

## Identifying modifiable risk factors contributing to musculoskeletal injury in thoroughbred racehorses

*A review of recent studies focused on identifying risk factors contributing to race day musculoskeletal injury in thoroughbred racehorses. Further avenues of research have also been highlighted.*

Max Lloyd

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Catastrophic musculoskeletal injury (CMI) is the principal cause of fatality in thoroughbred (TB) horses on race day (Boden *et al.*, 2006; Rosanowski *et al.*, 2017). Specifically, CMI are those that necessitate euthanasia and are predominantly attributed to fractures of the appendicular skeleton (Rosanowski *et al.*, 2017; Wylie *et al.*, 2017). Occurrences of CMI on race day are clearly detrimental to the welfare of the racehorse and contribute to further public scrutiny of the racing industry. The following articles seek to identify risk factors that predispose CMI, to assist in determining optimal racing practices to reduce their incidence.

Rosanowski *et al.*, (2018) conducted a study in Great Britain to identify risk factors associated with race day fatalities occurring in racing starts from 2000 to 2013. A range of horse, course and race level exposure variables were assessed by logistic regression for association with race day fatalities on both turf and all-weather tracks. In total, 806,794 starts were included, 548,571 of these were on turf. All-weather tracks had higher incidence of fatality (0.76 per 1000 starts) as opposed to turf (0.69 per 1000 starts) (Rosanowski *et al.*, 2018). For both track surfaces, increased firmness, distance, increased performance level, increasing age, first year of racing and the use of eye cover all increased the odds of fatality (Rosanowski *et al.*, 2018). Increased number of starts were found to be protective (Rosanowski *et al.*, 2018). Summer, autumn and auction exhibition type races held on all-weather tracks had higher odds of fatality (Rosanowski *et al.*, 2018). On turf tracks, group one races and horses with no start history for the past 365 days increased the odds of fatality (Rosanowski *et al.*, 2018). Of the identified risk factors, those not previously reported in the literature include the use of eye covering, particularly for the first time, race type and horses in first year of racing (Rosanowski *et al.*, 2018). Vision restriction for the first time is a novel and potentially modifiable risk factor. This finding suggests that some period of acclimation to vision restriction may help reduce the risk of CMI. Lack of data on training style was an identified limitation; this is pertinent considering the observed disparity in fatalities between different trainers (Rosanowski *et al.*, 2018).

In contrast, Hitchens *et al.*, (2018) investigated specific horse level associations between lameness, medication use, surgery and exercise with CMI from May 2012 to June 2013 in California. Attending veterinarians to race day TB and Quarter Horse (QH) CMI were surveyed along with three matched case control horses (Hitchens *et al.*, 2018). Survey data along with necropsy data was included in a multivariable logistic regression model (Hitchens *et al.*, 2018). A total of 163 complete surveys were received, consisting of 45 TB cases and 101 controls, along with 11 QH cases and six controls (Hitchens *et al.*, 2018). No significant associations between race day CMI and medications were evident across the study population (Hitchens *et al.*, 2018). Administration of hyaluronic acid (HA) was, however,

found to increase the odds of training related TB CMI by up to five times (Hitchens *et al.*, 2018). No significant associations were apparent between cases and controls subjected to surgical procedures (Hitchens *et al.*, 2018). For TB cases, racing at greater intensity followed by a period of easing off was found to precede CMI (Hitchens *et al.*, 2018). TB cases were found to have had significantly greater odds of displaying lameness in the three months preceding CMI (Hitchens *et al.*, 2018). This together with the use of HA is a notable finding and constitutes management factors potentially reducing CMI risk. While the grade of lameness was not included in this study, low grade lameness has the capacity to evade identification (May & Wyn-Jones, 1987), and may be perceived as poor performance warranting use of blinkers (Rosanowski *et al.*, 2018). Given the elevated risk of CMI when vision is restricted (Rosanowski *et al.*, 2018), along with the results from this study an unidentified lameness may further compound the overall risk. Study limitations included low survey response rate, lack of complete veterinary history and the potential for misreporting bias (Hitchens *et al.*, 2018).

The contribution of lameness (Hitchens *et al.*, 2018), and prior non-catastrophic injury to CMI risk has been documented (Cohen *et al.*, 1997; Perkins *et al.*, 2005). Limited data exists on the incidence and risk factors for non-catastrophic injuries. Sun *et al.*, (2019) conducted a retrospective cohort study to describe the incidence of non-catastrophic and CMI, specifically fractures, at the Hong Kong Jockey Club (HKJC) over seven seasons. Data was collected from the HKJC Racing Information System along with the HKJC Veterinary Management Information System (VMIS) (Sun *et al.*, 2019). The use of such data systems, combined with close veterinary management, eliminated the study limitations identified by Hitchens *et al.*, (2018) (Sun *et al.*, 2019). Incidence rates (IR) for catastrophic and non-catastrophic fractures were calculated per 1000 starts for sex, age, trainer, racetrack and racing season with associations established using a generalised linear model (Sun *et al.*, 2019). No significant associations were established for catastrophic fractures. Trainer, sex and racing season were found to have significant associations with non-catastrophic fractures (Sun *et al.*, 2019). Variation in fracture incidence between trainers, along with limited data on training specifics is similar to that reported by Rosanowski *et al.*, (2018) (Sun *et al.*, 2019). Further research in this area is warranted to investigate low risk training practices. Over the study period, non-catastrophic fractures and catastrophic fractures occurred at a rate of 3.6:1 (Sun *et al.*, 2019). This statistic is concerning when considering TB welfare given the role such injuries can play in predisposing CMI. It is also of note that these injuries, while not requiring immediate euthanasia, will often result in early retirement and can contribute to wastage (Jeffcott *et al.*, 1982; Perkins *et al.*, 2005).

The studies reviewed have identified a number of potential novel modifiable CMI risk factors in thoroughbred racehorses. From this research, peak industry racing bodies may seek to adjust racing practices surrounding the use of vision restriction on race day and HA during training to reduce CMI incidence. The identified differences in fracture incidence between trainers is a clear avenue of future investigation to identify training practices that minimise fracture risk, ensuring the welfare of the horse.

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