# FEEDING HORSES IN COMPETITION

Nutrition is a powerful tool when used properly. Maximising the response to training, supporting recovery from exercise, and preparing for the next session can all be optimised by strategic feeding practices. The choice of feed and the time of feeding can also impact performance. However, the provision of the correct nutrients in the daily feed underpins health and performance

The daily diet should address the requirements of all systems in the horse's body, and for exercising and competition horses, art and science combine. As we all know, every horse is different and as owners we get to know what our horses like - and don't like! And with all the different feeds, information and supplements available, it's important to have the basic diet sound and correct before reaching for supplements. So firstly let's go through a check list of which nutrients are required to support the demands of exercise and training, which ones need to be increased and which ones don't.

Obviously energy is top of the list. Dietary fibre is the most important source of energy, so free choice hay or pasture is most important for competition horses. This can be supplemented with beet pulp, which has twice as much energy as hay, produces less of a glucose high and less risk of 'hot' behaviour than sweet feeds or grains. Oil, which has almost 3 times the energy of grains can also be added and for horses not on pasture, the oil needs to be high in omega 3 fatty acids (linseed or flaxseed). Pasture has an omega 3 content of around 6%, dropping to 2-3% when it is cut and dried as hay. Feeding 120-180ml of flaxseed oil per 10kg of hay restores intake to pasture levels. Omega 3 oils have been found to benefit blood oxygen levels and reduce the incidence and severity of arthritis and inflammatory skin conditions in both humans and animals. They are also the best oils for horses with polysaccharide storage myopathy (PSSM).

As the horse gets fitter, the muscles ability to utilise oil for energy increases, but feeding rate should be increased gradually. It takes 3 weeks for the gut to increase its ability to absorb oil, and around 6 weeks for the muscles to increase their ability to use oil for aerobic energy generation. High oil diets (10-12%) reduce heat, increase energy density and absorption of vitamins A and D, and help reduce dust and fines. Even as work level increases, oil and fibre can provide enough energy for steady speeds of up to 160 metres per minute. At higher speeds and for competitions that require rapid bursts of speed, the need for glucose increases.

Although the muscles have a reserve of energy as ATP and phosphocreatine, these reserves are for sprint exercise and can only sustain intense speed for about 7 seconds – just enough time to flee a hungry carnivore. Primarily the muscles rely on glucose for energy generation. The amount of energy required is influenced by the combined weight of the horse and rider, the biomechanical efficiency of the gait and how balanced the hooves are. Fatigue is linked to a fall in blood, muscle and liver glucose levels. However, it's important to know that the fuel used for exercise is built up 24-48 hours before the exercise session, and cannot be increased by feeding grain before work. In fact a grain meal before work will often depress exercise capacity. This is because after a grain meal, the muscle takes in glucose and uses it to build muscle glycogen. Exercise requires the breakdown of glycogen. Building muscle glycogen and breaking down muscle glycogen cannot occur at the same time. This is

why feeding grain within 4 hours of exercise often results in reduced exercise output and why many trainers do not feed before work. It is important though not to work horses on an empty stomach as the reflux of acid into the stomach increases stomach ulcer formation. The risk is reduced by feeding 1kg of lucerne hay or a small amount of beet pulp 60-90 minutes before work.

Feeding after work is the time for refuelling and is the same across the equestrian disciplines. Some horses respond well to corn syrup (100ml) as soon as possible and again 1 hour after work, followed by a small grain feed 2 and 4 hours after work. Grain digestion is better if it is fed without roughage at this time. For horses with a poor appetite, provide hay and administer the corn syrup as a paste.

Next on the list is protein – or rather amino acids, because no matter how balanced the diet, exercise causes a disruption to normal cellular processes. The working muscle releases enzymes to breakdown other body tissues. The nutrients, including amino acids, vitamins, minerals and anti-oxidants, are donated to repair and build the muscles used in hard work. Once these enzymes are triggered, tissue breakdown is irreversible - protein synthesis rates drop 30%, tissue damage and delayed muscle soreness may persist for 3-5 days - longer in young horses just beginning training. Add to this the hundreds of tiny rips and tears, overproduction of free radicals and muscle membrane leakage that occur during exertion and it's easy to see why the muscles need support.

Skin and coat health, reproductive efficiency, resistance to disease, ability to tolerate hard work, recovery from injury and illness and whether a young growing horse deposits fat instead of building muscle and bone all depend on the quality and quantity of protein in the diet. Protein is made of amino acids, joined together in long chains. Every protein has its own unique sequence of amino acids. To appreciate how much the hard-working competition horse depends on receiving the correct amino acids is to be aware of how dynamic the equine system is - every second the bone marrow makes millions of red cells; every four days blood platelets and the gut lining are replaced; every 10 days, most of the white blood cells are replaced and the number of new cells created in horses that are training and racing is huge.

Horses require a certain number of grams of protein a day, not a percent. Comparing the percent protein of different feeds is a futile exercise unless the weight of feed is factored in. If for example, a feed is 10% protein and a horse is fed 3kg of the feed – the horse receives 300g of protein. If another feed is 20% protein and a horse eats 1.5kg, it still receives 300g of protein. So it is meaningless to compare feeds on % protein alone. In addition, the dietary protein must contain the 10 essential amino acids. Muscle building is so specific that if the feed meets required levels of 9 essential amino acids, but has only half of the tenth, body protein synthesis will be reduced by up to 50% - and fat deposition increases. Poorly profiled feeds may be 14% protein - but only 8% 'useable'. Soybean meal has at least 15 times more lysine than most hays, and at least 10 times more leucine, and is a useful protein supplement.

