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Jetlag in horses: Neuroendocrine mechanisms underlying effects of transmeridian flying on equine welfare and physiology

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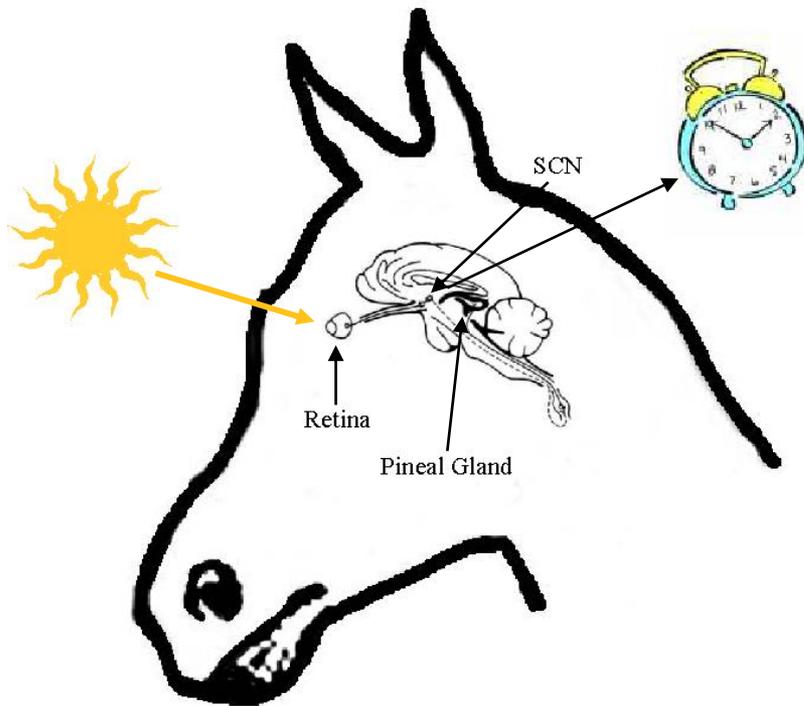


The question

- Horses are the only species other than man transported around the world for competition purposes
- In humans, transport across several time zones can result in adverse symptoms commonly referred to as jetlag
- Can changes in the light:dark cycle, equivalent to those caused by transport across several time zones, affect daily biological rhythms, and performance in equine athletes?



The body clock



- Light signals are captured by the retina and relayed to an area of brain called the suprachiasmatic nucleus (SCN), which contains the master body clock
- The signal is relayed to the pineal gland which secretes the hormone melatonin only at night (inhibited by daylight)
- Melatonin thus translates photoperiodic information and can also reset the master clock
- The master clock orchestrates physiological circadian (daily) rhythms
- The crossing of several time zones disrupts the master clock causing the detrimental symptoms of jetlag



How we did it?

- Thoroughbred racehorses were kept in light-controlled stables
- Subjected to changes in the 24h light:dark (LD) cycle equivalent to west- and eastbound flights
- Blood samples taken before, during and after change in LD cycle and subjected to hormonal analysis
- Locomotor activity monitored throughout to assess behavioural changes
- Pre- and post-change treadmill tests carried out to test performance





The results

- Horses are exquisitely sensitive to changes in the 24h light:dark cycle
 - Whereas true circadian rhythms are expressed, the daily rhythm of locomotor activity is dependent on the presence of light cues
 - Changes in the 24h light:dark cycle, such as those associated with trans-meridian air travel, disrupt endocrine systems and affect athletic performance
 - Effects on athletic performance can be beneficial and depend on both direction of flight (west vs east) and time of year
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Potential implications

- The results have direct implications not only for the transport of race-horses across time zones, but also for their training





Scientist's Summary

Daily and annual changes in daylight affect the biological cycles in appetite, sleep, reproduction and other primary functions in many species. In humans, sudden alterations in the 24-h light:dark cycle, such as those arising from trans-meridian flying, result in a feeling of fatigue and disorientation, with adverse consequences on physiology, behaviour and physical performance, commonly known as jetlag.

Whether racehorses exposed to trans-meridian travel are affected in a similar way was not known. Here, we examined the expression of daily biological rhythms and the effects of abrupt shifts in the light:dark cycle, like those experienced after travelling across several time zones, on the secretion of hormones associated with wellbeing and athletic performance in racehorses.



Scientist's Summary

Thoroughbred horses were acclimatised to light controlled rooms, and daily rhythms in locomotor activity, body temperature and hormone secretions were investigated in the presence and absence of a 24-h light:dark cycle. Then, the effects of sudden changes in daily light mimicking a westbound or an eastbound trans-meridian flight and on hormone secretions and performance were studied. The effect of a simulated trans-equatorial flight was also examined. The results show that racehorses display clear daily rhythms of locomotion, body temperature and hormone secretions, but that they are dependent on the presence of light cues for the expression of some of those rhythms.



Scientist's Summary

Indeed, horses were shown to be extremely sensitive to changes in the light:dark cycle such as those associated with trans meridian travel, and these changes can have acute beneficial effects depending on the direction of the flight (west vs. east) and the time of year. In contrast, a trans-equatorial flight can have a negative influence on the horses performance. These findings have important implications for the training and transport of racehorses across time zones.

Find out more about jetlag in horses



- Biological rhythms, jetlag and performance in Thoroughbred racehorses, D. J. Tortonese & R. V. Short:

<http://onlinelibrary.wiley.com/doi/10.1111/j.2042-3306.2012.00589.x/full>
