ELECTROLYTES AND THE PERFORMANCE HORSE

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Electrolytes are substances that dissociate in solution into electrically charged particles called ions. In the horse, electrolytes play an important role in maintaining osmotic pressure, fluid balance, and nerve and muscle activity. During exercise, sodium (Na^+), potassium (K^+), chloride (Cl^-), and magnesium (Mg^{++}) are lost in the sweat and urine. Loss of these electrolytes causes fatigue and muscle weakness, and decreases the thirst response to dehydration.

It is important to have some idea of the magnitude of loss of electrolytes from the horse during exercise before a feeding program can be developed to replace these losses. Since most of the electrolyte loss in the horse occurs through sweating, one method of calculating electrolyte requirements can be based on different amounts of sweat loss. Body weight loss during exercise is a good way to estimate the amount of fluid lost, where 1 kg (2.2 lbs) of body weight loss equals 1 liter of fluid.

Table 1 contains the levels of Na^+, Cl^-, K^+, and Mg^{++} required per day by a horse at rest, and after exercising hard enough to lose either 5, 10, 25, 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*	*25 liters*	*40 liters*
Sodium (Na^+)	10	27	43	93	142
Chloride (Cl^-)	10	41	71	163	254
Potassium (K^+)	25	34	43	70	97
Magnesium (Mg^{++})	10	12	13	19	24

The amount of fluid loss will depend on a number of factors such as duration and intensity of exercise, temperature and humidity. Therefore, the best way to determine this loss is to weigh the horse before and after exercise. This after exercise weight should be taken before the horse is allowed to drink. A racehorse training in Florida will obviously lose more sweat than one training in England, but for the sake of comparison we will consider that during a routine workout, sweat loss in a racehorse will amount to between 5 and 10 liters. Losses of 25 liters might occur during a normal endurance ride, and 40 liters of fluid loss would probably only be seen in an exhausted, dehydrated endurance horse in serious danger of dying.

Researchers at the Universities of Tennessee and Georgia measured weight loss, water loss and electrolyte balance in horses competing in a 3-day event in New Jersey (Andrews, *et al*, 1993). Even though the environmental conditions during this event were fairly mild, the horses lost a significant amount of body water and electrolytes during the competition. The 48 horses measured in this study lost an average of 18.4 liters of body water during the cross country phase of the three day event.

At the 1996 Olympic Games in Atlanta, several 3-day event teams weighed their horses daily throughout the competition. Figure 1 shows the average body weights of the three teams that won medals at the games (Australia-Gold, USA-Silver and New Zealand-Bronze). During the endurance day, the average weight loss of these three teams was 18.4 kg.

Many people don't have a good idea of their horse's daily sweat loss or don't have access to a scale to weigh their horse before and after exercise. Therefore, a more general set of recommendations based on work intensity can be used. Table 2 contains daily requirements of electrolytes for 500 kg horses at maintenance and at light, moderate and heavy work. These values were calculated by Dr. Helmet Meyer, a German researcher who has extensively studied electrolyte requirements in horses (Meyer, 1987).

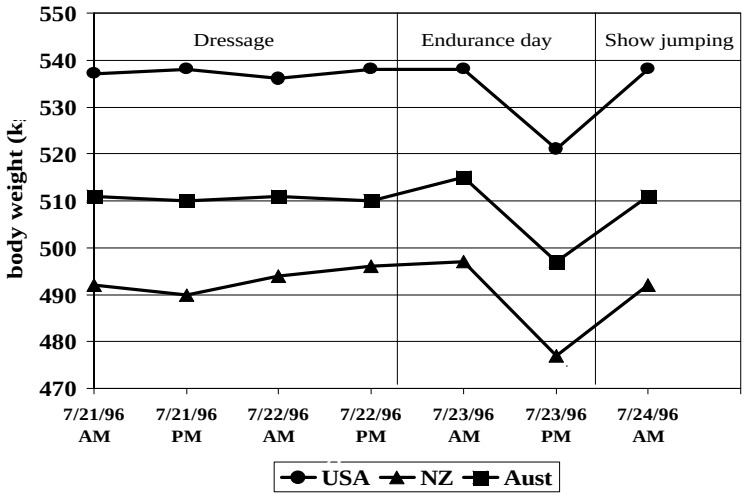

Figure 1. Mean body weights of team 3-day event horses at 1996 Atlanta Olympic games

Electrolytes and Rhabdomyolysis

Equine rhabdomyolysis, or tying up is a common problem in performance horses. There are a number of possible causes of tying up, but recent research from England

suggests that many cases of tying up are related to electrolyte imbalances. Using urinary fractional electrolyte excretion tests, researchers at the Animal Health Trust in Newmarket evaluated the electrolyte status of 144 horses which had suffered repeated attacks of tying up (Harris and Snow, 1992). One hundred of these horses had electrolyte balances outside of normal ranges. Of these 100 animals, 72 suffered no more attacks of the condition after receiving proper electrolyte supplementation.

Table 2. DAILY REQUIREMENTS OF SODIUM, POTASSIUM, CHLORIDE, AND MAGNESIUM FOR HORSES EXERCISING AT DIFFERENT INTENSITIES. (GRAMS/DAY)

	Work Intensity			
Electrolyte	*Rest*	*Light*	*Moderate*	*Heavy*
Sodium (Na^+)	10	20	50	125
Chloride (Cl^-)	10	25	70	175
Potassium (K^+)	25	30	44	75
Magnesium (Mg^{++})	10	11	14	15-19

It is the author's impression that many cases of tying up are caused by electrolyte deficiencies resulting from inadequate forage intake. A major source of potassium for horses is forage. Hays typically contain from 10 to 20 grams of potassium per kg. When fed in adequate amounts, hay provides a great deal of a performance horse's potassium requirement.

Besides providing large quantities of potassium, forage helps maintain water balance in exercised horses. German research has shown that horses fed adequate forage maintained water and potassium balance better during exercise than horses fed a high concentrate diet (Meyer et al, 1987). Unfortunately, forage is very low in sodium and marginal in chloride. Therefore, supplemental sodium and chloride are required by the performance horse. A portion of the sodium and chloride required by the performance horse can be provided by a salt lick. Research at Cornell in the US has shown that horses at rest will voluntarily consume about 50 grams per day from a salt block (Schryver et al, 1987).

Supplementing Electrolytes

Although it is theoretically possible to fulfill an exercising horse's electrolyte needs with plenty of good quality forage and free choice salt licks, many equine practitioners have reported that supplemental electrolytes are important and beneficial for maximum performance. Besides aiding in the prevention of tying up, electrolytes help horses

rebound from hard work sooner, return to feed quicker and begin the necessary rebuilding phase that occurs after exertion.

While electrolytes are essential to the performance horse, electrolyte preparations must be properly formulated to meet the horse's needs. Unlike human preparations, equine electrolyte replacements should not be largely sugar (although some sugar aids in rapid uptake from the gastrointestinal tract). Electrolytes should be formulated to replace the amounts of loss from the horse during exercise.

In summary, electrolytes are essential nutrients for the performance horse. Since horses lose large quantities of electrolytes in sweat, requirements increase with exercise intensity and sweat loss. Adequate intakes of good quality forage and a free choice salt lick will help meet much of the electrolyte requirements of the performance horse. In addition, a commercial electrolyte supplement can help prevent electrolyte depletion, but it should be evaluated to determine whether useful amounts of the critical electrolytes are being supplied.

References

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