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PRELIMINARY INVESTIGATIONS INTO THE ETHOLOGICAL RELEVANCE OF ROUND-PEN (ROUND-YARD) TRAINING OF HORSES

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Abstract

Recently, training horses within round-pens has increased in popularity. Practitioners often maintain that the responses they elicit from horses are similar to signals used with senior conspecifics. To audit the responses of horses to conspecifics, 6 mare-young-horse dyads were introduced to each other in a round-pen and videoed for 8 min. These dyads spent significantly more time further than 10 m apart than they did less than 1 m apart ($p < 0.001$). The time they spent less than 1 m apart decreased over the 8 min test period ($p = 0.018$). Mares occupied the centre of the round-pen and chased youngsters for 0.73% of the test period ($p < 0.001$). All agonistic approaches were made by mares ($p < 0.001$) and all investigative approaches by youngsters ($p = 0.018$). Head-lowering and licking-and-chewing were exhibited most when the youngsters were facing away from the mares ($p < 0.001$). The frequency of head-lowering increased during the test period ($p = 0.027$) while the frequency of licking-and-chewing did not change. The current results bring into question the popular interpretation and ethological relevance of equine responses commonly described in round-pen training and show that mares did not condition young horses to remain in close proximity to them.

Keywords: behavior, ethology, horse, join-up, round-pen, round-yard, training

Introduction

Round-pens (also referred to as round-yards) are circular enclosures currently popular for the training of horses. Round-pen training is commonly advocated by so-called 'horse whisperers' or 'natural horsemen' (Krueger, 2006) and has been described as an ethological training method (Baragli, Sighieri, de Andreis, Gazzano and Nicol, 2004) because it requires an understanding of the horse's behavior (Miller, 1995a; Rivera, Benjamin, Nielsen, Shelle and Zanella, 2002; Sighieri, Tedeschi, de Andreis, Petri, and Baragli, 2003). This method is regarded as gentle (Krueger, 2006) and humane (Rivera et al. 2002) since it involves less apparent coercion than traditional restraining techniques and minimal direct contact between horse and handler. Therefore, it is propounded as a method that can be used to decrease the fear responses of horses to humans (Miller, 1995a) or to novel situations (Rivera et al. 2002). Consequently, it is often employed during breaking-in or foundation training (Miller, 1995a), also referred to as 'starting' (Roberts, 1996).

The chief premise for the round-pen technique is that it is claimed to use the behavioral responses of horses in their natural environment where group structure is maintained by the horses' use of a range of visual communication signals to communicate. Generally, the leader of the group is the most senior mare (Miller, 1995b; Linklater and Cameron, 2000). Anecdotally, it has been reported by proponents of round-pen training that equine leaders seeking to discipline an unruly youngster may chase it away from the group and keep it away from the group for a period. Subsequently, the youngster may show certain responses such as turning an ear towards the trainer, lowering its head towards the ground and licking-and-chewing, commonly referred to as signs of submission (Parelli, 1993; Miller, 1995b; Roberts, 1996; Sighieri et al. 2003). These responses are said to prompt the mare to acquiesce by showing behavioral signs that include aversion of her gaze and allowing the youngster to re-join the group (Roberts, 1996). Unfortunately, among the many studies of horse behaviour in wild, feral and domestic populations, there are no scientific reports of this phenomenon occurring.

According to popular interpretation of the round-pen technique, the trainer assumes the role of the dominant mare and chases the young horse around the round-pen. The trainer will use eye contact and arm movements to initiate this chasing and may keep the horse moving by flicking the end of a long lead (such as a lunge rein) towards the horse, which results in the horse continuing to run around the perimeter of the round-pen as it attempts to distance itself from the handler. The chasing

would normally continue until the young horse shows responses such as turning an ear towards the trainer, lowering its head towards the ground and licking-and-chewing (Rivera et al. 2002). It is worth emphasizing that there are a number of different interpretations of these responses, including their being signs of submission (Miller, 1995a), that the horse is 'ready to negotiate' (Parelli, 1993) or they may also be a displacement activity associated with conflicting motivations (Goodwin, 1999). Houpt, Law and Martinisi (1978) reported that licking-and-chewing occur during other activities such as anticipating feed. While Krueger (2006) found a correlation between chewing and head-lowering, there was no association with licking and those responses. Warren-Smith, Greetham and McGreevy (2007) reported that there was no relationship between licking-and-chewing with head-lowering. Goodwin (1999) proposed that head-lowering was not a submissive signal but one that solicits distance reduction and affiliation. Head-lowering and licking-and-chewing may also simply be a reflection of the physiological response to the presence of a potential predator (McGreevy, 2004) whereby the horse could be salivating after adrenaline release has caused a dry mouth, or simply moving its jaw after having it tightly clenched while being chased. In this instance, as the threat reduces (i.e. less chasing), then head-lowering and/or licking and chewing may indicate redistribution of saliva around the buccal mucosa.

