The Veterinary Journal 181 (2009) 53–55

Contents lists available at ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Effects of a stretching regime on stride length and range of motion in equine trot

Natasha S. Rose [a], Alison J. Northrop [a,*], Charlotte V. Brigden [a], Jaime H. Martin [b]

[a] Equine Research Group, Equine Department, Myerscough College, St. Michael's Road, Bilsborrow, Preston PR3 0RY, UK
[b] Equine Research Group, Agriculture and Countryside Department, Myerscough College, St. Michael's Road, Bilsborrow, Preston PR3 0RY, UK

ARTICLE INFO

Keywords:
Equine trot
Gait characteristics
Movement
Performance
Stretching

ABSTRACT

The aim of this study was to quantify the effects of two different 8-week stretching regimes on stride length (SL) and range of motion (ROM) in the equine trot. Eighteen horses were divided into three matched groups: a 6 days/week stretching regime (6DSR), a 3 days/week stretching regime (3DSR) and a control no-stretching regime (NSR). SL and ROM data were collected at weeks 0, 2, 4, 6 and 8 for trot in-hand.

Stretching had no significant effect on SL. A number of significant differences were found in joint ROM between treatments in the shoulder, stifle and hock, suggesting some negative biomechanical effects of the 6DSR. Stretching daily may be too intensive and cause delayed onset of muscle soreness. Further examination of stretch frequency may establish its potential to enhance performance and welfare.

Introduction

As equine sports become increasingly competitive, maintaining athletic soundness through appropriate training and management becomes vitally important. Horse trainers aim to produce movement that is efficient, limits injury and conforms to competitive standards (particularly in dressage). Passive stretching exercises are often used to help achieve these aims. LaRoche and Connolly (2006) described stretching as a technique to facilitate an increase in range of motion (ROM).

Stretching before participation in athletic activities is standard protocol for many human sport training sessions (Thacker et al., 2004), and can reduce the risk of injury (Best, 1995) and enhance performance (Sharma et al., 2004). Stretch routines for horses are also becoming more widespread, probably reflecting the positive findings from research on human athletes that indicates potential increases in muscle force, jump height, speed, ROM, muscle length and flexibility (Thacker et al., 2004). Improvements in these parameters would be of great benefit to equine performance in all equestrian disciplines.

A review of human sports research however highlights many areas of dispute regarding the optimal methods and the effects that stretching produces. This indicates the challenging nature of research in this area. Although stretching three-times-per-week appears to be a standard frequency used by humans (LaRoche and Connolly, 2006), equine physiotherapists often use a more frequent stretching programme.

There has been research into the effects of stretching in horses (McGowan et al., 2007). However, Giovagnoli et al. (2004) found that after passive stretching was applied to a group of horses for no more than 30 s, wither height was reduced in at least 60% of the animals. It was hypothesised that the neuro-muscular relaxation (probably due to a temporary reduction in motor-neuron excitation) produced the decrease in wither height (Giovagnoli et al., 2004). The aim of the present study was to quantify the effects of two different 8-week passive stretching regimes (either 6 days/week or 3 days/week) on stride length (SL) and ROM in the equine trot.

Materials and methods

The study was conducted under the ethical guidelines set by the Biological Sciences Department, University of Central Lancashire and received ethical approval from the University Ethics Committee (Ref: EQ 06/032).

Eighteen riding-school horses of similar performance and fitness levels, comprising six mares and 12 geldings (mean age ± SD 11 ± 3.84 years) were divided into three matched groups according to conformation, breed type and age. The subjects were matched in order to eliminate covariate effects and reduce potential bias. Conformation assessment was carried out according to Mawdsley et al. (1996) to give an overview of the horse's conformation type prior to the trial.

The groups were assigned to a 6 days/week stretching regime (6DSR), a 3 days/week stretching regime (3DSR) or a no-stretching regime (NSR) control group. Stretches were applied to all limbs and were performed by one researcher who was a qualified equine body worker. All subjects were warmed up for 10 min on a horse walker (5 min in each direction) prior to the stretching treatment.

The stretching regime (all passive techniques) consisted of a limb relaxation technique and specific forelimb and hindlimb stretches as recommended by Pattillo (2005). The forelimb stretches were modified girth stretch, full girth stretch, leg flexor lift and triceps release. The hindlimb stretches comprised hamstring stretch, farrier stretch, stifle and hip flexor stretch and lateral quad stretch. The stretches were applied twice and held for 10 s initially and then for a further 20 s. The control subjects had approximately 10 min of human contact time daily, to ensure that all

* Corresponding author. Tel.: +44 1995 642222; fax: +44 1995 642333.
E-mail address: anorthrop@myerscough.ac.uk (A.J. Northrop).

