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Characterisation of the splenius muscle's activity (*Splenius cervicis*) during a walk phase at the warm up onset of ridden horses (*Equus caballus*)

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For human athletes, any physical performance usually begins with a warm-up including a phase of cardiorespiratory activation as well as a phase of neuro-muscular mobilization, including stretching patterns. To be efficient, the stretching has to be performed on relaxed muscles. In order to be able to apply this on ridden horses, these lasts have to be relaxed. However, the horse is a prey whose survival depends on its capacity to detect any potential danger in its environment and to flee if needed. As a result the warm up would be improved if adapted to this equine specificity. Therefore we added a walk phase preceding the usual warm-up during which the horses were allowed to visually assess their environment without constraint from their rider, who hold the reins loose. In a previous study, we showed that a walk phase at the warm up onset helps to mentally relax the horses and so decrease attentional resources involved in environmental monitoring. In this study, we have analysed the electromyographic activity of the neck supporting muscle (*splenius cervicis*) associated with the biomechanics of the strides to assess if this walk phase contributes to muscular relaxation, which would lead to an efficient stretching.

We assumed that when the horse displays a high neck as if monitoring its environment, the neck supporting muscles would be highly activated. In contrast, when the horse is more relaxed, the neck would be lowered, supported mostly by the nuchal ligament, a structure composed by elastin and collagen fibrils, running from the occipital skull to the thoracic dorsal spinous processes through the cervical vertebrae. Indeed, thanks to its composition and the anatomical organization, the nuchal ligament supports passively the neck and head of the horse against gravity and contributes to locomotion by storing and returning elastic strain energy during the swings of the head

For each walk stride, two bursts of electromyographic activity were observed when the neck oscillatory cycle is in its lowest position. The duration, the amplitude, the integral, the root mean square along with the power of the electromyographic activity of the bursts have been significantly decreased. The duration of the EMG bursts added to the interval inter-bursts has not changed, which is consistent with the biomechanical measures showing that the duration of the strides has not changed while their length along with the members movement speed has significantly increased. A significant lowering of the neck has also been observed.

In conclusion, our results suggest that a walk phase at the warm up onset would help to improve muscular relaxation. The contribution of the elastic structures of the nuchal ligament to the neck swings is increased while the energy expenditures are decreased. Remarkably, the beat of the strides is not changed but more ground was covered.

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