Rider Weight Study Provides New Evidence of the Deleterious Effects of Inappropriate Loading on Equine Gait and Behaviour

A ground-breaking new scientific study has just been published in the peer-reviewed journal *Equine Veterinary Education.* The authors were a team of researchers led by Dr. Sue Dyson, Head of Clinical Orthopaedics at the Centre for Equine Studies at the Animal Health Trust in Newmarket. The multi-disciplinary study took place at World Horse Welfare's Norfolk headquarters and represented an extraordinary level of collaboration and cooperation from across many sectors of the UK equine industry. The study was generously supported by World Horse Welfare, the Saddle Research Trust, Frank Dyson, British Equestrian Federation, British Horse Society, Pony Club, Polocrosse UK, The Showing Council, The Showing Register, The Society of Master Saddlers, Riding for the Disabled, British Eventing, British Dressage, the British Horse Foundation, the Worshipful Company of Saddlers and Endurance GB.

Industry support

Recently, there has been a growing concern within the equine industry that as the human population gets heavier, horses are increasingly being subjected to excessive loading. The problem that we currently face however, is that there is a lack of objective evidence that can provide us with guidelines for appropriate weight ratios of horses and riders. The controversial topic was discussed at the Saddle Research Trust 2nd International Conference and highlighted as a research priority. World Horse Welfare and the British Equestrian Federation subsequently organised an industry consultation meeting that was attended by senior representatives from the equine industry. As a result of that meeting, many of the UK's leading equine organisations pledged to financially support a research project to help develop appropriate weight ratios guidance.

Study design

The research team designed a study that aimed to assess gait and behavioural responses. A group of six sports horses were ridden in a standardised exercise test by four riders of different body weights but similar ability, in a randomised order. Horses and riders were selected so that the rider to horse bodyweight ratios would be in four different rider categories: Light (rider L), 10-12%; Moderate (rider M), over 12% and less than 15%; Heavy (rider H), over 15% and less than 18%; Very Heavy (rider VH), over 20%.

The height and weight of all the riders was recorded

The horses were assessed as sound before the study commenced. Saddle fit was assessed and adjusted by an experienced, qualified saddle fitter before and during the study. Objective gait measurements were recorded with Inertial Motion Units (IMUs) that were positioned on the poll, withers and pelvis of the horse. The IMU data provided movement asymmetry values for each stride.

Before every test a saddle fit check was carried out and IMUs were attached to each horse

Pressures exerted onto the horses' backs under the saddle were recorded with a Pliance™ sensor mat. To facilitate biomechanical video analysis, markers were placed on the pelvis of the horse, the cantle of the saddle and the riders wore snugly fitted tops with horizontal and vertical lines marked on them. The horses were observed throughout each test and the appearance of any gait abnormalities, lameness or markers of pain behaviour were noted. A test was abandoned if lameness over 3/8 was observed or of more than 10 of 24 behavioural markers were noted.

Results

There was a substantial, temporary adverse effect or the rider on the horses' gait and behaviour, with no tests being completed by riders H and VH. All tests for rider VH were abandoned due to the appearance of lameness. Five tests for rider H were also abandoned due to lameness and one due to behavioural markers demonstrated in

canter. Only one rider M test was abandoned due to lameness and no rider L tests were abandoned. When re-assessed moving in hand after each abandoned test, no lameness was observed in any of the horses.

Each horse was re-assessed in hand after a ridden test was abandoned

The IMU data agreed with the subjective lameness scoring throughout the testing. Although the IMU data varied considerably between horses, the magnitude or variability of asymmetry of the gaits was greater for the heavier riders. The total scores for the presence of pain behaviour markers were significantly higher for riders VH and H.


All the horses demonstrated increased behavioural markers (image on left) or gait asymmetry (image on right) with Riders H & VH

Increased speed results in increased peak forces exerted onto the back. None of the tests were abandoned during the first walk phase; lameness or behavioural markers were only demonstrated during trot and canter, suggesting that if a horse is only ridden at walk, it may be reasonable to expect it to carry a heavier load.

The rider's size in relation to the horse, not just the weight ratio, affected the horse's way of going, suggesting that Body Mass Index (BMI) was not the key factor. The rider's position in the saddle and on the horse's back was influenced by the size of the saddle: the taller and heavier riders were unable to maintain optimum posture and balance in saddles that were too small for them and as a result, the weight distribution on the horse's back was altered. A range of saddle sizes would have been necessary to resolve the issue but in this study, none of the horses would have accommodated longer trees and therefore all the horses wore their own saddles throughout, which reflects real-world practice.

The four test riders (from left to right: Riders L, M, H & VH) shown riding the same horse

Further investigation

Detailed analysis of the riders' positions will be reported in a future publication. More research is required to determine whether rider weight, it's distribution, or both are the main causes of gait asymmetry. There are many factors which affect rider position and balance in the saddle, for example seat length in relation to rider size, and whether the saddle seat is correctly balanced on the horse's back. Future study of the effect of the rider on the horse should address this important aspect.

Saddle fit for each rider was not optimal: The saddles were too short in the seat for Riders H & VH (images 3 & 4 on the right)

Saddle fit was not optimal in all horses, despite recent fitting reviews, which may have adversely affected weight distribution. Detailed analysis of the forces that were recorded under the saddle in each test will be reported in a future publication. Weight fluctuations and the potential presence of sub-clinical lameness in some of the horses meant that there was undesirable movement of the saddles at times. Future studies should ideally use a panel of experienced, professional saddle-fitters to facilitate optimal saddle fit.

Although it has been previously demonstrated that more than 8 / 24 behavioural markers are likely to reflect musculoskeletal pain, the cut-off for test abandonment in this study was set at 10/24. Live scoring of behaviour in comparison to retrospective analysis of video recording probably resulted in under-scoring because some markers, such as eye closure, were very difficult to record accurately in the test environment. Detailed analysis of the behaviour of the horses throughout the study will be reported in a future publication.

It is widely believed that horses with more “bone”, such as cobs and “chunkier” pony breeds are capable of carrying more weight than their lighter-limbed counterparts, but there is no reliable scientific evidence to support that assumption. In this study, one horse had substantially greater cannon bone circumference than the others, but nonetheless failed to complete any test with the heavier riders. Further work with a much larger number of horses would be required to draw any meaningful conclusions regarding horse type and cannon bone circumference in relation to their weight bearing capacity.

Full results of the physiological measurements which were taken throughout the study will also to be reported in a future publication: salivary cortisol levels, pulse and respiration rates, blink rate, back dimensions before and after exercise and back muscle tone and pain response to palpation were all recorded and analysed.

Conclusions

This part of the rider weight study has clearly demonstrated that there are substantial negative effects on the horse's gait and behaviour as a result of inappropriate rider size and suggests that saddle fit for both the horse and the rider are important factors.
The key take home message is that when larger riders ride, they should select a horse of appropriate size and fitness with a saddle that is optimally fitted to both horse and rider.

The full paper is available to read, download and share by clicking on this link:
https://onlinelibrary.wiley.com/doi/full/10.1111/evj.13088

DYSON, S., ELLIS, A. D., MACKECHNIE-GUIRE, R., DOUGLAS, J., BONDI, A. & HARRIS, P. 2019. The influence of rider:horse bodyweight ratio and rider-horse-saddle fit on equine gait and behaviour: a pilot study. *Equine Veterinary Education*.