

## Electrolytes

### What Are Electrolytes?

Electrolytes are one of the most abundant compounds in the body after water. The major **electrolytes** include **sodium (Na)**, **potassium (K)**, **chloride (Cl)** and **calcium (Ca)**. Electrolytes are not evenly distributed throughout the body. For example, red blood cells and nerve cells contain very high concentrations of potassium but the concentration in plasma is quite low. Calcium is also low in plasma, but high in bone and muscle cells.

### Myths About Electrolytes

There are many **myths about electrolytes**. For example, it is not uncommon to hear someone refer to an “electrolyte allergy”. There is no such thing. A horse cannot be allergic to compounds as small as electrolytes and if it were allergic it would be dead! Some people also refer to electrolytes as “poisoning” horses! Whilst it is possible to feed a diet low in electrolytes, it is not possible, nor desirable, to eliminate them completely. However, misuse of electrolytes can produce effects on a horses health and performance.

### What Form Do Electrolytes Come In?

When electrolytes are fed to horses in supplements, they are in the form of compounds, such as sodium chloride or plain salt (NaCl) or potassium chloride (KCl) or calcium carbonate (CaCO<sub>3</sub>). Electrolytes are also present in the horse’s natural diet – grass, and in hay. All compound feeds also contain electrolytes. A diet consisting of hay and a **commercial concentrate feed will generally supply adequate amounts of the different electrolytes for horses at pasture or in light work.**

### Why Do Horses Need Supplemental Electrolytes?

**Horses in regular work need supplemental electrolytes to perform optimally and to avoid problems** such as synchronous diaphragmatic flutter (“thumps”) or some forms of rhabdomyolysis (“tying-up”). **A diet low in electrolytes is a frequent and often undiagnosed cause of horses not performing to expectation.**

### The Effect of Dehydration On Heart Rate

If a horse sweats excessively fluid is removed from the blood and blood volume shrinks. This means there is less fluid in the circulation and in order to compensate, the heart must pump faster i.e. the heart rate goes up. For an endurance horse, this can mean the heart rate not coming down to pass the veterinary inspection. For a racehorses or sport horses this can mean they fatigue earlier or have less capacity for exercise.

## Can a Horse Rehydrate Just on Water?

If a horse drinks water alone, this cannot be held in the body and the kidneys will try and remove as much of the extra water as possible. If water is consumed along with electrolytes, either in feed, given by syringe or dissolved in the water, the water can then be held in the body and the horse will rehydrate.

## Absorption of Electrolytes

Not all the electrolytes consumed by a horse will be absorbed. However, for electrolytes like **Na, K and Cl, the absorption is very high** (probably 95% or more). Calcium is interesting in that there is great individual variation in the ability absorb calcium between individual horses. The form of calcium fed also determines what proportion is absorbed. Ground limestone flour (calcium carbonate or  $\text{CaCO}_3$ ) is not absorbed as well as for example, calcium gluconate ( $\text{HOCH}_2[\text{CH}(\text{OH})_4\text{CO}_2]_2\text{Ca}$ ), although the latter contains less total calcium. Alfalfa is a naturally rich source of calcium that is absorbed easily. Other components of the feed may interfere with calcium absorption and or excretion, such as feeds high in phosphates (e.g. bran).

## What Happens If You Feed Too Much Electrolyte?

When electrolytes are fed in **excess**, the kidneys try to restore the normal blood concentrations by **excreting more electrolyte**. Too high an electrolyte content in the feed may result in **decreased feed intake** and if the electrolytes are eaten, disturbance to the **gastro-intestinal tract** (e.g. mild colic) and possibly **diarrhoea**. This is often associated with **increased urine production and increased water consumption**. **However, in horses under-supplementation is much more common than over-supplementation**. If you are feeding too little, then your horse may perform poorly, especially in hot weather or be prone to high muscle enzymes, tying-up or “thumps” or have a slow heart rate recovery.

## Blood Tests As An Indicator of Electrolyte Balance

Electrolyte concentrations in plasma are very rarely a good indicator of adequate and balanced intake, and may only be abnormal if your horse is very severely deficient or ill. The only reliable way of assessing electrolyte status is to do a creatinine clearance test, which looks at the concentrations of electrolytes in urine compared to those in plasma.

## How Do Horses Lose Electrolytes?

**The main route for electrolyte loss during exercise is via sweating**. The harder the horse works, the hotter the horse gets, and the longer a horse works and the hotter the environment, the more sweat and electrolytes a horse will lose. **One litre of equine sweat contains approximately 3.5g of sodium, 6g of chloride, 1.2g of potassium and 0.1g of calcium**. An endurance horse can lose 10 litres of sweat per hour on a hot day at a competitive pace. **Over 10 hours** this would equate to the loss of **100 litres of sweat and therefore around one kilogram of electrolytes being lost** (1 kg or 1000g or 36 ounces!!!). We usually feed endurance horses 50-100g of electrolytes per day so it could take up to 10-20 days to restore the electrolytes lost in one race. Even if you gave the horse 10 doses of 50g during the race, there would still be a deficit of 500g at the end of the race.

