Electrolytes Critical for Performance Horses

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Electrolytes are a critical component of a performance horse's feeding program because they play an important role in maintaining osmotic pressure, fluid balance, and nerve and muscle activity. During exercise, sodium (Na+), potassium (K+), and chloride (Cl-) 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 performance horses begin competition with optimal levels of fluids and electrolytes in their bodies and that these important nutrients are replaced throughout prolonged exercise.

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+, Cl-, and K+ 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.

	Sweat loss (liters/day)				
Electrolyte	Rest	5 liters	10 liters	20 liters	40 liters
Sodium (Na+)	15-20	33	50	85	155
Chloride (Cl-)	27-33	55	83	139	251
Potassium (K+)	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 will lose between 5 and 10 liters of sweat per hour. During higher intensity exercise, 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 of the three-day event, which translates to a sweat loss of around 15 liters.

Meeting Electrolyte Requirements

Unfortified hay and grain rations tend to be deficient in sodium and contain variable quantities of chloride. In contrast, most forage is high in potassium and when fed in adequate quantities will meet daily potassium requirements. Salt (NaCl) offered as a free-choice block or top-dressed onto grain along with adequate forage will meet the electrolyte requirements of idle and lightly exercised horses. However, if forage intake is restricted (less than 1% BW on a dry matter basis) and/or high sweat losses occur as a result of hot summer weather and moderate to heavy work, then additional potassium supplementation may also be necessary.

Many commercial electrolytes contain sugar (dextrose), which is purported to improve electrolyte uptake in horses. Recent research at Kentucky Equine Research (KER) has demonstrated that this is not true. Thoroughbreds were dosed with 92 grams of electrolyte (72 g NaCl, 20 g KCl) either alone, with 10 g dextrose, or with 100 g dextrose. The electrolyte mixes were dissolved in 1 liter of water and administered via nasogastric tube. A fourth treatment of 1 liter water with no added electrolytes served as a control. Plasma Na+ and osmolality were significantly elevated post-dosing in all three electrolyte treatments compared to the control, but dextrose did not affect the rate or duration of increase. All electrolyte treatments increased voluntary water intake, which is important in performance horses. A second trial using deuterium oxide labeled water showed that the addition of dextrose did not affect the rate of water uptake from the digestive tract when compared to a straight electrolyte mix.

An interesting alternative source of Na+ for performance horses is EquiShure®, an encapsulated sodium bicarbonate designed to prevent hindgut acidosis in horses. The vegetable oil-based encapsulation agent prevents the rapid breakdown of the sodium bicarbonate in the small intestine, allowing it to survive into the large intestine where it slowly dissolves over the course of 6-24 h. Digestion trials conducted at KER have shown that the Na+ in EquiShure® is digested and absorbed as completely as Na+ from NaCl, but it is absorbed more slowly, resulting in greater sodium retention.

Furosemide and Electrolyte Loss

About 90% of Thoroughbreds and up to 70% of Standardbred racehorses in the United States are treated with furosemide (Lasix) before racing to prevent exercise-induced pulmonary hemorrhage (EIPH). Furosemide exerts a diuretic effect by reducing the reabsorption of Na+ in the kidney. The magnitude and duration of electrolyte loss following furosemide administration have not been previously measured in horses. KER recently conducted a study to measure the effect of furosemide on 72 h urinary and fecal excretion of calcium, phosphorus, magnesium, sodium, potassium, chloride, and sulphur in nonexercised Thoroughbred geldings.

Total fecal and urinary excretion was measured for 72 h before and 24 h, 48 h, and 72 h after a single dose (0.5 mg/kg BW) of furosemide. Urinary Na+ excretion increased 24 h post furosemide administration but returned to pretreatment levels 48-72 h post treatment. Urinary calcium, potassium, chloride, and sulphur excretion increased post treatment and remained elevated 72 h post treatment. Calcium, potassium, and chloride balances were negative 72 h post treatment even though the horses received adequate dietary mineral intakes. Urinary phosphorus and magnesium excretion was unaffected by treatment. Fecal excretion of all minerals was unaffected by treatment.

This study shows that furosemide administration has a profound and long-lasting effect on electrolyte balance in horses. Longer-term studies are needed to assess the effect of chronic furosemide administration on calcium loss and skeletal soundness in horses. Additional studies are also needed to develop electrolyte supplementation strategies to correct the electrolyte imbalances caused by furosemide administration in racehorses.

In summary, electrolytes are essential nutrients for performance horses. Because horses lose large quantities of electrolytes in sweat, requirements increase with exercise intensity and sweat loss. Adequate intakes of good-quality forage and free-choice salt will meet the electrolyte requirements of idle or lightly exercised horses. Additional electrolyte supplementation including potassium may be necessary if forage intake is limited and sweat losses are moderate to heavy. Racehorses treated with furosemide require potassium supplementation even if they are receiving adequate forage.