1090-0233/$ - see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.tvjl.2009.03.010

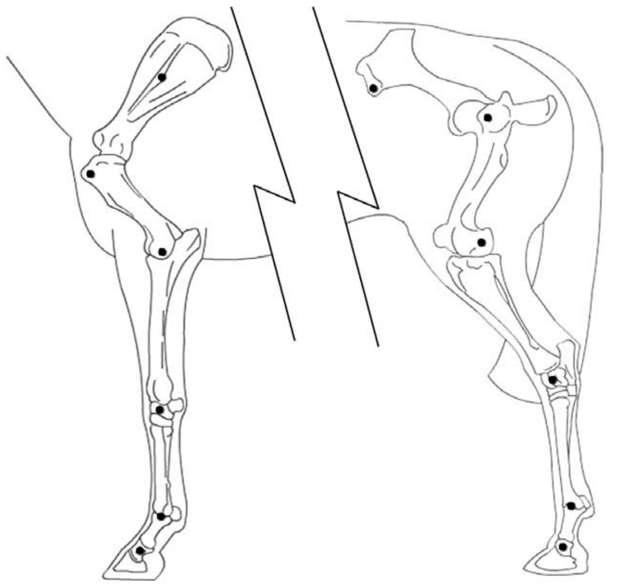

Fig. 1. Anatomical marker positions (marked with a black dot).

groups had the same amount of human intervention; this consisted of brushing the body and picking up the hooves. All subjects were on a similar exercise and management routine and were stabled at the same location. One veterinarian examined all horses before the trial began to ensure physical soundness and general health.

Measurements of stride length (SL) and range of motion (ROM) in trot were obtained using video analysis prior to the treatment (week 0) and every 2 weeks during the 8-week treatment regime. The joints examined were the shoulder, elbow, carpus, fore fetlock, hip, stifle, hock and hind fetlock. An experienced researcher applied skin markers to the appropriate anatomical locations (Fig. 1) for measurement of these joints (following the method described in Clayton and Schamhardt, 2001).

Horses were videoed being trotted-up in-hand by the same experienced handler at a consistent speed for each horse. Speeds were calculated using computer software and analysed to ensure that there was no significant difference between groups. Video footage was recorded using a digital video camera (Sony DCV-TRV60E) recording at 50 Hz perpendicular to the trot-up line. SL and ROM were measured using Quintic two-dimensional motion analysis software (Quintic Consultancy Limited). Measurements were averaged from four repetitions. Video assessments were made of the horses trotting in-hand (rather than being ridden or on a treadmill) in order to assess the horses' natural gaits. Ambient temperature and individual horse behaviour were recorded as these factors may influence gait characteristics.

Prior to analysis, data were examined for normality using an Anderson–Darling test. Where appropriate, log transformations were applied. General linear models (GLM) and Minitab 14 were used to establish the effects of a stretching regime on SL and ROM. Covariates (week 0, horse and velocity) were added to the GLM to account for influences they may have. Where differences occurred between SL or ROM and stretching regime, a Bonferroni–Dunn post-hoc test was used to identify individual differences between treatments. Results were deemed significant where $P < 0.05$.

Results

Examination of stride length at the baseline (week 0) highlighted no significant differences ($P = 0.555$) between the treatment groups. There were no recognisable or consistent changes in SL throughout the study associated with either stretch regime ($P = 0.127$). ROM results varied according to the joint studied, with only the stifle, hock and shoulder demonstrating a significant response (Figs. 2a–c).

The stifle ROM in each treatment group followed a similar pattern of change over the experimental period but the overall ROM result for each group differed (Fig. 2a). The overall stifle ROM in the 6DSR group was significantly lower than in both the NSR and 3DSR groups ($P = 0.004$).

