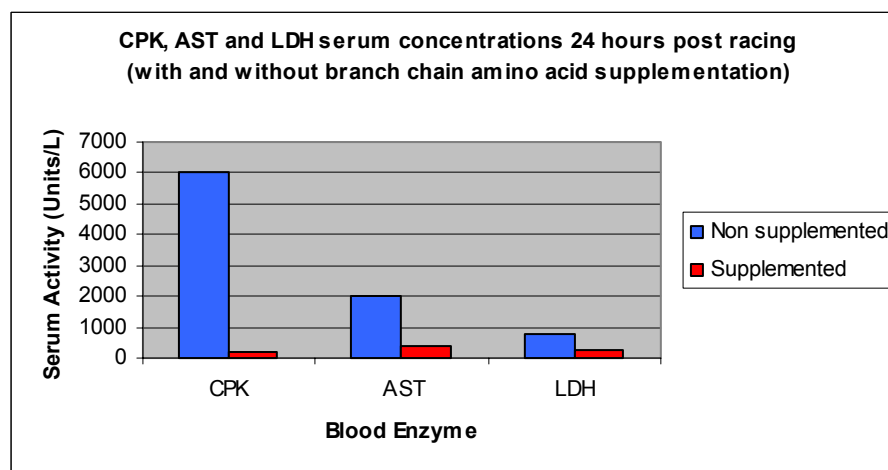


### BRANCH CHAIN AMINO ACIDS & TYING-UP... Nutrient Engineering Affects Performance!

Post-exertional rhabdomyolysis otherwise known as **'tying-up'** imposes not only significant welfare implications to horses afflicted but also significant loss of days training and substantial monetary loss indicated for treatment. There are a number of theories in regards to causative agents (Please refer to Ranvet's library article 'Tying-up' available at [www.ranvet.com.au](http://www.ranvet.com.au)) and the condition is likely multi-factorial meaning there is more than one singular contributing factor to a horse suffering an episode.

One factor all theories have in common is that the syndrome results from **metabolic abnormalities within muscle cells that are triggered by physical exertion**. In particular, several of these theories suggest that uncompensated over production of free radicals may result in oxidative damage of structural cellular components. **Clinical symptoms presenting themselves by the way of pain, loss of neuromuscular responsiveness, tissue damage and leakage of intracellular enzymes into the extracellular fluid**. Due to this leakage, a tentative diagnosis may be confirmed by an elevation in serum AST activity in blood samples drawn 24 hours after the onset of functional deficit/clinical signs.

One potential cause of excessive production of free radicals is an inability of oxidative metabolism to limit the acidification of muscle cells during work, which results from a local deficiency of branch chain amino acids (BCAA's) at the sites of muscle oxidation. This suggests that **supplemental BCAA's provided to muscle cells during work could postpone the onset of or alleviate the severity of post-exertional myopathy in equine athletes susceptible to this condition**. This theory was examined (*Glade, Veterinary Review, 1992 12:2*) and the below graph summarizes some of the results found from this research.



Graph: Serum enzyme concentrations 24 hours post racing with and without branch chain amino acid supplementation (*Glade, 1992*)

As can be seen, serum enzyme activities were significantly increased when episodes of 'tying-up' were left unaddressed however, **supplementation of BCAA's pre and post exercise resulted in significant decrease in serum enzyme levels**, representing a marked decrease in leakage of muscle and liver enzymes into the blood. These findings suggest that BCAA supplementation provides a degree of protection from muscle damage to horses previously exhibiting signs of episodic tying-up.

The five branch chain amino acids – **leucine, isoleucine, valine, glutamine** and **carnitine** are classed as 'essential' amino acids and are most plentiful in muscle tissue – making up over one third of the volume of muscle protein. Insufficient provision may result in muscle cell damage including reduced ability of muscles to contract and relax during extreme exertion, muscle fatigue, lactic acidosis and delayed recovery as muscle tissue completes the repair process. Research has demonstrated that plasma concentrations of leucine, isoleucine and carnitine decrease during exercise, suggesting that **the utilization of these amino acids is accelerated during strenuous work**. Research also supports that the effect of administration prior to hard work may be more to spare muscle tissue from breakdown during strenuous activity, therefore being a more favourable and efficacious supplementation schedule for horses prone to episodic 'tying-up'.

The following beneficial effects have been reported following pre-exercise supplementation of key amino acids (BCAA's);

- Ergometric improvement in aerobic work capacity.
- Superior conditioning of horses for intense competition.
- Decreased breakdown of muscle tissue.
- Decreased recovery time.
- Preservation of muscle glycogen stores.
- Delayed onset of fatigue and lactic acid accumulation.

### **The Big Five**

**L-Leucine:** Maintains muscle strength and inhibits the breakdown of muscle proteins, particularly during times of physical stress and intensive exercise. Leucine is metabolised in muscle and responsible for regulation of protein synthesis and energy metabolism.

**L-Isoleucine:** Powerful anti-oxidant action supporting the cell-protecting mechanisms of Vitamin E by detoxifying peroxides.

**L-Valine:** Improves energy metabolism and protein synthesis (*NRC, 2007*) in addition to maintaining muscle strength and integrity during times of physical stress and intensive exercise.

**L-Glutamine:** Used as an energy substrate particularly by the kidneys and intestines, facilitating greater concentrations of circulating glucose to be available to the brain, nervous system and muscles.

**L-Carnitine:** Essential to the transportation of fats into cells for energy production, crucial during periods of high exertion. Aids in the conservation of muscle glycogen (carbohydrate) stores for rapid anaerobic energy production.