

A preliminary study investigating the effect of rug-wearing on measured stride length in horses

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Application When using rugs on horses, consideration should be given not only to the effects of one rug on physical parameters such as stride length, but also the combined effect of multiple rugs. Layering of rugs appears to affect horses' stride length over time.

Introduction The use of equine rugs is common practise in colder climates to assist thermoregulation and prevent the horse from reaching the lower critical limit, where the horse's core temperature requires use of energy resources for maintenance. Layering rugs in the stable for warmth is anecdotally common practise (Clayton et al, 2010). Layering of clothing has shown to produce restrictions in human movement, limiting joint angles and causing participants to alter motion strategy (Rahmatalla et al, 2005). This study investigated the effect on the equine musculoskeletal system of the number of rugs worn, as measured by stride length.

Materials and Methods Riding School horses (n=12), stabled or loose housed from the same yard were selected; 8 geldings and 4 mares, mean age \pm s.d. (range) 10.9 \pm 2.91 (5-15) years, mean height \pm s.d. (range) 152.5 \pm 16.15 (127-175) cm with no known existing conditions. Horses were divided into two evenly matched groups. Group 1 (n=6) wore 1 x 200g rug for four weeks; group 2 (n=6) wore 2 x 100g rugs for four weeks. Rugs were taken off only for ridden or walker exercise, and stabled horses wore a different rug for paddock turnout of one hour per day. A digital video camera recorded each horse walk a straight 10m length track in an indoor school at the start and end of a 28-day period. Each walk consisted of 4 passes (2 from right, 2 from left) under three conditions: no rug, 1x 200g rug and 2 x 100g rugs. Markers were placed laterally on the coronet band of each hoof, hair clipped 1cm square for repeatability. Kinovea software measured 5 stride lengths for each limb per condition per horse (n=20). Data was tested for normality (skewness test) and variance, ANOVA-2 factor without replication with post-hoc paired T-Tests. Statistical significance $P < 0.05$.

Results When comparing stride length of different walk conditions for all horses on Day 0 and Day 28 there were significant differences in mean stride length (cm) between walk conditions in all except one instance (table 1). Day 0 (n=12); no rug with 1 rug ($P = 0.0002$); 1 rug with 2 rugs ($P < 0.0001$); no rug with 2 rugs ($P < 0.0001$). On Day 28 (n=12); no rug with 1 rug ($P = 0.0004$); no rug with 2 rugs ($P < 0.0001$) but no significant difference between 1 rug with 2 rugs ($P > 0.05$).

Table 1: Horse stride length (cm) (mean \pm s.d.) (n=12) for all horses at each walk condition at Day 0 and Day 28

Walk condition all horses (n=12)		No rug	1 rug	2 rugs
Time period	Day 0	204 \pm 29.7 ^{AC}	202 \pm 28.8 ^{AB}	199 \pm 28.7 ^{ABC}
	Day 28	200 \pm 26.0 ^{AB}	198 \pm 26.7 ^A	197 \pm 26.5 ^B

Significant differences between mean values within each row are indicated ^{A B C} ($P < 0.001$)

When comparing stride length of the same walk condition for each Group at 0 and 28 days, the results varied between groups. For Group 1 (1 x 200g rug) horses (n=6), there was no significant difference ($P > 0.05$) in stride length for each walk condition at 0 and 28 days. For Group 2 (2 x 100g rug) horses (n=6), there were significant differences in stride length ($P < 0.0001$) for each walk condition at 0 and 28 days (table 2).

Table 2: Horse stride length (cm) (mean \pm s.d.) for each Group (n=6) at each walk condition at day 0 and day 28

Groups (n=6)	Walk condition					
	No rug		1 rug		2 rugs	
Group 1 (1 x 200g rug for 28 days)	day 0: 199 \pm 29.2 day 28: 199 \pm 26.7	$P > 0.05$	day 0: 197 \pm 27.0 day 28: 196 \pm 26.6	$P > 0.05$	day 0: 194 \pm 26.4 day 28: 195 \pm 27.2	$P > 0.05$
Group 2 (2 x 100g rugs for 28 days)	day 0: 209 \pm 29.9 day 28: 201 \pm 26.0	$P < 0.0001$	day 0: 207 \pm 30.2 day 28: 200 \pm 27.3	$P < 0.0001$	day 0: 204 \pm 30.4 day 28: 199 \pm 26.2	$P < 0.0001$

Conclusions The physical number of rugs worn significantly affects walk stride length ($P < 0.001$). Stride length decreases as the number of rugs increases. Wearing one rug decreases stride length compared with not wearing a rug. Wearing two rugs further decreases stride length in comparison to wearing only one rug. Wearing one rug (1x200g) daily over a 28-day period, does not significantly reduce stride length compared to day 0 ($P > 0.05$).

However, wearing two rugs(2x100g) over a 28-day period significantly reduces stride length ($P<0.0001$) whether walking with no rug, one rug or two rugs. Wearing rugs and the number of rugs worn has an effect on walk stride length indicating a potential effect on horses' musculoskeletal system. The number of rugs worn daily over a 28-day period, (two rugs compared to one rug) has a negative effect on walk stride length. Further research is warranted to evaluate further the effects of layering rugs and types of rugs on horses' musculoskeletal system which could potentially affect performance and welfare.

References Clayton, H.M., Kaiser, L.J. and Nauwelaerts, S. (2010). Pressure on the horse's withers with three styles of blanket. *The Veterinary Journal*, 184(1), pp.52–55.

Rahmatalla, S., Kim, H.L., Shanahan, M. and Swan, C.C. (2005). Effect of Restrictive Clothing on Balance and Gait using Motion Capture and Stability Analysis. In: *Digital Human Modeling for Design and Engineering Symposium*, Warrendale, USA: SAE International 114, pp.713-722.