The range of motion of the hock followed a similar pattern to the stifle joint (Fig. 2b). The individuals in the 6DSR group produced a significantly lower hock ROM than those in either the con-

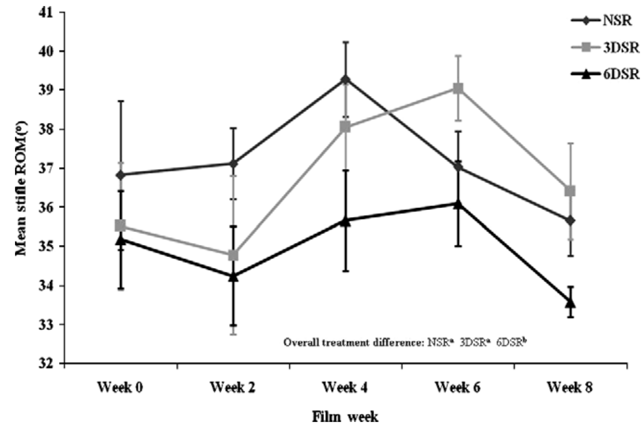

Fig. 2a. Mean stifle range of motion (ROM) (±1SE) in horses ($n = 18$) measured at trot in-hand over 8 weeks of 6-days stretch regime (6DSR), 3-days stretch regime (3DSR) or no-stretch regime (NSR). Overall 6DSR results were significantly lower than 3DSR or NSR ($P = 0.004$). Different letters denote differences between the overall stretching regimes at the $P < 0.01$ level.

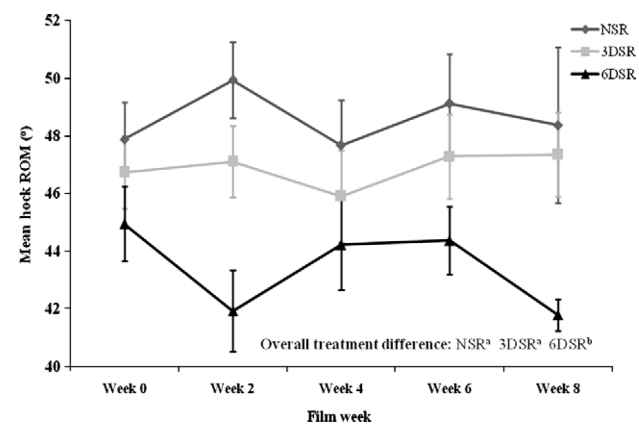

Fig. 2b. Mean hock range of motion (ROM) (±1SE) in horses ($n = 18$) measured at trot in-hand over 8 weeks of 6-days stretch regime (6DSR), 3-days stretch regime (3DSR) or no-stretch regime (NSR). Overall 6DSR results were significantly lower than 3DSR or NSR ($P \leqslant 0.0001$). Different letters denote differences between the overall stretching regimes at the $P < 0.001$ level.

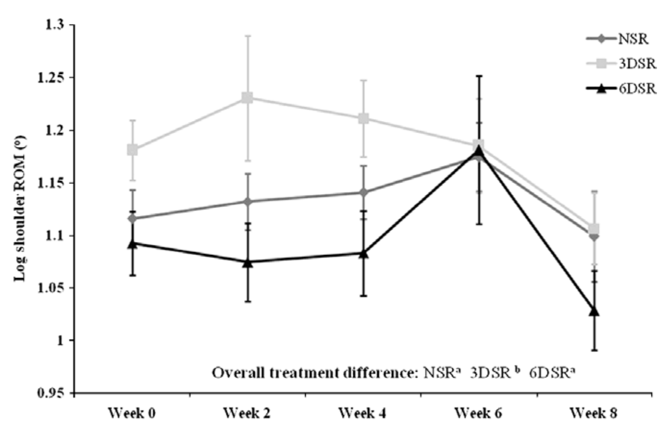

Fig. 2c. Mean log shoulder range of motion (ROM) (±1SE) in horses ($n = 18$) measured at trot in-hand over 8 weeks of 6-days stretch regime (6DSR), 3-days stretch regime (3DSR) or no-stretch regime (NSR). Overall 3DSR results were significantly higher than 6DSR or NSR ($P \leqslant 0.0001$). Different letters denote differences between the overall stretching regimes at the $P < 0.001$ level.

trol or the 3DSR ($P \leqslant 0.0001$). Stretching regime effects were similarly apparent in the ROM for shoulder (Fig. 2c). Shoulders treated with the 3DSR were found to have significantly higher ROM over the experimental period than those of the 6DSR and controls ($P \leqslant 0.0001$).

Discussion

We found no significant difference in SL by measuring in-hand trot using two-dimensional motion analysis. It is unclear whether SL in the equine trot will increase due to stretching; it may be that frequency and hold times should differ from those highlighted in this study.

