ABSTRACT

While the management and training of horses for competition should undoubtedly be tailored to the requirements of each individual, scientific evidence exists linking certain management practices to some common owner and rider veterinary complaints.

The transportation of sport horses is common. However, journeys of any length can impact on respiratory health. Transportation can cause dehydration, elicit a stress response and lead to increased levels of creatine kinase, indicating muscle damage through exertion – all of which may, in turn, affect performance.

Tension during ridden work can be a frequently reported problem, usually reflecting musculoskeletal injury or abnormality. Cross training, avoidance of repetition or over-training, and performing ridden and in-hand exercises to improve musculoskeletal strength all probably reduce the risk of lameness. The surfaces horses are trained and competed on also appear to be important factors.

Obesity in horses used for general purposes, showing and dressage is prevalent. These horses are at high risk of equine metabolic syndrome and atypical laminitis, which can cause lameness or poor performance. Owners are frequently poor judges of body condition, so education is one of the first steps in tackling this problem.

Performance horses of all disciplines, whether competing at elite or low level, are placed under varying degrees of both physical and psychological pressure that can lead to physical injury or behavioural problems, which may impact on performance.
Numerous exercise and management practices can have beneficial and detrimental effects on an individual, and little scientific evidence exists on the impact of these practices on the overall health of athletes.

The aims of this article are to explore scientific knowledge in relation to common presenting complaints and management issues pertaining to sports horses.

**Transporting horses**

Transportation of horses for training and competition is commonplace and an integral part of the management of many horses. Transportation is a stressor for all horses and some travel poorly. Potential health implications exist for both long and short journeys, and evidence shows it can impact on performance.

Pleuropneumonia – commonly known as “shipping fever” – is a recognised complication of long journeys, occurring in 5% of horses (Wilkins, 2003). Unless travelling abroad, the risk of pleuropneumonia appears to be low due to the usually short duration of journeys within the UK.

However, the prevalence of inflammatory airway disease (IAD) among sports horses is high (Gerber et al, 2003). Horses with IAD usually show subtle clinical signs, including poor performance, mild exercise intolerance, occasional chronic coughing and a mild to moderate mucopurulent nasal discharge. Inhalation of dust and pollution are thought to be the cause of IAD, which has been associated with stabling (Holcombe et al, 2001). The transportation of horses, for even short distances, is likely to be a risk factor for IAD.

Periods of rest during long journeys, improving air quality through cleaning practices and reducing the dust content of feed appear to be factors that influence the inflammatory and stress responses in horses during transportation, although the relative importance of each is difficult to ascertain (Oikawa et al, 2005). No evidence exists on the optimal frequency and duration of rest periods. Feeding soaked hay, using dust-free bedding, regularly mucking out and ensuring good air flow are likely to maximise air quality.

During transportation, restricting the head movement of horses is common practice to prevent interference with other horses. Accumulation of purulent material in the lower respiratory tract and reduced mucociliary clearance have been demonstrated in horses that had their heads elevated for 24 hours (Raidal et al, 1996). Restrictions of head movement may, therefore, partially hinder the innate immune system and contribute to the increased risk of respiratory tract infection. Allowing free head movement, and free movement and feeding from the ground during rest periods, may accelerate clearance of the respiratory tract and reduce the risk of infection during long journeys.

While elite horses are more likely to travel long distances over several days, to different climates and completely novel environments, they are, perhaps, more used to this. Low-level competitors
probably travel at variable frequencies for training and competition, but over shorter distances, often to venues the horses have been to before.

The effect of transportation on the stress response of showjumping horses was greater in horses with less travelling experience than experienced horses (Covalsky et al, 1991); transportation over short distances has little effect on the performance of horses with previous travelling experience (Beaunoyer and Chapman, 1987).

Haematological and biochemical analysis following transportation of horses for either one or three hours' duration in a sideways-facing position, showed a significant increase in serum cortisol concentration and PCV (Tateo et al, 2012). When transported for three hours, the horses also had raised serum creatine kinase values. Many event horses will travel for this length of time, so arriving the day before competition may be beneficial.

