A Preliminary Study on the Effect of Massage to Reduce Stress in the Horse

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A Preliminary Study on the Effect of Massage to Reduce Stress in the Horse

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REFEREED

The use of massage (as a potential form of acupressure) has long been documented as a human relaxation aid. However, little scientific research has been carried out into its potential use as a form of stress reduction in the horse. This preliminary study investigated the effect of massage at six different sites (thoracic trapezius [withers], mid-brachiocephalicus, cervical ventral serrate and cervical trapezius [mid-neck], proximal gluteal fascia and proximal superficial gluteal [croup], proximal and mid-semitendinosus [second thigh], lateral triceps, proximal extensor carpi radialis and proximal common digital extensor [forearm], proximal brachiocephalicus, proximal splenius and ear [poll and ears) on stress-related behavioral and physiological (heart rate [HR]) measures in the horse. Ten riding school ponies/horses were massaged at each of the six sites (three preferred and three nonpreferred sites of allogrooming (mutual grooming between conspecifics) and changes in HR and behavior were recorded. The results indicated that during massage, all sites except the forearm resulted in a significant reduction in HR ($P < .05$) with massage at the withers, mid-neck, and croup having the greatest effect (preferred sites of allogrooming). Massage at preferred sites of allogrooming also elicited significantly more ($P < .05$) positive behavioral responses compared with the three nonpreferred sites. The practical implications of this study are discussed. (J Equine Vet Sci 2004;24:76-81)

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INTRODUCTION

The term massage comes from the French verb "amaser," meaning to knead. It is a manual technique normally involving the hand to manipulate the muscle and soft tissue of the body. From a therapeutic perspective, and in the context of traditional Chinese medicine, massage can constitute a form of acupressure.[1] Although human massage has been documented for some time (references on the Indian medicine of Ayurveda date back to 1800 BC), modern therapeutic systems stem largely from the work of Swedish professor Peter Henrik Ling (1776-1839), who established an institute in Stockholm for the teaching of massage and medical gymnastics (The Swedish Movement Treatment).[2,3] Today, human massage has become a popular alternative therapy for the treatment of chronic and acute musculoskeletal disorders and also as a method to reduce stress.[4,5] Several different types of massage technique exist (eg, stroking, effleurage, petrissage, shaking, vibration, friction, nerve manipulation, and tapotements).[6] Effleurage is the move most commonly applied and involves a gliding motion of both palm and hand with even pressure applied throughout the stroke. Therapeutically, equine massage is also recognized as a practiced alternative therapy for the relief of musculo-skeletal disorders in horses.[7] Its use, however, to reduce equine stress levels has not been examined to the same extent. Anecdotally it is considered to do so; for example, cavalrymen of the 1850s used massage,[8] potentially in the context of battle. More recently, work by Feh and De Mazieres[9] demonstrated that grooming/scratching of semi-tame Camargue horses at the site of preferred allogrooming (the lower midneck) significantly reduced HR (mean decrease of 11.4% in adults and 13.5% in foals) whereas grooming on a nonpreferred site (the lower shoulder to elbow) did not. If grooming/scratching can be considered as variations of massage, then human-directed massage on horses may have a calming, and thus a potentially stress-reducing, effect. The aim of this

Table 1 Details of horses used in the study

Horse	Breed/type	Age	Sex
1	Thoroughbred (TB)	18 +	Gelding
2	New Forest	15	Gelding
3	New Forest X	8	Gelding
4	Shire X	8	Mare
5	Welsh cob	10	Gelding
6	Fell	12	Gelding
7	Shetland	20 +	Gelding
8	TB X	11	Gelding
9	TB	18	Mare
10	Colored cob	10	Mare

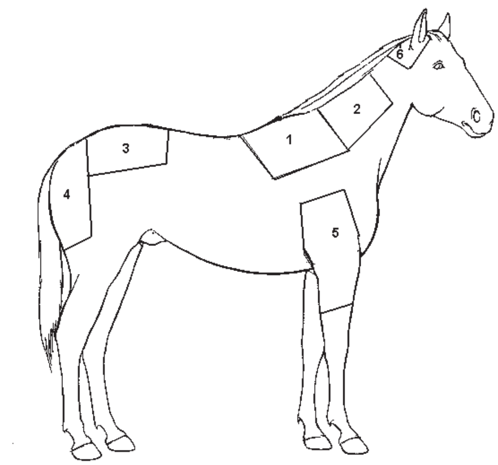

Figure 1. The six sites of massage used during the experiment.

preliminary investigation was to assess the effect of massage at various anatomical points, on the behavior and physiology of the horse.

