrolyte powder in applesauce, water, or liquid antacid. A reasonable dose of electrolyte powder (or equivalent) is 60 grams at each vet check. Thirty- to 60-gram doses of electrolyte can be administered on the trail. It is worth reemphasizing that the horse must have access to drinking water when receiving concentrated electrolyte pastes. These pastes are hypertonic (a greater concentration of electrolytes) compared to blood and will effectively draw fluid out of the horse and into the gut if they are not diluted by water. Administering large doses of electrolytes without adequate

water intake will result in serious problems, including colic, dehydration, and possibly death.

How well will this electrolyte supplementation program replace losses from sweating? Endura-Max powder and Endura-Max Plus paste are calcium- and magnesium-containing electrolytes formulated specifically for endurance competition. Supplementation with 300 grams of Endura-Max powder (60 grams at five vet checks) along with five tubes of Endura-Max Plus paste on the trail will provide 336 grams of sodium, chloride, and potassium, the quantity of electrolytes lost in 33 liters of sweat. If the horse consumed enough water to complement this level of electrolyte intake, then it would finish the ride with a fluid deficit of between 12 and 27 liters. While this level of fluid deficiency is as good as or better than what has been reported in scientific literature, why not try to replace all of the electrolytes lost during the ride? The answer lies in the horse's ability to absorb and retain large quantities of electrolytes in a short period of time. Sodium is actively transported across the intestinal wall by an energy-requiring process. The maximal rate of sodium transport is not known. Practical experience has shown that the levels of supplementation described above can be safely administered. Higher levels may be possible, but the risk of complications related to malabsorption will certainly increase.

## Post-ride supplementation

Administering 120-280 grams (4-8 ounces) of electrolyte over the 24-hour post-ride period can eliminate most residual electrolyte deficit. A portion of this can be given as a paste shortly after the conclusion of the ride followed by top-dressing of electrolytes on the next two or three meals.

## Conclusion

The health and well-being of the endurance horse can be enhanced by proper electrolyte supplementation during training and competition. The level of supplementation should be adjusted to match sweat losses, which are affected by exercise intensity, terrain, and environmental conditions. A well-formulated electrolyte supplement that replaces the quantities of sodium, chloride, and potassium lost in sweat should be used during training. An electrolyte containing calcium and magnesium is recommended to prevent metabolic disturbances such as thumps from occurring during competition. Electrolytes should only be administered when the horse has access to water because both electrolytes and water are needed to maintain optimal fluid balance. ☺☺