Horses travelling in a herringbone pattern appear to find it more difficult to balance, compared with horses facing forwards or backwards, and it is possible they may develop greater serum cortisol and creatinine kinase values; however, this has not been investigated. Change in heart rate variability and increased salivary cortisol have also been demonstrated in response to transport (Schmidt et al, 2010).

Although no studies demonstrate how protracted the stress response following transport is, pre-existing levels of stress at the start of competition could feasibly impact on performance. Increased locomotor activity due to stress could lead to increased energy expenditure and over-arousal could lead to decreased concentration.

Horses that travel badly may benefit from a companion that travels well and being given access to forage as a distraction. Horses who find balancing difficult may also move around a lot and become stressed. Using partitions not solid down to the floor, or which can be widened to allow the horse more space, will allow horses to adopt a wide-based stance and this can often help.

Transportation suppresses drinking and, combined with the often limited availability of water on journeys and the changeable ambient environment, can lead to dehydration (Iacono et al, 2007; Mars et al, 1992). Diuretic-induced dehydration negatively affected the performance of long distance more than short distance runners during controlled treadmill exercise (Armstrong et al, 1985).

In two endurance competitions, eliminated horses presented with haematological and biochemical evidence of significantly greater dehydration than successful horses (Munoz et al, 2010). It is likely dehydration prior to competition can affect performance. Allowing appropriate acclimatisation time with access to water and roughage prior to ridden work will probably reduce stress and allow correction of dehydration and replenishment of glycogen stores in muscles.
Tateo et al (2012) suggested, following a three-hour journey, a horse should be allowed a four-hour acclimatisation period with access to food and water before physical activity.

**Tension caused by riding**

Tension during ridden work is a common problem often assumed to be a reflection of temperament and anxiety. Little or no scientific evidence exists to support the efficacy of feed additives, touted for their calming properties, for use in stressful situations or to reduce anxiety and tension.

Feeding magnesium aspartate reduced the reaction speed of horses; however, the amount fed in the study was far greater than the quantities available in commercial calming products (Dodd et al, 2015). Supplementation with alpha-casozepine appears to have anxiolytic properties in several species, including horses put under novel stress (McDonnell et al, 2013).

Studies have concluded in a variety of species that L-tryptophan appears to reduce aggressive behaviour in. However, the response was variable and several potentially confounding factors were present. Conversely, a study on horses actually showed excitation following administration of L-tryptophan (Bagshaw et al, 1994). L-tryptophan is a Fédération Equestre Internationale (FEI) prohibited substance. No scientific evidence shows the feeding of valerenic acid (valerian, also an FEI prohibited substance), calcium or B vitamins as calming substances.

Some calming nutritional supplements appear, anecdotally, to positively affect some individuals and may be a true response in some horses and a placebo effect in others. Lack of response may be due to inefficacy of the given compound in a genuinely anxious horse – or, alternatively (or additionally), the cause of tension or anxiety is not primarily temperamental. The attribution of temperament as the cause of tension during ridden exercise is often erroneous.

Stiffness of the thoracolumbar spine, a high head carriage with the mouth held open, unwillingness to perform certain movements, not working into the corners of the arena, spookiness and conflict behaviour, such as bolting, rearing and bucking, are all common clinical signs of musculoskeletal pain causing lameness or poor performance. Abolition of pain following diagnostic analgesia will usually result in a more willing and relaxed way of going (**Figure 1**).

Musculoskeletal pain or abnormal biomechanical function is the most common cause of poor performance and veterinary-related, career-ending decisions in sports horses (Sloet van Oldruitenborgh-Oosterbaan, 2010), and has been identified as the most common reason for withdrawal of event horses from competition and elimination from endurance rides (Munsters et al, 2013; Nagy et al, 2010).

