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Trailer Loading Stress in Horses: Behavioral and Physiological Effects of Nonaversive Training (TTEAM)

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Resistance in the horse to trailer loading is a common source of stress and injury to horses and their handlers. The objective of this study was to determine whether nonaversive training based on the Tellington-Touch Equine Awareness Method (TTEAM; Tellington-Jones & Bruns, 1988) would decrease loading time and reduce stress during loading for horses with a history of reluctance to load. Ten horses described by their owners as "problem loaders" were subjected to pretraining and posttraining assessments of loading. Each assessment involved two 7-min loading attempts during which heart rate and saliva cortisol were measured. The training consisted of six 30-min sessions over a 2-week period during which the horse and owner participated in basic leading exercises with obstacles simulating aspects of trailering. Assessment showed heart rate and saliva cortisol increased significantly during loading as compared to baseline ($p < .001$ and $p < .05$, respectively). Reassessment after training showed a decrease in loading time ($p < .02$), reduced heart rate during loading ($p < .002$), and reduced saliva cortisol as compared to pretraining assessments. Seven "good loaders" also were subject to loading assessment for physiological comparison. Increases in heart rate during loading were significantly higher in the good loaders ($p < .001$). Nonaversive training simulating aspects of loading may effectively reduce loading time and stress during loading for horses with a history of resistance to trailer loading.

Accidents related to trailering horses are a common source of injury to both horses and people handling horses. Many of these injuries occur while loading and unloading the horse from a trailer. The most common problem is the horse who refuses to enter the trailer. The ensuing struggle can lead to injury (Houpt,

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1982). Unfortunately for the horse, the recommended solution is often brute force: "applying a little strong arm technique from behind … [and] a couple of smart slaps" (Ledger, 1982). Houpt (1982) reported, "Many otherwise moderate horsemen and veterinarians resort to using a painful stimulus—a 2 × 4 for example—to urge a horse into the trailer" (p. 13). Some horses respond by learning to rush dangerously into the trailer to avoid the aversive treatment, whereas others become even more difficult to load (Houpt, 1982). Both situations greatly increase the likelihood of injury to horse and handler and, invariably, are stressful for the horse and frustrating for the handler. Apart from the risk of physical injury, this stress and frustration also can be damaging to the relationship between horse and handler and have a negative impact on training.

To reduce the likelihood of injury, horses who have difficulty loading may be trained to load more willingly. According to Scoggins (1996), successful training involves increasing the horse's confidence by breaking loading into simpler, separate tasks that can be accomplished in a relaxed mental and physical state. These tasks include moving forward on command, stepping onto—and backing off—an unstable floor, and moving into a confined space.

The Tellington-Touch Equine Awareness Method (TTEAM), developed by Linda Tellington-Jones and described by Curcio-Wolfe (1996), takes this concept of relaxed, progressive training one step further. This method uses nonaversive touch and commands in novel situations as a means for inducing behavioral changes in horses. Horses are generally neophobic (Houpt, 1982), and TTEAM is specifically designed to teach horses to relax and function in the presence of novel and potentially frightening stimuli (R. Hood, personal communication, September 1999).

There are three main components to TTEAM training: bodywork, leading exercises, and riding exercises. This study focuses on the use of leading exercises specifically geared toward improving willingness to load on trailers. Basic leading exercises were used in conjunction with obstacles that simulated different aspects of loading: stepping onto—and backing off—a raised floor, walking onto noisy and unfamiliar surfaces, and moving through low and narrow spaces. Bodywork also was incorporated into each training program. The TTEAM bodywork involves the use of light, circular touches that draw the horse's attention to different parts of the body where there may be tension, discomfort, or resistance to being touched. By making gentle connecting strokes over all the body, horses become habituated to being touched in areas where previously there may have been resistance. Anecdotal case studies claim excellent success using TTEAM to retrain horses with loading problems (Shearer, 1997); as yet, no experimental data have been reported.

If TTEAM is an effective method for training horses to accept loading into a trailer, it is preferable to more traditional methods for several important reasons. First, it does not involve the use of a trailer. Instead, commonly found articles such as poles, plywood, and tarps are used to create obstacles that resemble various aspects of the trailering experience. Second, breaking down the components of trailering into simple common obstacles makes the training safer than putting a trailer, horse, and handler into a situation in which the horse may be fearful and resistant. Third, TTEAM is very easy for handlers to learn and implement (Curcio-Wolfe, 1996). Many veterinarians, behaviorists, and animal trainers use TTEAM as part of their regular procedure for handling and calming frightened and injured animals (Harman, 1998).

