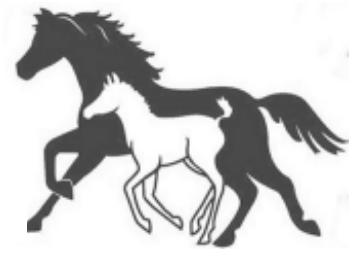




Ranvet



RANVET'S EQUINE NUTRITION SERIES



ENDURANCE FEEDING... THE APPLIED SCIENCE

Metabolically Challenging Endurance Riding

Endurance races are metabolically challenging and range from 30-60km or 100km+ to be run over two days to as extreme as 500km to be run over 5 days.

Generally, Arabian horses when compared to Thoroughbreds are better adapted to endurance work and this is attributed to their greater oxidative capacity however, the correct metabolic management of the endurance horse is of the utmost importance regardless of breed. There is a significant effect of nutrition and correct feeding strategies to influence performance, the main goals of which are to provide both nutrients to meet requirements and supplements to minimize or avoid the impacts of metabolic disturbance, facilitating the use of energy substrates in an efficient and effective manner. Alarmingly, in a study conducted in 1998 (Burger and Dollinger) which overviewed 7117 International endurance rides, it was determined that 24% of horses failed to finish for metabolic reasons. Therefore, the correct metabolic management of the endurance horse is paramount.

Endurance horses are extreme athletes and nutrition, as with any elite athlete is the determinant of athletic ability. It must be remembered that the duration of the energy sources is the vital point for consideration. Extended exercise also equates to increased sweat loss, increased fluctuations in fluid balance and increased generation of waste products and the need for disposal.

Energy for the Endurance Horse & Feeding the Hindgut

The supply and subsequent utilization of energy is of primary importance for the endurance horse. Due to the type of exercise being performed, energy must be derived mainly from the utilisation of fatty acids (both volatile fatty acids from the hindgut and long chain fatty acids from supplemented or stored fats). Ideally, 75% of the energy required for the endurance horse should be derived from hindgut fermentation (Spangfors 2000). The endurance horse is best prepared for long distance racing when there are high levels of microbial activity from beneficial hindgut microbes. The proportion of energy derived from the hindgut can be regulated by the fibre content of the ration and if there is less than 15% crude fibre in the diet, the horse's digestive tract is forced to function in a similar fashion to that of a human however, with a high fibre content, the horse becomes more dependent on microbial fermentation and volatile fatty acids (VFA's) from the hindgut. The endurance horse when provided with a diet of high quality forage can compete efficiently due to the hindgut serving as a reservoir for water and electrolytes (Schott and Hinchcliff 1998). An adequate fibre source is essential for optimal competition, as the hindgut serves as a reservoir for water and electrolytes. Therefore, good quality hay containing 80-90g crude protein (CP)/kg as fed will ensure sufficient protein while limiting nitrogen excess and aiding in the retention of fluid and sodium. Conflictingly, starch excess escapes small intestinal digestion and will hold water in the large intestine, resulting in increased difficulty in water use to compensate for dehydration during endurance rides.

RANVET PTY LTD

10-12 Green St Botany, NSW 2019
Toll Free: 1800 727 217 ■ +61 2 9666 1744
www.ranvet.com.au

Additionally, fat is a good source of important fat soluble nutrients as essential fatty acids and fat soluble vitamins, in particular Vitamin E have beneficial anti-oxidant properties. Horses fed fat enriched diets can mobilize and utilize fat more adequately during long distance exercise (Pagan *et al*, 1987) and fat adapted horses have higher speed at which lactate begins to increase sharply during exercise and lower lactic acid concentrations during aerobic work (Kronfeld *et al*, 2001).

Numerous factors contribute to fatigue in the endurance horse and these include increased ammonia (NH₃) increased levels, which occur as a result of adenosine monophosphate (AMP) diamination with exercise. Increased NH₃ levels inhibit neuromuscular function and aerobic energy production and as a result, greater anaerobic energy production is necessary which increases glycogen depletion and lactic acid production and utilization.

Fatty Acids

In an optimally fed hindgut, there are nutrients to sustain a horse for days without feed however, the greater exercise demand by way of speed or distance, the more importance placed on glucose metabolism from glycogen. Glucose is stored in muscles and the liver in the form of glycogen and with prolonged exercise, the horse becomes more reliant on glucose derived from glycogen stores. These 'stores' are constantly being refilled even during exercise however, it is a slow process so if the speed of work is high, the breakdown and formation of glycogen is unable to maintain the required pace. Alternatively, if the duration of work is prolonged, and you are unable to feed the horse during the race the horse must revert to using other sources for the formation of glucose in order to save glycogen stores.