As well as physical conditioning and skill learning for optimal performance, training should be designed to minimise the risk of injury during training and competition. The risk of different types of injuries varies among equestrian disciplines and is likely to be due to repetitive overload from a lack
of variation in training (Murray et al, 2006).

Training programmes

Cross training appears to be protective against days lost due to injury, probably because it reduces the risk of repetitive overload injuries, as well as improving physical strength, proprioception and fitness (Engenvall et al, 2013; Murray et al, 2010a). Time spent turned out was protective for lameness in a group of dressage horses (Murray et al, 2010a).

Varying the training programme probably maintains a horse’s motivation to perform. Pain appears to negatively affect the performance of dressage horses sooner than horses working in other disciplines. This may be due to the often repetitive workload in one environment, leading to boredom and reduced motivation to perform in the presence of pain. Horses with more varied training, such as event horses, appear to be more motivated to perform despite the presence of pain.

Extended trot-increased fetlock extension compared with collected trot (Walker et al, 2013a). Canter (and gallop) and jumping probably lead to equal, if not greater, fetlock extension. This is likely to lead to greater loading of the suspensory apparatus and, therefore, may predispose to injury of the suspensory ligament. It may be advisable to avoid prolonged or frequent periods of time training in extended trot, canter, jumping or encouraging extravagant movement in young horses that may have poorer limb stability than mature sports horses.

Training should focus on progressive strengthening of the musculoskeletal system, without over-training, which can lead to fatigue, and avoiding multiple repetitions. Once a horse can perform a movement or skill easily, it should not be repeated unnecessarily. If a horse becomes fatigued then the quality of work will decline and further training is likely to increase the risk of injury or encourage incorrect muscle recruitment, rather than contribute to fitness or honing a skill.

Arena surfaces

The type of arena surface and how it is maintained are associated with the occurrence of lameness in dressage horses. Sand surfaces are associated with tripping and an increased risk of lameness, and horses are most likely to slip on woodchip surfaces (Murray et al, 2010a; 2010b).

Wax-coated or mixed sand and rubber surfaces were associated with a lower risk of injury compared with other surfaces. Interestingly, with more frequent training on a sand surface per week, the risk of lameness decreased, probably due to adaptation of the musculoskeletal system and improved proprioception.

Training on a variety of surfaces may be beneficial to prepare the horse for what may be found in competitions, both for the warm up and for the competition. The number of times an arena is ridden
on between routine maintenance (harrowing) was positively correlated with risk of injury and surfaces that remained uniform were associated with a decreased risk of injury (Murray et al, 2010b).

In the study, wax-coated surfaces were used by a large number of horses between maintenance, thereby decreasing uniformity. Despite this, the risk of injury with wax-coated surface was low. This surface type may be best suited to yards and riding schools with high usage of arenas. While maintaining a uniform surface appears to be important, more work needs to be done to identify the optimum method and frequency for each surface type.

**Equipment training aids**

The use of equipment as training aids to improve posture and strength is common, and a wide variety are available.

Choice of equipment is often based on anecdotal evidence, familiarity, market trends and rider endorsement rather than scientific evidence, which is lacking. Lunging with a Pessoa training aid may improve posture and activation of core muscle groups (Walker et al, 2013b). The long-term effect has not been investigated. However, lunging on a relatively small circle is likely to place additional stresses and torque on the musculoskeletal system.

Lunging on a large circle can be useful prior to ridden exercise to reduce any initial anxiety and tension when mounted or first ridden. The only evidence for alterations in posture, flexibility, stability and performance with the use of training aids other than the Pessoa training aid is purely anecdotal. As well as appropriate selection of potentially beneficial training aids, it is important owners are trained to use the aid effectively and without potential detriment to the horse.

**Exercise precautions and weight management**
Figure 2a. An obese show horse not moving as expressively as previously. There was no response to hoof testers or increase in digital pulse amplitudes. Step length was improved by palmar (at the base of the proximal sesamoid bones) nerve blocks.

