

Physical stresses encountered by two-year-old Thoroughbred racehorses whilst undergoing intensive training

By Michelle Reed

Introduction

The wisdom of allowing 2-year-old Thoroughbreds to race is frequently debated even though it is a long-standing tradition within the racing industry. Questions have often been raised as to whether the horses involved are physically mature enough to cope with the intense physical training that they are subjected to or whether race-speed competition is necessary for optimum physical development (Mundy, 2000). For this reason, some recent research has been focused towards the study of the interrelation between intensive training programs and the consequential physical adaptations and degenerations that may occur in the musculoskeletal and cardiovascular systems of these horses. Subsequently, inferences can be made based upon this scientific evidence to better manage the welfare of these horses through the implementation of more informed training regimes and physical checking of such horses prior to racing.

Discussion

Of particular concern with 2-year-old Thoroughbred racing is the incidence of dorsal metacarpal disease (DMD, shin-soreness or bucked shins). This painful condition of the dorsal aspect of the third metacarpus in the horse is believed to be partially caused by superimposition of the effects of race training on normal bone growth and development as researched by Buckingham and Jeffcott (1990). Boston and Nunamaker (2000) conducted a study exploring the type of training regime implemented by trainers of 2-year-olds and their relation to incidence of DMD. Five stables in the Eastern United States participated in this study and provided the health and training records of 226 two-year-old horses. Of 226 racehorses, 56 developed DMD, 9 completed their year of training without DMD and 161 were lost to follow-up. Although this study was restricted in its ability to follow up the causes of the losses of these horses from race training, the sheer number of horses lost indicates the vulnerability of 2-year-old racehorses to injury and other mishaps.

The essential finding of this study was that training programs that focused on breezing (work at very high speeds) had substantially better survival profiles than those that focused on galloping. Different exercise patterns develop different loads and bending forces in the third metacarpal bone of horses. Tension on the dorsal surface of this bone may be the result of slow galloping, whereas breezing will result in compression of this surface. This can be related back to the hypothesis that the bone models and remodels on the basis of the loads that it receives. Hence horses that are trained primarily on stints of slow-speed galloping acquire bone adapted to this training modality and will be susceptible to DMD. The findings of this study would be most useful in devising optimum training programs for horses of this age.

Griffiths, Steel, Symons and Yovich (2000) attempted to determine the prevalence of DMD in two-year-old Thoroughbred racehorses by pre-race inspection. Additionally, they wished to evaluate the effectiveness of a DMD detection program on the predictability of race performance and the distance between the first and last-placed horse in a field. A DMD detection program has been in place at the Western Australian Turf Club since 1995. The pre-race detection program includes digital palpation of the dorsal aspect of the third metacarpal bone of two-year-old racing Thoroughbreds. Horses that exhibited pain by repeated and forceful withdrawal of the leg being tested were subsequently withdrawn and not permitted to race for 6 weeks. The race records of all 2-year-old Thoroughbreds racing at Ascot racecourse from December 1993 until December 1995 were compared with the race results from December 1995 until March 1997, after the initiation of the DMD detection program. The results were analysed from 359 horses in 35 races before the institution of the DMD detection program and from 313 horses in 31 races after the program began. After the initiation of the

program, it was calculated that horses were racing more predictably over 1100m and 1200m. Additionally, these horses finished closer to the winner over both distances.

DMD is the most common cause of lameness in 2-year-old Thoroughbred racehorses in their first year of training as stated by Bailey (1998), affecting 42-80 percent of horses in training in Australia and causing wastage in the industry through lost training time and poor performance. Griffiths et al believe that while only two horses were found to have pre-race clinical signs consistent with DMD, the program implemented at the racetrack caused trainers to withhold horses that exhibited signs of DMD from inspection especially as one case of withdrawal early on in the DMD inspection program received much adverse public attention. The corresponding statistical improvements in the predictability and decreased field spread support this theory as the improved performance of horses indicate that the levels of soundness amongst them has increased. The lack of significant improvements in 1000m races may be due to the fact that DMD may not cause fatigue in these horses over shorter distances. The results of this study indicate that the implementation of such a program at other racetracks would have positive implications for the welfare of racehorses, as there may be a consequential reduction in the number of horses racing whilst afflicted with DMD.