## Commercial Electrolyte Products

There are many electrolyte products on the market. These range from very expensive flavoured and or coloured salt to multi-mineral supplements. In many cases **commercial products contain relatively little of the important electrolytes** in the product, but lots of glucose to make it palatable. Some products give recommendations for feeding in water but these are not always accurate. **In some cases the final concentration of electrolytes may be very low - palatable but low efficacy.** Is one electrolyte product ideal for both prolonged exercise such as endurance and shorter, more intense activities such as racing? Probably not. In endurance the blood becomes more alkali. This has been the basis for including compounds such as citrate (citric acid) to reduce the blood pH. Unfortunately, citrate can have negative effects on the horse's gut. In sports like racing, the blood becomes more acidic and this has been the basis for including compounds such as bicarbonate.

## How Important is Glucose (Sugar) In Electrolyte Products?

It used to be thought that glucose was essential for electrolyte uptake. However, studies in horse and man have shown that glucose is not important for efficient electrolyte uptake. Many products contain high amounts of glucose in order to try and increase palatability.

## How Do I Judge What Is A Good Electrolyte Supplement?

Look on the labelling of the product and look for the sodium or sodium chloride content. The higher the sodium chloride content, the better the product. This is usually expressed either as g per dose or %. Alternatively, look at the order in which the ingredients are listed. The higher up the list sodium or sodium chloride or salt is, the more effective the product. The lower down the list, the less effective it will be.

## What Should I Look For In An Electrolyte Syringe?

- Look for a product that has **sodium or sodium chloride or salt** near the front of the list for ingredients
- A good syringe should be delivering at least **30g of electrolyte per dose**
- Check that the texture is **smooth** and therefore easy to squeeze out into the horses mouth
- A **strong masking flavour** (not sugar/glucose) helps with acceptance
- A **sticky** texture helps prevent the horse from spitting the electrolyte out

## When Should Electrolytes Be Given?

There is a school of thought that electrolytes should only be fed in training and not during competition. It is also common for horses to only be fed supplemental electrolytes immediately before and during competition. If a horse were put off its feed during endurance competition by feeding large amounts of electrolytes then it would be better not to give them via this route of administration. The palatability of electrolyte products either in feed or water can be a problem for many horses. If you feed enough electrolytes during training you may be able to get away with not feeding any electrolytes during competition (except in the case of endurance), but if you don't feed in training and feed only in competition you are asking for trouble. It can take months not days to fully restore the body's normal electrolyte levels following prolonged periods of training.

## **Recent Findings On Electrolytes And Gastric Ulcers**

Typical diets for racehorses in full work do not supply enough salt (NaCl or sodium chloride) and so it is necessary to add extra salt to the diet. However, it is well known that adding extra salt to the diet can cause problems such as food refusal. Furthermore recent evidence suggests that salt can exacerbate gastric ulcers in horses.

A study was carried out last year by the Veterinary School at Oklahoma State University in which horses were given 57g (around 2 ounces) of a commercial electrolyte supplement mixed in 60ml of water (around a ¼ of a mug) every hour for 8 hours, to reproduce typical electrolyte administration during an endurance race. This amount of electrolytes given in this way increased the number and severity of gastric ulcers present.

Tasteless Salt<sup>TM</sup> permits the electrolyte needs of a racehorse in work to be met without problems of palatability. In addition, because it dissolves slowly due to the fact that it is coated, it is gentler on the stomach than ordinary table salt or commercial electrolyte products.

## **Should Electrolytes Be Given By Syringe Or In Feed?**

The horse should normally receive most of its electrolyte in its daily feed, from a combination of forage, concentrate feed and an electrolyte supplement. In circumstances where horses are not eating or where extra electrolyte is required, for example before, during or after training, transport or competition, then an electrolyte paste is indicated.

## **I Make Up My Own Syringes – What's The Disadvantage?**

Making up syringes can be messy. It can also be hard to attain a consistent dosage. Homemade mixes can also be either too sloppy or too dry – in both cases these can be difficult to administer and a large amount can end up on the floor. Homemade syringes (e.g. for endurance) commonly supply sodium, chloride and potassium but no calcium or magnesium, which are also lost in sweat. A further potential problem with homemade formulations is the accidental incorporation of prohibited substances. Products not intended for horses (e.g. table salt) will not be certified as being free of prohibited substances. In addition, making syringes up by hand could result in contamination with caffeine or nicotine, both prohibited substances.