METHODOLOGY

Animals

Ten mature injury-free riding school ponies and horses were used (age, breed, and sex varied [Table 1]). Each pony/horse was exercised for one hour (12-3 PM) before testing (6pm-7pm). Six sites of massage were used (Fig. 1):

- Site 1: thoracic trapezius [withers];
- Site 2: mid-brachiocephalicus, cervical ventral serrate and trapezius [mid-neck];
- Site 3: proximal gluteal fascia and proximal superficial gluteal [croup];
- Site 4: proximal and mid-semitendinosus [second thigh];
- Site 5: lateral triceps, proximal extensor carpi radialis and proximal common digital extensor [forearm]; and
- Site 6: proximal brachiocephalicus, proximal splenius and ear [poll and ears).

Sites 1 to 3 are common and preferred sites of allogrooming, whereas sites 4 to 6 are nonpreferred sites of allogrooming.[10]

Prior introduction to massage is considered necessary to elicit an effect,[11] thus, all horses were introduced to the technique for 7 days before the start of the study. The animals were also acclimated to the HR equipment during this period. Effleurage, as the specific massage technique, was selected for this study. A randomized experimental design was applied (Genstat, Lawes Agricultural Trust, Hertfordshire, UK), to ensure that the sequence of treatments for each animal differed. Each animal underwent one treatment (massage site) per day for each of the 6 massage sites. Treatments were carried out in the animal's stable.

Procedure

The pony/horse was loosely halter-tied in its stable and the HR monitor (Polar Oy, Helsinki, Finland) was fitted according to the manufacturer's instructions and set to record at 5 second intervals. The resting pulse rate was recorded for 5 minutes before the initiation of massage at the appropriate site and the mean value taken to give the 'Pre' value. Recording continued for the duration of the massage period (5 minutes, mean value gave 'During' value) and for 5 minutes afterwards (mean value gave 'Post' value). Throughout the experiment, one observer scored each pony/horse for behavior (Table 2). This procedure was repeated for each of the 10 ponies/horses for each massage site.

Statistics

The normal distribution of both HR and behavioral data facilitated the use of parametric statistics. Split Plot analysis of variance (Genstat, Lawes Agricultural Trust), in conjunction with least significant difference (LSD) values, was used to identify statistically significant time differences ('Pre' vs 'During' and 'Pre' vs 'Post' values) for each treatment. Treatment effects were tested using an ante-dependence test where the order structure of the data was first calculated to identify appropriate covariates to be used in a subsequent analysis of variance (Genstat, Lawes Agricultural Trust).

General analysis of variance tested for differences between treatments for the behavioral score data (Genstat, Lawes Agricultural Trust).

RESULTS

Effects of massage on HR

Mean (±SEM) HR data are presented in Figure 2.

There was an overall significant effect of treatment on HR values between measurements ('Pre', 'During', and 'Post') (degrees of freedom, 2; variance ratio, 45.22; $P < .001$). Multiple comparisons between 'Pre' 'During', and 'Post' values for each treatment are indicated in Figure 2.

Massage on the majority of massage sites had a similar overall effect of significantly reducing HR with a trend of greater reduction during the treatment (average reduction, 4.3%) and to a lesser degree afterwards (average reduction, 2.6%). Exceptions to this were massage of the forelimb, which had no apparent effect on HR, and massage to the ear and poll region, which produced a significant reduction during the massage and continued after the treatment had stopped. Massage to the withers and mid-neck produced the greatest decrease in HR.

Tables 3 and 4 present, respectively, the mean 'During' and 'Post' treatment HR values adjusted for 'Pre' values as a covariate. The arbitrary differences between means are also presented and denoted (*) where a significant difference exists based on the generated least significant difference values.