Propionic acid from hindgut fermentation is probably the most important precursor for glucose as the horse has an enormous capacity to form glucose from propionic acid. The conditioned horse is also capable of using long chain fatty acids as energy in muscle cells after degradation to shorter carbon units.

Water & Electrolyte Reserves

High fibre content of the ration can have beneficial effects on hydration status of the endurance horse, also resulting in a microbe-sparing effect in the hindgut. The faecal loss of valuable nutrients is much less in horses fed fibre-rich feeds. This fluid barrier also prevents water and electrolyte losses through the faeces due to hindgut fibrous matter acting as a 'sponge' reservoir for water and electrolytes. Conversely, if the diet is rich in starch that escapes enzymatic digestion in the small intestine, starch particle hold water in the large intestine therefore making it difficult for the horse to use water in the large intestine to compensate for dehydration during endurance events.

Additionally retained sodium is significantly higher for horses receiving high fibre rations and as sodium travels where water travels, a high fibre diet also increases the water reservoir in the large intestine. In contrast, high energy grains such as oats have a higher concentration of starch that is digested to glucose by enzymatic digestion in the small intestine subsequently leading to sodium entering the bloodstream (as sodium travels where water travels) when glucose is absorbed through the small intestine wall. This leads to further compounding the level of dehydration.

RANVET PTY LTD

10-12 Green St Botany, NSW 2019

Toll Free: **1800 727 217** ■ +61 2 9666 1744

www.ranvet.com.au

Common 'electrolytes' include sodium, potassium, magnesium and chloride. These dissolved minerals are lost in large amounts via sweat, urine, faeces and respiration in the endurance horse. Additionally, not all electrolytes are lost through the same mechanisms or at same ratios for instance, the loss of potassium and chloride is elevated in sweat and for this reason, electrolytes administered in the horse immediately prior to competition may be of benefit when ingested with adequate provision of water. Furthermore, the losses of various electrolytes may cause different problems for example, the loss of magnesium may result in muscle malfunction in the endurance horse due to the intimate association with calcium for neuromuscular function. It must be considered that replacement of fluid and electrolytes should be based on sweat losses occurring during exercise which in most cases would fall in the range of 1-5L/hour with the exception of exercise conducted in hot/humid conditions whereby losses can be as great as 10-15L/hour.

Avoid Protein Excess

It must be considered that the comparative protein requirement for an endurance horse is relatively low. Additionally, during endurance races, the filtration rate of the kidneys is lowered in an attempt to conserve water reserves and subsequently, blood urea levels increase which may lead to metabolic disturbance. Protein which escapes enzymatic digestion in the small intestine is transformed by bacteria into NH₃ when it enters the large intestine, eventually reaching the liver where it is converted into urea.

However, it must be considered that although not advisable to use as primary energy substrates, amino acids (in particular branch chain amino acids) are integral to the performance of the endurance horse.

Water

Water is often a forgotten nutrient. Exercise conducted in hot, humid conditions may increase basic water requirements by 300% (Duren, 2000). In particular, endurance exercise influences body fluid composition, body weight and packed cell volume (PCV) (Bergero *et al*, 2001). Fatigue and exhaustion may occur when compensatory mechanisms fail due to severe water and electrolyte losses and insufficient replacement. Not only is water fluid balance crucial to the endurance horse, so is the ionic composition of body fluid reserves.

Minerals & Vitamins

As with all performance horses, the endurance horse requires optimal levels of minerals and vitamins and of particular importance are the B-Group vitamins due to their involvement with energy metabolism. In addition to B-Groups which are water soluble, the fat soluble Vitamin E is of importance due to its powerful anti-oxidant activity

RANVET PTY LTD

10-12 Green St Botany, NSW 2019

Toll Free: 1800 727 217 ■ +61 2 9666 1744

www.ranvet.com.au

Meeting Specific Needs

The endurance horse has specific metabolic requirements attributed to their utilization of specific energy substrates and metabolic challenges associated with this.

Points to consider are;

- ✓ Avoidance of large amounts of small intestinal energy
- ✓ Moderate protein levels
- ✓ Unlimited water provision
- ✓ Unrestricted roughage provision
- ✓ Daily electrolyte provision and additional supplementation
- ✓ Utilize the structure and composition of the feed to ensure meals pass through the small intestine quickly
- ✓ Feed small amounts as often as possible to prevent large hormone and energy peaks and troughs
- ✓ Provide the hindgut with fuel to maintain optimal microbial activity!

