Fractures and shin soreness: the effects of an intense training and racing regime on the musculoskeletal system of young Thoroughbred racehorses

By Shae Sullivan

Introduction

The Thoroughbred racing industry is continually challenged to improve the welfare conditions for horses both in training and competition (Verheyen and Wood, 2004). An investigation conducted by the Australian Rural Industries Research and Development Corporation concluded that 85% of the horses studied were diagnosed with at least one injury or illness during their racing season as 2- or 3-year-olds(Bailey, 1998). The most common injuries requiring veterinary attention, and causing a subsequent loss of training time and absence from competition (due either to early retirement or euthanasia) are musculoskeletal in origin (Firth et al., 2004). Shin soreness and fractures of the distal limb are two very common injuries occurring both in training and competition. Consequently, there has been a push by both animal welfare groups and investors in the industry to investigate the possible risks associated with the high musculoskeletal injury rate in the hope of increasing the welfare of the animal and decreasing economic wastage (Verheyen and Wood, 2004).

Discussion

Preparation of Thoroughbred horses for flat racing usually begins at 15-16 months of age (Firth et al., 2004) and most of these horses are introduced to competition as 2-year-olds. The fundamental aim of training is to increase the fitness of the horse. However, reduced injury rates can be achieved if trainers adopt scientific training methods that also concentrate on the conditioning of musculoskeletal tissues (Barneveld and van Weeren, 1999). Parkin et al. (2004) performed a study in the United Kingdom focusing on the risk factors associated with distal limb fractures in Thoroughbred racehorses that resulted in fatalities. A case-control study was adopted, which included 109 case horses that suffered fractures and three uninjured control horses for every case horse. Previous studies have investigated the effects of differing training surfaces on the musculoskeletal system (Moyer et al., 1991), and also possible risk factors leading to injury, such as age, sex, shoe type and quality of horse (Bailey et al., 1998). Parkin et al. (2004) also investigated possible variables that may have an effect on fatal fractures in competitive Thoroughbred racing, including breeding, racing history (i.e., training regime, number of races, total distance raced, length of spells, changes in racing distances, surfaces raced on), sex and age. Verheyen and Wood (2004) conducted a similar study with 13 racehorse trainers in the UK over two years. In the 1178 horses studied, 148 fractures were recorded, of which 77% were associated with training and 23% occurred while racing.

The essential finding in these studies was the association between risk of fracture, the age of the horse and a training regime with no gallop work. The ability for the bone to adapt to the stress it is being placed under depends on conditioning of bone strength throughout training. The third metacarpus is subjected to different loads depending on differing exercise patterns. For example, tension at the dorsal cortex is caused by slower speeds, whereas, compression of the dorsal surface is caused by high-speed galloping. Therefore, if a horse is not subjected to gallop work during training, the bones are not prepared for the loads encountered during race speed, and thus are placed at a higher risk of fracture. However, high-speed training over long distances can also increase the risk of stress fractures due to over-use. Thus the optimal distance of high-speed gallop training should be conducted over a distance of 805-2012 metres per week at peak fitness (Parkin et al., 2004). These investigations also concluded that there is increased risk of fracture in young Thoroughbreds in their first year of racing due to poor bone conditioning. The results of these studies indicate that a more scientifically based training regime should be adopted, especially in younger horses, to create a stronger skeleton capable of withstanding injury. Alternatively, the age at which we begin training Thoroughbreds for competition should be increased.

Shin soreness (Dorsal Metacarpal Disease-DMD) is a common injury sustained by young Thoroughbreds during training. This condition causes temporary lameness of the third metacarpal bone (shin) and a reluctance to work at speed (Cogger et al., 2004). This injury is most commonly found in 2- and 3-year-old horses predominantly in their first 8 months of training (Jackson et al., 2005). The Rural Industries Research and Development Corporation previously documented that this injury affected 42% of young racing Thoroughbreds and was a recurring injury in 40% of these horses. In a study investigated by Cogger et al. (2005), the training regime of three cohorts of 2- and 3-year-old Thoroughbred racing horses (606 horses in total) was conducted over a period of two racing seasons. Every facet of the training regimes and medical assessments were documented, and it was found that the following basic training outline would reduce the risk of shin-soreness:

- First 7 weeks of training - It was recommended that each horse should train for a distance of 800 metres/week at speeds of 800-890 metres/minute. This distance should be increased to 1000 metres/week after the first 7 weeks of training.
- First 9 weeks of training - It is recommended that each horse should train for a distance of 200 metres/week at speeds >890 metres/minute(or "home on the bit"). This distance should be increased to 400 metres/week after the first 9 weeks of training.

In light of these results, it was concluded that the distance travelled per week by Thoroughbred racehorses at speeds greater than 890 metres/minute were closely related to the incidence of shin-soreness. Horses that were trained for distances below these specifications weren't adequately prepared for the physical strain of competitive racing, and thus were more likely to suffer from shin-soreness after a race meeting. If trained above these weekly guidelines, there was a higher incidence of horses suffering from training-associated shin-soreness due to over-use. It was also found that horses beginning their training at 30 months of age were less likely to suffer from DMD than those that commenced their racing preparation at 28 months. These results are further supported by an investigation into the use of biochemical bone markers as a form of early diagnosis of DMD conducted by Jackson et al. (2005). In this study of 165 2-year-old Thoroughbreds, it was found that the two biochemical markers used to identify bone formation and resorption (Osteocalcin and carboxyterminal cross-linked telopeptide of type I collagen (ICTP)) were significantly increased in the early stages of the preparation season of young horses that subsequently developed shin-soreness. However, as the skeleton reaches maturity and epiphyseal closure occurs, these bone markers become less effective at predicting shin-soreness. This indicates that prevention of DMD can be assisted by the early detection of bone marker concentrations in young Thoroughbreds in conjunction with a scientifically based training regime. Alternatively, delaying the commencement of Thoroughbred training allows the musculoskeletal system of the horse to reach its physical peak, thus reducing the potential for limb injury.

Conclusion

In light of these recent studies focused on improving the welfare of young Thoroughbred racehorses, it has been inferred that distal limb fracture and DMD can be prevented by following a scientifically modified training method tailored to suit the developing skeletal frame of these young athletes.

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