'During' HR values for treatment 1 (withers) were significantly different from treatments 4 to 6 (forearm, second thigh, and poll and ear) but not treatments 2 and 3 (mid-neck and croup). In addition, 'During' HR values for treatment 2 (mid-neck) were significantly different from treatments 3 to 6 (croup, forearm, second thigh, and poll and ear). Treatment 3 (croup) HR values were significantly different from treatment 4 (forearm). No other 'During' HR values were significantly different between treatments.

'Post' HR values for treatment 1 (withers) were significantly different from treatments 3 and 4 (croup and forearm) but not treatments 2, 5, and 6 (mid-neck, second thigh, and poll and ear). In addition, 'Post'-HR values for treatment 2 (mid-neck) were significantly different from treatments 3 and 4 (croup and forearm). Treatment 4 (forearm)-HR values were significantly different from treatment 6 (poll and ear). No other 'Post'-HR values were significantly different between treatments.

Effects of massage on behavior

Mean (±SEM) behavior score data are presented in Figure 3.

Site of massage was found to have a significant effect ($P < .001$) on the behavior of the animal. Massage at sites 1 (withers), 2 (mid-neck), and 3 (croup) were significantly different in their effect on behavior compared with sites 4 (second thigh), 5 (forearm), and 6 (poll and ears), where the latter sites appeared to produce either no behavioral changes or changes that were considered to be negative (Table 1). Massage of the poll and ear produced a high level of individual variation in the reaction to this treatment, with horses responding both positively (scores of 5) and negatively (scores of 1).

Table 2 Behavioral score criteria

Behavioral score	Criteria
1	High negative response to the massage with large degree of restless behavior including raising of head, foot stamping, biting or other signs of aggression.
2	Negative response to the massage with some restless behavior including raising of head, foot stamping, occasional biting or other signs of aggression.
3	Indifferent response to massage, behavior does not change.
4	Positive response to massage with behaviors including grooming masseur, movement of lips, repeated lateral movements of hind-quarters, leaning into massage or rubbing against masseur.
5	Highly positive response to massage with behaviors including grooming masseur, movement of lips, repeated lateral movements of hind-quarters, leaning into massage or rubbing against masseur. Additional somnolent type behaviors including leg-resting, lowering of head, relaxation of lower lip.

DISCUSSION

Massage to the withers and mid-neck resulted in the largest drop in HR and the largest (positive) behavioral score values. This observed effect progressively diminished in the order of treatments to croup, second thigh, ear, and forearm. Thus, it was apparent that massage at preferred sites of allogrooming (mid-neck and withers) caused the largest physiologic and behavioral effect compared with nonpreferred sites (forearm). These results support previous findings.[9]

The considered general function of allogrooming is threefold: (1) hygiene: cleaning, extraction of ectoparasites, and prevention of infections; (2) distensive: the restraint, prevention, or diversion of potential aggression; and (3) affiliative: establishing and maintaining bonds.[12] Functional variation may exist between species, for example, in primates, all-over body grooming may relate