Finally, and most important, TTEAM does not use force or physical pain to motivate the horse to comply. An unpublished study described by Harman (1998) found that horses undergoing TTEAM training had significantly lower levels of adrenocorticotropic hormone (ACTH) than horses with similar workloads that were not subject to TTEAM. ACTH is responsible for stimulating the production and release of cortisol from the adrenal cortex, a phenomenon that occurs in response to stressful situations. Other manifestations of stress such as an increase in heart rate, blood pressure, and respiratory rate (Von Holst, 1998) often accompany adrenocortical activation. Indeed, studies of heart rate measurement during transport have suggested that loading is the most stressful aspect of transport for horses and other species (Ball, 1998).

One objective of this study was to assess the effectiveness of training using the TTEAM bodywork and leading exercises on the loading performance and stress response of horses with a history of loading problems. Experimentally confirming the effectiveness of a nonaversive and nonstressful method for rehabilitating "problem loaders" may reduce the use of excessive force in horse handling and decrease the incidence of injury to horses and handlers during trailering.

A second objective was to measure the stress experienced by horses during the loading process and determine whether the stress would be reduced by nonaversive training. This was achieved by continuous heart rate monitoring prior to and during loading assessments. Saliva samples also were collected and analyzed for salivary cortisol measurements. Saliva cortisol was recently validated as an appropriate method for measuring cortisol in horses (Van der Kolk, Nachreiner, Schott, Refsal, & Zanella, 2001). There is extensive evidence of significant increases in saliva cortisol due to stress found in humans (Miluk-Kosala, Obminski, Stupnicki, & Golec, 1994), dogs (Beerda, Schilder, Janssen, & Mol, 1996), sheep (Fell, Shutt, & Bentley, 1985), and goats (Greenwood & Shutt, 1992). Increases in saliva cortisol due to stress in horses have not been reported but are expected based on the established correlation with blood cortisol levels and elevations in other species. Based on experiments with humans, it is estimated that saliva cortisol increases will be detectable within 10 min of exposure to a stressful situation (D. Granger, personal communication, May 1999). A third objective was to document any physiological differences during loading between horses who are willing to load and those who are not.

METHOD

Participants

Ten horses who were considered problem loaders by their caregivers (owners) were recruited from local boarding stables in response to advertisements placed in tack shops. To participate, horses had to be trained to lead and were not to be trailered for the duration of the study. In addition to the 10 experimental horses, we enlisted 7 horses who were considered by their owners to be “good loaders.” For a summary of age, breed, and sex of these horses, see Table 1.

Before commencement of the experimental phase of this project, an Animal Utilization Project Proposal was approved by the Research Advisory Board of the Animal Care Committee of the University of Guelph. This approval is based on the humane treatment and proper animal care for animal subjects involved in the experiment. The Animal Care Committee Guidelines are based on recommendations from the Canadian Council on Animal Care.

TABLE 1
Descriptions of Problem and Good Loaders

Horse	*Sex*	*Breed*	*Age*[a]
Problem loaders			
1	Mare	Canadian	4
2	Mare	Canadian	7
3	Gelding	Arabian/saddlebred	6
4	Gelding	Thoroughbred	12
5	Gelding	Thoroughbred	19
6	Mare	Arabian	9
7	Mare	Quarter horse	4
8	Mare	Quarter horse	2
9	Mare	Paint	2
10	Gelding	Anglo-Arab	14
Good loaders			
A	Mare	Hanoverian/thoroughbred	11
B	Mare	Thoroughbred	18
C	Mare	Thoroughbred/pony	23
D	Gelding	Thoroughbred	11
E	Gelding	Thoroughbred	6
F	Gelding	Quarter horse	7
G	Mare	Quarter horse	12

[a]Given in years.

Apparatus

Telemetric heart rate monitor. A Polar Beat Heart Rate Monitor® was attached to the horse by a modified surcingle fitted around the horse's girth.

Saliva cortisol. Saliva samples for cortisol analysis were taken using plain (noncitric acid) cotton Salivettes® from Sarstedt©. Samples were taken by wiping the horse's tongue with the Salivette. All samples were frozen at –20 ºC immediately following collection and were shipped frozen to the Behavioral Endocrinology Laboratory at Pennsylvania State University for analysis using Salimetrics© Salivary Cortisol Enzyme Immuno-Assay Kit.

Trailer. Standard two-horse, rear-loading trailers with a ramp were used in all cases except for one in which an owner had a rear-loading three-horse slant trailer. Each trailer was used for at least two horses; in total, four different trailers were used.