The aim of the study conducted by Brama, Tekopple, Bank, Barneveld, Firth and van Weeren (2000) was to determine whether or not strenuous exercise would lead to any changes at a molecular level in the collagen component of articular cartilage in the joints of horses that could be related to microdamage. In order to ascertain these details, water content and the characteristics of the collagen network were determined in tissue samples of articular cartilage of strenuously exercised and control 2-year-old Thoroughbreds. Seven 2-year-old Thoroughbred fillies were subjected to a typical flat-race training regime. Another group of seven fillies of the same age and breed were allowed free exercise in sand yards and served as the control group for this study. After the horses were euthanased at the end of this training regime of 13 weeks, the right metacarpophalangeal joint was examined macroscopically with respect to lesions at the lateral and medial eminence of the proximal phalanx, and for wear and tear lines on the medial and lateral condyle of the proximal phalanx. Water content of the samples was also calculated, as were the collagen content and levels of hydroxylysine and cross-link hydroxyproline.

A generalised finding was that the racing training given in this study was sufficient to initiate significant changes in the collagen component of the extracellular matrix of the metacarpophalangeal joint. Consequently, these changes led to the disappearance of the normal physiological and biochemical differences between the glenoid surface and the dorsal articular margin. It has been hypothesized that the decline in hydroxyproline cross-linking is a characteristic of a certain degree of disruption of the collagen network, and hence ultimately of microdamage which may be a predisposing factor to the development of chronic degenerative joint disorders.

Young and Wood (2000) tested the hypothesis that athletic training influences the prevalence of murmurs of atrioventricular valvular regurgitation in Thoroughbreds. Cardiac auscultation was carried out on 2 groups of Thoroughbreds ranging in age from 2 to 5 years. Part 1 of the study was comprised of the examination by auscultation of 85 2-year-old horses before they underwent 9 months of race training. Fifty-six horses in full race training aged from 2 to 5 years were examined once for a comparative study. During the examination of each of the horses, a cardiology stethoscope was used to identify murmurs of valvular regurgitation, with the intensity of any murmur recorded. Echocardiographic examinations were performed within 21 days of the previous test, with the horses being at full race fitness at this time. The left and right atria and the inflow tracts of the left and right ventricles were included in this examination and regurgitation at any valve was noted.

Prior to intensive training, the incidence of mitral regurgitation murmurs was 7.3 percent, tricuspid regurgitation 12.7 percent and aortic regurgitation zero percent. After training, the corresponding values had increased to 21.8 percent, 25.5 percent and 2 percent respectively. Forty-four percent of the 2-year-old group were classed as having tricuspid regurgitation with 24 percent affected by mitral regurgitation, whilst horses in the 4 and 5 year-old groups had

an incidence of 20 percent for both forms of valvular regurgitation. The data collated and analysed indicate that the prevalence of both tricuspid and mitral regurgitation increase when young Thoroughbreds are subjected to athletic training. The results strongly suggest that athletic training has a positive influence on the development of murmurs of atrioventricular valvular regurgitation in flat racing Thoroughbreds.

Conclusions

Conclusively, the training of 2-year-olds for racing presents these horses with many physical challenges that their cardiovascular and musculoskeletal systems may react to in an adverse manner. Boston and Nunamaker (2000) clearly indicated that the welfare of such horses may become compromised where horses were trained in programs that did not cater to the physiological adaptations that occurred in horses subjected to race training. The work of Griffiths et al (2000) highlighted the welfare and performance advantages of pre-race inspection of horses for signs of DMD. The work of Brama et al (2000) highlighted the adverse impact that training could have on the collagen component of articular cartilage in young horses and how damage inflicted on this region could be associated with later degenerative joint disease. Young and Wood (2000) also found that race training in young horses contributed to the development of atrioventricular valvular regurgitation. Clearly, in the latter two studies, more research would be of benefit to the welfare of horses so that the information gained might alter training programs so that the incidence of these physical stresses encountered by 2-year-old horses might be minimised in these areas.

References

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