A variety of ridden exercises can be performed, which develop different muscle groups without the need for multiple repetitions or inducing fatigue. Ridden pole exercises and gymnastic jumping are likely to be beneficial to sports horses of all disciplines, and may increase limb stability, proprioception, core strength and posture. Dynamic mobilisation exercises (stable or in-hand exercises) appear to improve posture, core stability and flexibility when assessed clinically.

Hypertrophy of the multifidus muscles in response to a dynamic mobilisation exercise programme has been demonstrated (Stubbs et al, 2011). The multifidus muscle group is important for back stability in humans and probably horses, too. Atrophy of the multifidus muscles is seen in patients with back pain, and reduced risk of recurrence is associated with performance of exercises and hypertrophy. Atrophy leads to intervertebral instability and increased risk of pathological changes, such as OA. Working in a correct outline or “long and low”, so avoiding working the horse with an extended back posture, will contribute to maintaining good posture.

A high prevalence of obesity is present among horses – particularly those used for general purposes, showing and dressage. Pleasure horses are more likely to be obese than competition horses, probably because they receive less exercise per week (Robin et al, 2015).

Regional adiposity is described as the phenotype of laminitis or equine metabolic syndrome (EMS) prone horses (Carter et al, 2009). Overweight dressage and show horses are at risk of EMS and atypical laminitis. Atypical laminitis in horses with EMS is probably a result of recurring low-grade laminar inflammation leading to chronic laminar pathology, with absence of an historical acute laminitic episode. Horses suffering atypical laminitis are often presented with poor performance (Figure 2a).

Increased digital pulse amplitudes may be present. Application of hoof testers may elicit a painful response. Horses are often mildly lame or short stepping in front, worse on hard ground and can be reluctant to go forwards when ridden. Diagnostic analgesia of the palmar nerves (at the base of the proximal sesamoid bones) typically abolishes the lameness and increases the step length of the forelimbs.

Radiographic examination can reveal an increased ratio of the thickness of the dorsal hoof wall to the palmar length of the distal phalanx, non-parallel alignment of the dorsal aspect of the distal phalanx to the hoof wall and loss of the normal radiolucent halo around the distal phalanx at the toe (Figure 2b).
Figure 2b. The right front foot of the horse in Figure 2a showing a long toe and rotation of the distal phalanx, with mild modelling of the toe of the distal phalanx, consistent with chronic atypical laminitis. There is also a loss of the normal radiolucent halo around the toe of the distal phalanx.

Weight management is a vital step in both the treatment and prevention of atypical laminitis. However, owners tend to underestimate the condition of their horses, even obese horses (Wyse et al, 2008).

Educating owners to accurately body condition score a horse, identify regional adiposity and differentiate fat and muscle may be difficult, but is important. Obese sports horses usually undertake an adequate amount of exercise and, therefore, it is often the nutrition that needs to be addressed. Overfeeding horses relative to their energy requirements is common. Unless undertaking strenuous exercise, feeding good quality forage and high-fibre, low-starch hard feed with a balancer is usually adequate. Weighing out the appropriate amount of forage, with or without soaking to reduce sugar content, is preferable to ad libitum provision or roughage.

Many owners become concerned about equine gastric ulceration syndrome when feeding weighed-out roughage rather than providing it ad libitum, but providing it in small-hole hay nets should avoid unnecessary periods of time without roughage available.

Summary

The interaction between exercise, stress and behaviour with performance, physical health and psychology of the equine athlete is intricate, and relevant to horses competing in all disciplines and at all levels.

We know management and training practices can, and do, influence the health of performance horses. While naturally athletic, horses did not evolve to cope with the same environment and stressors as the sports horse of today.

It is, therefore, important to optimise the management and exercise regimes of all horses to minimise the risk of injury or illness, while maximising their potential in their given careers. With the huge variation among disciplines, levels and individual physical and psychological characteristics, this must be done on an individual basis.
References

- Munsters C, van den Broek J, Welling J, van Weeren R and Sloet van Oldruitenborgh-