Training equipment. Training equipment included 4 ft (1.2 m) dressage whips, 6 ft (1.8 m) nylon lead ropes with a 30 in. (0.76 m) chain, 8 ft (2.4 m) × 10 ft (3.0 m) blue plastic tarps, 10 ft (3.0 m) to 12 ft (3.6 m) wooden poles, and solid 4 ft (1.2 m) × 8 ft (2.4 m) plywood planks.

Procedures

Pretest 1: Assessment of loading. Each assessment of loading was comprised of four phases: a baseline period, a first loading attempt, a break between loading attempts, and a second loading attempt. The entire assessment of loading (pretest or posttest) took approximately 30 min. Heart rate measurements were recorded every 15 sec from placement of heart rate monitor during baseline period until the end of the assessment.

Phase 1: Baseline period (10 min). Two baseline measures of salivary cortisol were taken 10 min apart with the horse at rest in the stall. During this 10-min baseline, the heart rate monitor was placed around the horse's girth. Heart rate data was collected for at least 4 min prior to walking the horse to the trailer.

All horses in the study previously had been handled, bridled, and saddled. No horses showed any evidence or history of discomfort or stress associated with wearing a surcingle around the girth or being bridled. The average heart rate during the baseline period was 40.5 beats per minute (bpm), a normal resting heart rate for horses. The swabbing of the mouth for saliva sampling was similar to the horse's being bridled or having a finger placed in the mouth prior to bridling; no horses resisted the swabbings.

Phase 2: First loading attempt (7 min). After Phase 1, the horse was walked to the site of the trailer. Either the owner or the horse handler (who was unfamiliar with the horse and the purpose of the study) attempted to load the horse. The person loading the horse was instructed to lead the horse to the trailer and load. If the horse was unwilling to load, the person was to continue trying until the horse loaded or 7 min had elapsed. A horse who loaded was kept in the trailer for 1 min, then asked to back out and reload. Each loading attempt was videotaped to permit collection of behavioral data.

Phase 3: Between loading attempts (3 min). At the end of the first loading attempt, a saliva sample was collected. The horse was allowed to stand for 3 min prior to the second loading attempt. The purpose of this period was to allow the horse's heart rate to decrease toward baseline values prior to a second loading attempt with a different person.

Phase 4: Second loading attempt (7 min). After Phase 3, the other person (owner or horse handler) attempted to load the horse. After 7 min had elapsed, a saliva sample was collected. This concluded the assessment.

Pretest 2: Control assessment. To ensure that changes in loading resistance were not due simply to the passage of time or to familiarity with the process, four horses were tested again 6 weeks after Pretest 1. In the interim, these horses received no training pertinent to loading and were not transported in a trailer. The Pretest 2 procedure was identical to Pretest 1. The horse handler was blind to the training status of the horse.

The other six problem horses were not available for the length of time required to complete both of the pretests and the training program. Therefore, these horses began the training immediately following Pretest 1.

Training. The training program consisted of 6 sessions of 30-min duration held approximately every other day within a 2-week period. During each session, I performed the exercises and instructed the owner on how to perform the exercises. Four of the horses' owners were unable to participate in the training sessions; I performed the exercises alone.

The program was based on TTEAM principles, exercises, and techniques as described by Shearer (1997) and by R. Hood (personal communication, September 1999). Each session included leading exercises with various obstacles. The first and third sessions also included TTEAM bodywork exercises. The exact content of the sessions varied depending on the obstacles available and the horse's reaction to the exercises. Horses were not forced to complete any exercise. If difficulty was encountered, the exercise was simplified or discontinued for that session.

Basic leading exercises. The purpose of the basic leading exercises was to establish clear and subtle signals for the horse to move forward, stop, and move back in a controlled manner on command. Horses learned to (a) walk forward from a sequence of stroking the back and then light tapping of the croup, (b) stop from a light tap of their chest with the whip, (c) back up one step at a time from their cannon bone being stroked against the hair on the leg they were being asked to move, and (d) lower their heads in response to a combination of a gentle pull and release of the lead and stroking of the chest and front legs with the whip.

Obstacles simulating aspects of trailering. Using the basic leading exercises as described previously, horses were led through a series of obstacles. For each obstacle, the horse was asked to walk to the obstacle and halt. Horses whose necks were above the horizontal were asked to lower their heads and walk over or through the obstacle. The difficulty or size of the obstacle was reduced for horses who refused to attempt an obstacle (by raising their heads, backing away, or attempting to turn or avoid the obstacle).