Exercise also results in cell damage caused by oxidants. Energy generation occurs in the muscle cell mitochondria. Mitochondria are like nuclear power plants in that they produce dangerous waste products. In the mitochondria these waste products are altered or partially spent oxygen molecules – called oxidants or free radicals. The more energy a horse generates, the more oxygen it uses, the more oxidants are produced. Excess iron also increases oxidant production. Oxidants damage DNA, cell membranes, proteins and fats. Indices of muscle cell damage (blood AST and CK levels) are correlated with oxidant damage. To protect against this damage, the horse maintains a complex and elaborate anti-oxidant defence system that requires vitamin E and selenium, vitamin C, copper and zinc. Muscle cell leakage increases when anti-oxidant intake is inadequate.

Blood vitamin C levels decrease during exercise, especially in hot conditions. Daily administration of 1-5grams of vitamin C results in greater tissue stores that are released into the circulation during exercise, and significantly increase the horse's antioxidant defences in the muscles, the lungs and the blood. It has recently been shown that the combination of stabling and limited access to pasture result in a drop in blood levels of vitamin C – in fact, levels are often undetectable in horses kept under these conditions – and heavy exercise drops levels to almost zero. The consequences of suboptimal vitamin C intake feature in the most common health problems of horses and the signs include poor performance, tendon

and ligament problems, low stress tolerance, increased susceptibility to viral infections, slow healing and breathing problems - including bleeding.

Vitamins A and D are plentiful in most feeds, and exercising horses do not have increased requirements. Vitamin B is a different story. Due to their role in energy generation, vitamin B requirements increase with exercise – especially with increasing grain intake or lack of fresh pasture. Generally any horse on less than 2% body weight (10kg for a 500kg horse) of roughage each day and/or more than 2kg of grain each day, will likely require vitamin B supplementation – especially thiamine 100-200 mg, riboflavin 50 mg, niacin 25 mg, biotin 10-20 mg, folic acid 25 mg, $B_{12}$ 120 mcg, $B_6$ 100 mg, pantothenic acid 50 mg and chromium 1-3mg/day.

In addition to the stress of training, the competition horse may also be exposed to transport stress, heat stress, respiratory stress, psychological stress and stress from pain and injury. The risk of 'shipping fever' or pneumonia, is related to inability to lower the head for long periods and inhalation of ammonia fumes from urine and manure, dust in feeds and vehicle exhaust. 'Shipping colic' is linked to impactions from reduced water intake, high grain diets, changes in diet or feed quality and low roughage intake. To reduce psychological stress during travel horses prefer to travel backwards and if untethered, most will turn to face the rear. This results in a lower head carriage, a more relaxed posture, a 35% reduction in moving and changing position, less sweating, lower heart rate and more normal manure consistency. Psychological stress has been linked to stomach ulcers in horses. In addition to grazing f or up to 16 hours and travelling over 20km each day in search of food or escaping predators, the natural horse is also a social animal. The stress of stabling can be reduced if horses are able to see each other, have constant access to forage and are fed 3-4 small meals each day - instead of 2 large ones.

Nutrition management also affects bone density. Diets which contain pasture high in oxalates (kikuyu, buffel grass, pangola, green panic and setaria) or excessive amounts of raw grains, chloride or sulphur, and those that are deficient in sodium and potassium, can lead to a reduction in body calcium, phosphorus and magnesium levels. Horses on oxalate pastures may require up to 100 grams of extra calcium - the equivalent of 1/3 kg of lime per day.

Chelation, the process by which minerals are bound to amino acids, improves calcium absorption up to 300% and hoof growth and hip height in yearlings are significantly superior when they are fed chelated compared to inorganic mixtures of minerals. Increasing the 'available' calcium in the diet also minimises the reduction in bone density in during early training.

For performance horses, maintaining body condition is the minimum requirement of feeding. A more important consideration is how performance can be improved through nutrition. For the competition horse, the demand for a constant supply of key nutrients — to meet the needs for tissue repair and adaptation, energy generation, protection against oxidative damage from free radicals and resistance to infections — is huge compared to a horse at rest. Recovery from hard exercise and preparation for the next session can be hastened by strategic feeding practices. To maximise the response to training and impact significantly on subsequent exercise capacity, the array and timing of nutrients supplied is critical. But, whatever the feeding regime, it should remain consistent when travelling and competing. Changes in diet and feeding schedule alone, may cause a stress response in the equine athlete.



**Dr Jennifer Stewart CEO BVSc BSc PhD Dip BEP Equine Veterinarian and Consultant Nutritionist**
Dr Jen Stewart has been an equine veterinarian for more than 40 years and an equine nutritionist for more than 20 years. Jen has been developing premium formulas for studs, trainers and feed companies - such as Mitavite - in Australia and around the world. Consulting to leading international studs and trainers in various countries while working on research projects and being involved in nutritional management of a variety of equine clinical conditions, including colic, tying-up, laminitis, performance problems, developmental orthopaedic diseases and post-surgery.

Dr Jen is currently the only practicing equine veterinarian and clinical nutritionist in Australia and was also an official veterinarian at the Sydney Olympics 2000. Jen's passion for nutrition along with her extensive experience and knowledge strives to continue to BRING SCIENCE TO YOUR FEED BIN