

## OVERTRAINING

**Dr J H Stewart BVSc BSc PhD MRCVS Dip BEP AAIM  
Equine Veterinarian and Consultant Nutritionist**

Overtraining occurs when work is in excess of fitness level or there is insufficient recovery time between work sessions. It is as common, if not more common than undertraining. Signs that a horse may be reaching this point include weight loss despite adequate food intake, loss of appetite, dry coat, dull eye, loss of enthusiasm for work, slower times, longer recovery, colic and nervous disorders. Athletic performance decreases and horses must reduce work or be spelled for various periods of time for recovery.

Affected horses may enter into a catabolic (ie tissue breakdown) state – the opposite of anabolic. This is thought to be due to insulin-resistance secondary to free-radical damage of muscle cell membranes. There is strong evidence for the involvement of free radicals, the immune system and hormones in the early symptoms of overtraining. The following nutrients have a role in the immune system and in forming the antioxidants that combat free radical damage from heavy exercise:

Vitamin A is important for cardiac muscle. However, unless the horse is on an unsupplemented grain and poor quality grass hay, deficiency is extremely unlikely. Vitamin E is a common deficiency in racehorse diets. The NRC recommends around 1500 IU/day for exercising horses, but requirements with heavy exercise could be up to 5000 IU/day.

There is a lot of concern about selenium. Exercising horses are often under-supplemented because of fear of toxicity. NRC has set the maximum tolerable limit at 2 mg/kg of diet or about 20 mg/day for a horse in heavy work. However, for race training, 3 mg/kg/day is probably the bare minimum. Levels naturally present in most feedstuffs are much lower than this.

Recently glutathione has received a lot of interest for its role in preventing 'overtraining syndrome'. Glutathione is made in the body from 3 amino acids, glycine, cysteine, and glutamic acid. When glutathione combines with selenium it becomes a powerful chelator – a scavenger of the free radicals that cause muscle and cell membrane damage and delayed muscle soreness. Other amino acids which act as 'chelators' include methionine, cysteine, aspartic acid and histidine. In addition, glutathione is one of the most important amino acids for the immune system.

Immune cells require glutathione to divide normally and be protected from the damaging byproducts they produce in their role of detoxifying and/or attacking foreign substances. In the muscles, glutathione accounts for 50% of the protein present and is the primary antioxidant substance, mopping up free radicals produced during exercise, before they can damage the muscle cell. Vitamin E and selenium maintain the integrity of the enzyme systems which keep glutathione in an active, functional state.

The cells of the immune system cannot manufacture glutathione. Exercise improves immune system function because muscle is the site of glutathione synthesis and large amounts are released during exercise. As long as exercise is not excessive, it enhances immunity by increasing the synthesis and release of glutathione. When exercise becomes excessive however, the loss of glutathione during work begins to exceed the capacity of the muscle to produce it. Muscle cells, lacking the necessary amount of glutathione, begin to show damage - which further increases their need for glutathione. The downward spiral continues until there is not enough glutathione for the immune cells either and compromised immunity results. These events are behind 'overtraining syndrome'. Hormonal abnormalities and deficiencies in magnesium, vitamin E, selenium and vitamin C affect how much glutathione is manufactured and are intricately involved in overtraining. Deficiencies are common in equine racing diets.

Other antioxidant systems in the body have an absolute requirement for trace minerals - copper, zinc and manganese. These are also common dietary deficiencies in horses. Ideally, levels in the total diet should be determined to avoid excesses of individual minerals which could interfere with absorption or utilization of the others. Excessive iron is detrimental because it promotes oxidation, thus increasing the requirements for antioxidant nutrients, vitamins and enzymes. It also interferes with absorption of many trace minerals.

Adding glutathione supplements will not correct deficiencies. Glutathione is extremely unstable - because it is such an effective antioxidant, it reacts with many substances and is unstable in solution. Supplemental glutathione is not well absorbed and high levels may lead to excessive ammonia levels in the blood. Because of these problems with supplements, a more effective strategy is to ensure the diet contains the precursors or raw materials, including the entire amino acid profile, with all the micro minerals in the correct amount, and let the body do the rest. If the diet doesn't master the fundamentals of supplying correct amounts of protein, amino acids, vitamins, minerals, fats and carbohydrates at the right times, little will be accomplished and supplementation will not correct inherent dietary deficiencies and imbalances.

The antioxidant status of many horses is questionable and biological quality of the dietary protein often unknown. Mitavite racing feeds are formulated with an understanding of the biochemical and hormonal effects of exercise on the body. Essential amino acids are combined with protected, heat-stable vitamins and chelated mineral proteinates. International pharmaceutical research continues to expand our knowledge of the effects of stress and training on the immune and anti-oxidant systems. As the roles of micro-, macro- and trace elements, essential amino acids and vitamins are further understood, MITAVITE applies them to the formulation of Mitavite feeds for the thoroughbred racehorse.