Also, if repeated attempts at an obstacle caused a horse to be increasingly reluctant, the difficulty or size of the obstacle was reduced. An 8 ft (2.4 m) × 10 ft (3.0 m) tarp could be folded to a size of 1 ft (0.3 m) square. If the horse still avoided the obstacle or if the difficulty could not be easily reduced, food treats (carrots or grain) were placed on the obstacle for the horse to eat before proceeding. The food was used only in this manner; it was not used to lure the horse through an obstacle, and it was not offered to the horse from the person's hand. If the horse still refused to perform as requested, work with that specific obstacle was terminated for that session.

The exercises included in the training were (a) stepping over long wooden poles lying flat on the ground, raised off the ground, or piled up; (b) stepping onto a raised wooden platform; (c) walking on unfamiliar surfaces such as a plastic tarp or a plywood plank; (d) walking through a narrow space such as that between plywood planks or plastic tarps; (e) walking under low obstacles such as an arch of long whips, broom handles, or a tarp held overhead; and (f) a combination of obstacles to more closely resemble the trailer—such as walking between tarps—with a tarp roof overhead.

TTEAM bodywork. As described in Tellington-Jones and Bruns (1988), the trainer and owner, using a gentle circular movement of the fingers and broad strokes, touched the horse over all the body. The strokes and touches were intended to connect areas in which the horse appeared comfortable being touched with areas in which the horse appeared to react with discomfort (girth, flank, rump, ears, mouth, tail, and hind legs).

Posttest (assessment of loading). Posttest loading attempts were conducted in the same manner as the pretests 2 days after completion of the training program. The trainer, in place of owners who were unable to attend, loaded four of the horses in the posttest.

RESULTS

Each loading attempt (two loading attempts per assessment) had a maximum time allowance of 7 min. If the horse did not load within this time, loading time was recorded as greater than 7 min (> 7 min). The analysis of variance (ANOVA) using a completely randomized split-plot design does not account for this censoring of loading time; therefore, a time of 7 min was used for analysis. This underestimate of actual loading time gives a lower estimated mean for those groups that include censored data.

Because we cannot estimate actual loading time differences from censored data, the percentage of loadings that were greater than 7 min as well as the number of horses with at least one loading greater than 7 min are given with mean loading times to facilitate interpretation by the reader (Table 2). ANOVA was chosen for analysis of loading time to account for random effects. A model for analysis accounting for both censoring and random effects was not available, and ANOVA

TABLE 2
Loading Time (Least Square Means in Minutes) Before and After Training

Horses	*N*	*Loading Time (M ± SE)*	*Range*		*Did Not Load in 7 Minutes (%)*	
			Min	*Max*	*Loadings*	*Horses*
Good loaders	7	1.04 ± 0.71	0.25	2	0.0	0.0
Poor loaders pretraining						
Pretest 1	10	6.00 ± 0.49[a]	3.25	> 7	60.0	80.0
Pretest 2	4	6.46 ± 0.75[b]	4.00	> 7	87.5	100.0
Poor loaders posttraining						
Posttest	10	4.25 ± 0.49[a,b]	0.25	> 7	35.0	40.0

Note. Min = minimum; max = maximum.

[a]Significant decrease in loading time between Pretest 1 and posttest, $t(18) = 2.94$, $p < .005$. [b]Significant decrease in loading time between Pretest 2 and posttest, $t(18) = 2.69$, $p < .01$.

was preferred for accuracy and ease of interpretation over models that account for censoring.

Heart rate measurements were averaged for each phase of assessment to create four measurements for each assessment: baseline, first loading, between loadings, and second loading averages. Saliva cortisol measurements from the beginning and end of the baseline phase were averaged to create a baseline cortisol value. Two additional measurements were taken, one at the end of each loading phase.

All data were analyzed by multifactorial ANOVA using a completely randomized split-plot design. Because good loaders received only one assessment, differences before and after training were analyzed separately from differences with good loaders. Some data were missing because of inconsistent telemetry transmission and the insufficient volume for analysis of a few saliva samples. Only heart rate data required logarithmic transformation to satisfy requirements for parametric statistics.

ANOVA revealed a significant difference between pretest and posttest loading time, heart rate, and saliva cortisol. Analysis also showed that significant changes in heart rate and saliva cortisol occurred during loading.

Loading Time

ANOVA indicated a change in loading time related to training, $F(2, 18) = 5.84$, $p = .01$. Paired t-test comparison showed that there was a significant decrease in loading time after training (posttest) as compared (Table 2) to Pretest 1, $t(18) = 2.94$, $p < .005$, and Pretest 2, $t(18) = 2.69$, $p < .01$.

