

Summary of “Fracture rate in Thoroughbred racehorses is affected by dam age and parity”

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Why was this research done?

The aims of this study were to find the association, if any, between the age of the dam and the foal’s risk of fracture, and also to determine any correlation between birth order (dam’s first foal or a later foal) and risk of fracture.

Studies in humans have found some relationship between small, light infants and the development of diseases in adulthood such as diabetes, coronary heart disease, and stroke. It is hypothesized that adverse prenatal conditions may cause adaptations in fetal organ systems, making these individuals more susceptible to specific health problems as adults. Other studies related to intrauterine influences on adult bone mass and the risk of osteoporosis in humans have been inconsistent, although there is some evidence that low birth weight may have an adverse influence on adult bone mineral density and content.

In horses, studies of parity (order of birth) and birth weight have shown that the lightest foals are typically first foals, or foals of aged mares that have had many foals. Mares that are in the middle part of their reproductive years tend to have the largest foals. A correlation was also found between somewhat poorer racing performance and foals of first-time dams as well as foals of mares that have given birth many times.

How was the study conducted?

Data for horses working under eight different trainers were collected for two years. Horses joined the study when they entered race training as yearlings. Daily records were kept for exercise (speed, distance, and type of surface) and injury occurrence (fractures or osteochondral chips). Information was recorded for each horse’s date of birth, dam, and sire. Dam’s sire, year of birth, age at foaling, and parity were also noted.

The data set included 335 horses, of which 62 were first foals. Dams numbered 323 and ranged in age from 5 (first foal) to 22 (sixteenth foal). There were 155 sires and 209 maternal grandsires.

Data analysis was used to investigate the effects of dam age and parity on fracture risk. Variations in fracture rate with sire, dam, and maternal grandsire were considered.

What results were found?

In this study, a statistically significant relationship was found between parity and fracture risk; specifically, being a first foal was correlated with about one-third the risk of fracture compared to later foals (after adjusting for dam’s age and exercise).

Other trends were seen, although the researchers reported these trends were either marginally significant or not significant:

- Fracture rates were highest in second foals, followed by a decline in rates with increased parity.
- Rate of fracture seemed higher overall in offspring from mares older than 5 or 6 years, with a gradual decline in dams older than 7 years.
- Sire, dam, and maternal grandsire were not found to have a significant effect on the rate of fractures.

What does this tell us about fracture risk for a particular racehorse?

Recognizing that no single factor can be held individually responsible for fractures in racehorses, the researchers made a number of observations:

- The finding in horses that being a first foal had a protective effect against fracture was not consistent with human studies that have shown a correlation between low birth weight and low peak bone mass.
- When taking into account other studies that have shown lower birth weights in first foals compared to foals born in the middle of a mare's reproductive life, the hypothesis can be offered that foals that are lighter at birth are at lower risk of fracture.
- Studies of humans where samples are taken from the general population may not correlate well with equine study groups in which vigorous exercise is performed before the skeleton is mature.
- No data exist for bone density in newborn equines, so it is not possible to compare horses with studies showing that lighter human infants have lower bone mass than heavier infants.
- The specific influence of dam's placental size and quality, milk production, and milk calcium concentration in bone quality is unknown. While milk composition is similar among Quarter Horse mares regardless of how many foals they had produced, mares in their middle reproductive years produced a greater quantity of milk than mares having their first foals. The authors grant that the decreased fracture rate in foals from older mares might be due to a selection bias in which fertile mares with a record of producing strong, healthy foals are used longer than those that are less fertile or produce foals that are not as healthy.
- As mares tend to carry their first foals longer before giving birth, this increased gestation may influence the low fracture rate for these foals, correlating to a similar finding in humans showing a positive effect of longer gestation on neonatal bone mineral measurements.
- Previous evidence shows that first foals tend not to have as much success in race performance as their later-born siblings. While it might be assumed that low fracture rates result from these foals having little talent, and therefore not being trained as intensely, this was not the case in this study, which showed that first foals were significantly more likely than later-born foals to appear on the racecourse as two-year-olds.
- The authors conclude that "environmental factors, of which exercise the likely to be the most important, may be the main determinants of fracture risk" in young racehorses.

The full text of this article was published in The Veterinary Journal, Vol. 174 (2007), pp. 295-301.



Reprint Courtesy of Kentucky Equine Research, Inc.

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