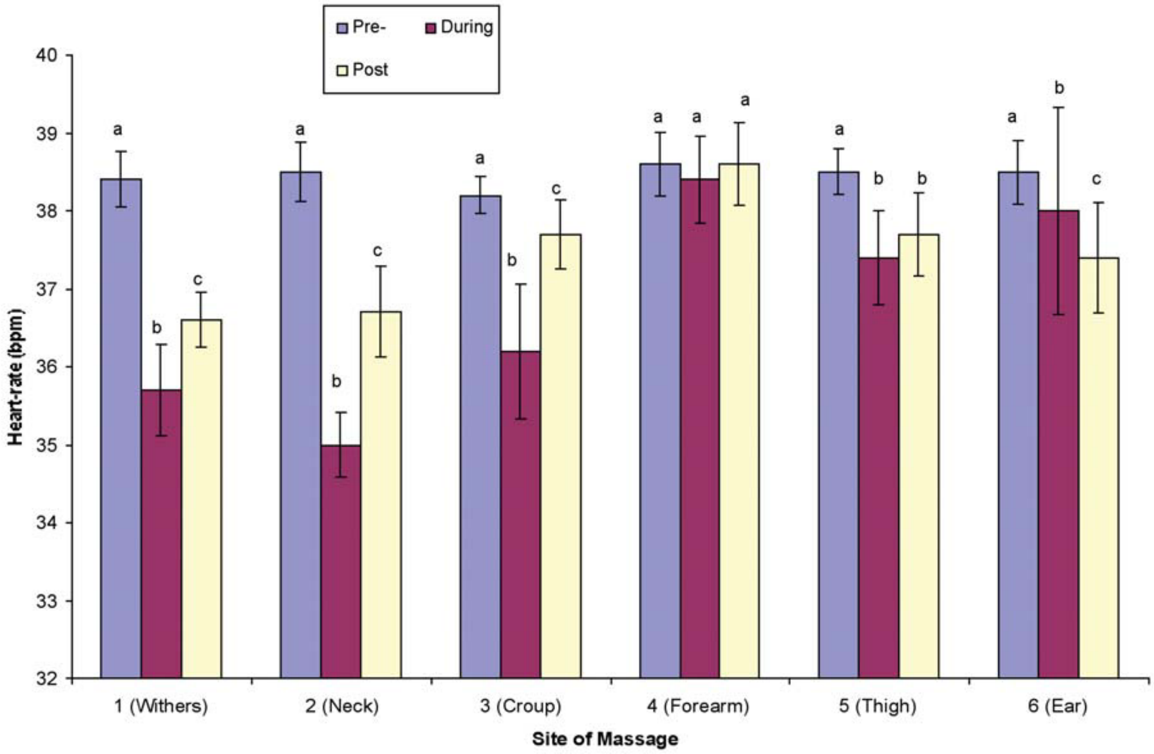

Figure 2. Mean (±SEM) heart rate values before (Pre), during (During), and after (Post) each treatment. Points with different superscripts (a, b, c) differ significantly ($p < 0.05$) within treatments.

Table 3 Mean "During" treatment heart rate values adjusted for "Pre" values as a covariate

	Treatments						Treatments
	1	2	3	4	5	6	
Covariate ("Pre") adjusted means for "During" values (n = 10)	35.75	34.95	36.43	38.26	37.35	37.35	
Differences between treatments (*indicates significant difference; LSD 1.45)		0.8	–0.68	–2.51*	–1.6*	–1.6*	**1**
			–1.48*	–3.31*	–2.4*	–2.4*	**2**
				–1.83*	–0.92	–0.92	**3**
					0.91	0.91	**4**
						0	**5**

Table 4 Mean "Post" treatment heart rate values adjusted for "Pre" values as a covariate

	Treatments						Treatments
	1	2	3	4	5	6	
Covariate ("Pre") adjusted means for "Post" values (n = 10)	36.63	36.67	37.86	38.5	37.67	37.37	
Differences between treatments (*indicates significant difference; LSD 1.06)		–0.04	–1.23*	–1.87*	–1.04	–0.74	**1**
			–1.19*	–1.83*	–1	–0.7	**2**
				–0.64	0.19	0.49	**3**
					0.83	1.13*	**4**
						0.3	**5**