Heart Rate

ANOVA showed a significant effect related to training, $F(2, 20) = 9.29$, $p = .001$, and phase of assessment, $F(3, 65) = 23.50$, $p < .0001$. For every loading attempt in both pretests and posttest, there was a highly significant increase in heart rate during loading as compared to baseline and rest period between loadings ($p < .001$). There was no significant difference between heart rate increases on the first loading attempt as compared to the second loading attempt, $t(65) = 1.62$, $p > .1$.

Despite these increases, paired t-test comparisons showed that heart rate was significantly lower during posttest ($x = 47.3 \pm 1.2$ bpm) as compared to Pretest 1 ($x = 53.9 \pm 1.2$ bpm), $t(20) = 3.39$, $p < .002$.

Saliva Cortisol

ANOVA showed significant differences during loading, $F(4, 18) = 6.38$, $p < .005$, for saliva cortisol. See Table 3 for paired t-test comparison, which showed that this effect was due to significant increases after loading during Pretest 1,

TABLE 3
Saliva Cortisol (Least Square Means in Micrograms per Deciliters)
Before and After Loading Assessment

Assessment	*Before Loading (M ± SE)*	*After Loading (M ± SE)*
Pretest 1	0.101 ± 0.017	0.106 ± 0.017
Pretest 2	0.069 ± 0.026	0.123 ± 0.026
Posttest	0.093 ± 0.016	0.086 ± 0.016

$t(18) = 2.20$, $p < .05$, and Pretest 2, $t(18) = 4.20$, $p < .001$. There was no significant increase in saliva cortisol after loading during the posttest assessment, $t(18) = 0.31$, $p > .5$. Increases in saliva cortisol were significant only after the second loading. There was no significant difference between the baseline and first loading attempt $t(16) = 0.57$, $p > .5$.

Good Loaders

Good loaders had a least square mean loading time of 1.04 ± 0.71 min (Table 3), which was significantly less than problem horses, $t(14) = 6.58$, $p < .001$. ANOVA for heart rate data showed a significant difference between the two groups during loading, $F(6, 78) = 5.17$, $p < .0001$. Both good loaders and problem loaders showed a significant increase in heart rate during loading as compared to baseline and between-loading values ($p < .001$); however, the good loaders had a significantly higher increase in heart rate during loading than did the problem horses before and after training ($p < .001$).

DISCUSSION

The results from this study indicate that a nonaversive retraining method (based on TTEAM) was effective at reducing loading time for horses with a history of reluctance to load onto a trailer. There also was a significant decrease in heart rate and saliva cortisol during the loading assessment after training. As indicated by a decrease in heart rate and saliva cortisol, this suggests that the training improves willingness to load and also may decrease stress at loading.

Because of the allowance of only 7 min for each loading attempt, it is difficult to assess the actual decrease in loading time achieved by the training program. The finding of significant results, given such a narrow time constraint, is strongly supportive of the effectiveness of this training.

Increases in heart rate during loading as compared to baseline values were noted for all horses in all loading attempts; however, this increase was significantly greater for horses considered to be good loaders. There is not enough information to assess the cause of this relatively greater increase.

Possible explanations might include the following: Physiological stress does not prevent willing behavior—in other words, good loaders also are stressed by loading, but this does not prevent them from loading on command. In addition, the horses who loaded willingly stayed on the trailer for a longer period of time than those who did not load willingly. The highest heart rates for good loaders and problem horses before and after training were recorded while they were standing in the trailer after loading. This increase in heart rate may be related to the stress of confinement or possibly the anticipation of travel. Despite an increase in the amount of time spent in the trailer during posttest assessments of problem loaders, however, their overall heart rate during posttest assessment was decreased. It is not known whether TTEAM training may reduce the heart rate during loading of horses who are willing to load.

The increase in saliva cortisol in both Pretest 1 and Pretest 2 was noted only after the second loading. This suggests that saliva cortisol increases may not be measurable in saliva until greater than 7 min following initiation of loading, as previously suggested by D. Granger (personal communication, May 1999). That no significant increase in saliva cortisol was noted in the posttest assessment suggests that TTEAM training may have reduced the stress of loading enough to eliminate significant increases in cortisol. This is in agreement with research quoted by Harman (1998) in which horses receiving TTEAM training had significantly lower levels of ACTH.

CONCLUSIONS

In summary, nonaversive retraining based on TTEAM decreased loading time and heart rate and saliva cortisol during loading for horses with a history of resistance to trailer loading. There is potential for such training to improve tremendously the welfare of horses being transported while also decreasing the risk of injury during trailering for horses and horse handlers.

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