EXERCISE AND HEAT STRESS©

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Racehorses can lose up to 10 litres of fluid and 100 grams of electrolytes during exercise or racing. Reducing and preventing dehydration secondary to sweat losses, is a constant and ongoing challenge for the horse and the trainer. If heat stress is severe, horses may become 'dry coated' and lose the ability to sweat.

About 75-80% of energy used in the body is given off as heat and during exercise, heat production increases 10 to 60 times over resting levels. The more heat produced, the more blood is shunted to the skin and this contributes to fatigue, by reducing muscle blood flow. Additionally, the gut flora, those bacteria that help digestion, are killed off *en masse* by high body temperatures. When this happens, the horse becomes lethargic, goes off its feed and manure may be loose.

Bigger, heavier horses have a larger body mass to surface area than leaner horses, favouring heat retention. Horses have a low ratio of surface area to body weight – a 60kg human has a skin surface area of around 1.7 square metres, whereas a 500kg horse has a skin surface area of only 5 square metres. So even though the horses body weight is approximately 8.5 times that of man, the skin surface area is only 3 times as large – which limits the amount of sweating.

Signs of a critically high body temperature after work include agitation, inability to stand still and constant tail swishing. Rectal temperature, pulse rate, respiration and dehydration should be monitored when working horses in hot weather. Heart rate should drop to 40-50 beats per minute within 15 minutes of finishing work. In hot or dehydrated horses, the post-exercise heart rate recovery is slower, but respiration rate and rectal temperature will give you a better indication of heat stress.

Normal respiration rate is 10-20 breaths per minute. During the first 10 minutes after work, respiration rate may remain at 60-80 breaths per minute. Horses that are overheated may have rates of 120-140 breaths per minute because they are using the respiratory system to lose heat. Under normal conditions, respiration rate can remain elevated for 30-60 minutes after finishing exercise, however if it is 120-140 after 5-10 mintues rest, the horse is overheated and needs active cooling. Increased respiration rate may also indicate a bleeding episode has occurred and the trainer will need to decide if a veterinary examination is indicated.

Rectal temperature may decline a little or increase slightly in the first 10-20 mintues after exercise and if it is 40.5-41°C, you should be concerned and begin active cooling measures. The rise in rectal temperature lags behind the rise in muscle temperature and 41°C rectally may mean over 43° in the muscles, which is enough to cause severe muscle damage. Cold hosing has been regarded as dangerous because of the misbelief that it will result in muscle damage and tying up. However, track and field research has recently shown that the muscle damage is caused by the high muscle temperatures, not by the cold hosing.

Given that heat production is inevitable with exercise and that summer occurs regularly, what feeding strategies can be employed during hot/humid conditions? Energy requirements are 14-27% higher in hot weather. If feed intake does not increase sufficiently to meet the increased needs during hot weather, then body weight and performance will be affected. The heat-stressed horse decreases feed intake and this, combined with the increased energy requirements, result in weight loss.

High energy-density is important for the racing thoroughbred, because energy requirements double in heavy training. Traditionally, this increased energy requirement was met by increasing grain intake. The major concern with increased grain intake is the risk of gut upsets from fermentation and increased risk of tying up, colic and laminitis. Subclinical laminitis occurs in 48% for thoroughbreds and is a major cause of poor performance. But because it usually only causes pain at full racing speeds, it is difficult to diagnose.

Oil is an excellent source of energy, providing 2.5 times as much energy as an equivalent weight of grain. In a traditional hay/grain diet, horses utilise between 50 and 60% of the energy, whereas they utilise 85-90% of the energy in oil. Using oil-enriched feeds allows for a reduction in the amount of grain in the diet. Another advantage of oil-adaptation is a reduction in metabolic heat generation both at rest and during exercise. Horses produce less body heat when they burn fat as a fuel, reducing the heat load and increasing the amount of energy available for physical activity and glycogen storage.

A high-oil diet works best in conjunction with a high carbohydrate intake and there is no benefit in feeding more than 10% oil in the total diet. So, if for example a horse is eating 12kg of feed a day, total oil intake would ideally be 960-1000ml. There are opinions that suggest a high oil intake compromises intense muscular exercise. However, this has not been observed when oil intake is at the levels given above and when adequate carbohydrate is available.

In one study, feeding extra oil resulted in a 14% decrease in total heat production and as a result, over 60% more energy was available for exercise. If this energy is not needed for performance it is stored and can be used to put on weight in underweight horses. Diets with added oil have been shown to be better than either high carbohydrate (40%) or high protein diets for both high speed and moderate speed exercise. Full adaptation to an oil-enriched feed takes up to 11 weeks, so time must be allowed to achieve the benefits.

Insufficient electrolytes can increase the risk of tying up, blood thickening and impaction colic and reduce urine production and the ability to sweat. However, electrolytes should never be added to the drinking water as this prevents the horse from regulating its body fluid levels. Thirst occurs when there is excess sodium in the body. If the drinking water contains sodium, the horse cannot restore the balance as drinking will increase sodium intake. Affected horses will drink and urinate excessively. If this vicious cycle continues, the horse will lose weight. The weight loss is frequently blamed on the feed – preventing recognition of the true cause.

Episodes of bleeding are more frequent in summer and are associated with poor stable air quality. The incidence is reduced in dust-free stables. Hay, raw grains and bedding are the major sources of stable air contaminants, in terms of respirable particles, fungal spores and bacterial fragments. Human grain workers develop inflammatory airway disease in response to dust and particles in the raw grains. A similar condition has been found in stabled racehorses and is thought to be more significant than the 'virus' as a cause of respiratory disease. Soaking hay for 6 hours to reduce particles and dust and the use of steam-extruded grains, which are low in dust and moisture, are major steps that will improve air quality and hygiene. MITAVITE has recently released steam-extruded barley, corn and lupins – to provide safer, cleaner, low allergenic feeds. Increased digestibility of steam-extruded grains also reduces the weight of feed required and waste heat production during digestion.

When feeds are selected, their difference in *waste heat* production should be considered in relation to climate and work load. Many horses are still fed according to traditions developed over a 100 years ago in cold regions of the northern hemisphere. In hot climates, the benefits of oil-enriched feeds, correctly profiled for amino acids and protein and of steam-extruded grains are well-recognised. MITAVITE has an ongoing commitment to research in nutrition and exercise physiology in hot climates and has recently included PROTEXIN to replenish gut flora affected by high body temperatures endured during training and racing in hot/humid climates.