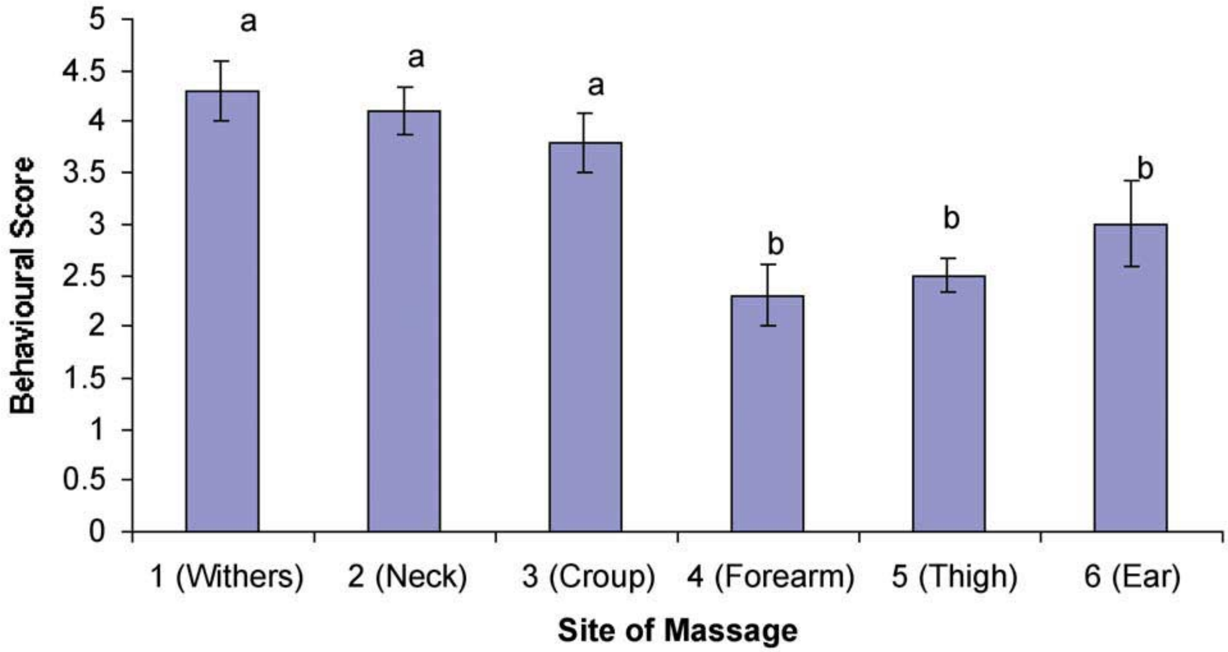

Figure 3. Mean (±SEM) behavioral score values during each treatment. Points with different superscripts (a, b, c) differ significantly ($p < 0.05$) between treatments.

specifically to hygiene,[13] whereas in ungulates, where grooming is much more body-region specific, the emphasis may be on social bond. Regardless of the exact function, allogrooming, has evolved as a motivated goal-directed behavior in several species and thus can be considered to confer benefit either to the individual or to the species as a whole. Like other goal-directed behaviors,[14] grooming appears to have a pleasurable or "reward" characteristic, which exists to maintain the behavior both in the shorter and longer term. It is potentially this "reward" element that allows massage to have stress-reducing qualities.

As previously discussed, massage can constitute a form of acupressure; the application of hand pressure to the body in a general pattern (massage) or at designated points (acu points) and locations.[1] Low-frequency stimulation at acupressure points causes the activation of small-diameter nerve fibers within peripheral nerves.[15,16] These synapse within the dorsal horn of the spinal cord and subsequently activate the spinal cord itself, the brain stem (reticular formation and periaqueductal gray area [PAG]), and the hypothalamus. Much of this initial neural activation appears to be opioid-mediated, especially within the ventrolateral periaqueductal gray area (vlPAG), with subsequent activation of serotonergic neurons within the raphe nuclei section of the reticular formation.[15-17] It is this opioid mechanism that is considered responsible for the analgesic affects of acupuncture[18] and the pleasurable or "well-being" sensation of acupressure or massage.[11] The caudal vlPAG also has efferent pathways to the rostral and caudal ventrolateral medulla, caudal midline medulla, and the nucleus ambiguous regions; these are primary depressor regions, stimulation of which can result in bradycardia.[19,20] Indeed it has been demonstrated experimentally that direct binding of delta and kappa opioid receptors within PAG results in lowered HR.[21] The differences in differential HR values ('Pre' vs 'During' and 'Pre' vs 'Post') between massage sites may, therefore, reflect differences in PAG stimulation. Thus, massage-induced activation of small diameter nerve fibers within the withers induces more PAG stimulation compared with the forelimb. Areas within the ear are noted as primary acupuncture points for the treatment of pain[22]; thus, the level of PAG opioid release may be greater or more prolonged in this instance. This may explain the prolonged bradycardia that was measured during the ear massage treatment.

In conclusion, and from an applied practical perspective, the preliminary results presented in this study suggest that massage may be used to induce a more relaxed, calm state in the horse. This may be beneficial to both horse and handler under certain low to medium stressful situations, such as isolation or veterinary procedures. Further research assessing the practical use of massage on horses in such situations may be of benefit in this respect.

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