The functional differences of the forelimbs and hindlimbs may have influenced the horses' response to the stretches. The improved shoulder ROM could relate to greater acceptance of forelimb stretches by the horse. The stifle, shoulder and hock joints demonstrated a significantly lower ROM after the 6DSR than after the 3DSR. The lower ROM results could indicate that the 6DSR induced increased muscle stiffness compared to the 3DSR. Muscle contractions, particularly eccentric contractions, have been found to cause minor damage to muscle fibres and may produce delayed onset of muscle soreness (DOMS) (Faulkner et al., 1993). The aim of stretching is to lengthen shortened tissues in an attempt to increase ROM, so the lengthening of the muscle fibres may cause DOMS. The 6DSR group could have been experiencing DOMS from the stretching treatment and may not have had sufficient opportunity to recover (between stretching treatments) and adapt compared to the 3DSR. These results suggest that stretching every day may not be appropriate for the horse, but that stretching 3 days a week provided some benefit in terms of range of movement.

Measuring SL and ROM in-hand enables the findings to be directly applied to equine performance. Assessments that are conducted 'in-field' can be limited by external variables and are difficult to perform with an appropriate level of repeatability. The weekly variations in ROM (Figs. 2a, b and c) may highlight this 'in-field' effect but are a commonality among field trials. Investigations using equipment such as an equine treadmill provide useful information within research, but the methods cannot always be applied to regular training and performance.

Assuming that stretching treatment can influence SL and ROM, it is not clear whether these changes can be detected from two-dimensional motion analysis of the in-hand trot. A horse would not necessarily expend more energy and engage its limbs to produce a longer stride if it were not encouraged to do so. It is well documented that individual variability in horse response means that it may be difficult to assess scientific significance when sample sizes are small (Harris and Harris, 2005). It was noted by the therapist that some horses adjusted well to the stretching regime and did not resist the movements, but other horses resisted the stretches and were not as comfortable having their limbs moved into unfamiliar positions. This did improve throughout the trial but the stretches would not have had the same effect on horses that demonstrated some resistance. Individual response differences will always be part of investigating humans or animals and it is the researcher's role to minimise the differences and maintain uniformity throughout any research trials. Pre-trial acclimatisation to the stretches may benefit future work.

Conclusions

The frequency with which passive stretches are applied to the horse appears to have some influence on horse movement. This research did not demonstrate consistent improvement in equine movement as a result of passive stretching and highlighted the possibility that stretching on a daily basis may not be appropriate. Application of stretching on a three-times-per-week basis may be a safer option for the industry to consider.

Conflict of interest statement

None of the authors of this paper has a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of this paper.

Acknowledgement

The authors would like to thank Myerscough College Equine Department for providing funding, the equipment, venue and horses used within the study.

References

Best, T.M., 1995. Muscle-tendon injuries in young athletes. Sports Medicine 14, 669–686.
Clayton, H.M., Schamhardt, H.C., 2001. Measurement techniques for gait analysis. In: Back, W., Clayton, H.M. (Eds.), Equine Locomotion. W.B. Saunders, London.
Faulkner, J.A., Brooks, S.V., Oplteck, J.A., 1993. Injury to skeletal muscle fibres during contractions: conditions of occurrence and prevention. Physical Therapy 73, 911–921.
Giovagnoli, G., Plebani, G., Daubon, J.C., 2004. Withers height variations after muscle stretching. In: Proceedings of the Conference on Equine Sports Medicine and Science, 2004, Oslo, Norway, pp. 172–176.
Harris, P.A., Harris, R.C., 2005. Ergogenic potential of nutritional strategies and substances in the horse. Livestock Production Science 92, 147–165.
LaRoche, D.P., Connolly, D.A.J., 2006. Effects of stretching on passive muscle tension and response to eccentric exercise. The American Journal of Sports Medicine 34, 1000–1007.
Mawdsley, A., Kelly, E.P., Smith, F.H., Brophy, P.O., 1996. Linear assessment of the thoroughbred horse: an approach to conformation evaluation. Equine Veterinary Journal 28, 461–467.
McGowan, C.M., Stubbs, N.C., Jull, G.A., 2007. Equine physiotherapy: a comparative review of the science underlying the profession. Equine Veterinary Journal 39, 90–94.
Pattillo, D., 2005. Equine sports massage, foundation certification course. In: Unpublished Course Notes. Equinology Inc., California.
Sharma, J., White, C., Senjyu, H., 2004. A description of single case design – as an example to evaluate the effect of warm-up and stretching on hamstring flexibility in a clinical setting. Journal of Physical Therapy Science 16, 21–26.
Thacker, S.B., Gilchrist, J., Stroup, D.F., Dexter Kimsey Jr., C., 2004. The impact of stretching on sports injury risk: a systematic review of the literature. Medicine and Science in Sports and Exercise 36, 371–378.