According to round-pen training advocates, the moment the horse displays these signals, chasing by the trainer should cease. The trainer should then assume a passive stance, turn the body away from the horse and remove eye contact. This prompts the horse to reduce its speed and approach the handler (Roberts, 1996). This is fundamentally an application of negative reinforcement (Farmer-Dougan and Dougan, 1999; Miller, 2000; Waran, McGreevy and Casey, 2002). When repeated, a learned association develops between the response (horse slowing and showing the desired signals) and the termination of chasing (Price, 1999; Krueger, 2006). Essentially the horse learns that if it approaches the handler in the centre of the round-pen, then it avoids being chased. This phenomenon is often referred to as 'join-up' which is generally defined as occurring "*when the animal willingly chooses to be with the human and walks toward them accepting their leadership and protection*" (Roberts, 1996).

The outcomes of round-pen training are reported to include the trainer becoming dominant over the youngster and the youngster 'accepting' the trainer as its leader (Farmer-Dougan and Dougan, 1999; Waran et al. 2002). However, a number of questions arise from this, such as whether horses can really regard humans as conspecifics, let alone a higher-ranking one. Is a horse able to show 'respect' for its trainer (Ladewig, 2007)? Additionally, the benefits of chasing horses, especially in confined spaces, have been questioned (McLean, 2003) as it may only serve to enhance the flight response which, in the interest of safety, should be avoided in all animal handling (Gonyou, 1995).

Given that different training methods will have different influences on horses (Baragli et al. 2004), it is important to investigate the mechanisms that underpin them. So, the current study recorded the behavioral responses of mares and young horses in a round-pen, to determine if the explanations offered by round-pen trainers have an ethological basis.

Methodology

Two thoroughbred broodmares (age 12.0 ± 2.0 yrs) that were not in estrus at the time of testing and 6 unbroken colts (age 1.7 ± 0.3 yrs) of either thoroughbred or warmblood breeding were used. The horses were group-housed in paddocks (approximately 10 ha) at Fairview Equestrian Park, with mares in one group and colts in another group. They were maintained on pasture and supplemented with a concentrate feed (Mitavite Breeda; Mitavite Feeds, 3 Pile Rd Somersby, NSW, 2250, Australia) to meet National Research Council (1989) equine nutritional guidelines. All horses were handled on a daily basis for feeding and general health checks. The mares had not been in the round-pen for at least five years prior to testing. The youngstock had never been in the round-pen, or exposed to the round-pen training technique. The mares and colts were not related and had never

met prior to testing.

Procedure

Each mare was fitted with a webbing head collar (with a cotton lead rope attached to its underside) and led into the round-pen. While the mare was held 5 m in from the edge of the round-pen, facing the gate, one of the youngsters was brought into the round-pen by another handler and held at a position of 5 m away, facing the mare (Figure 1).

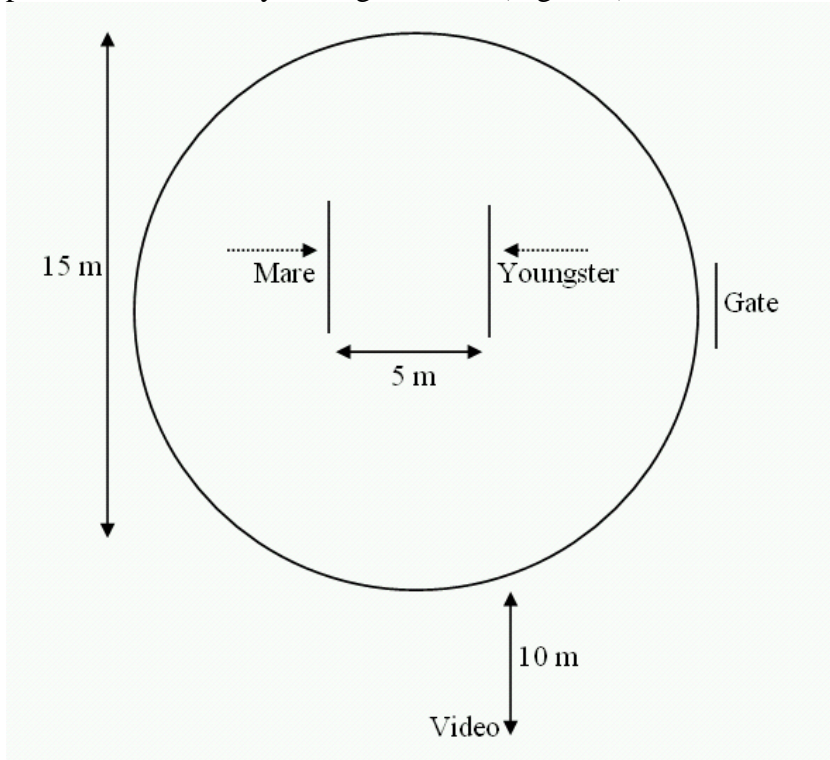


Figure 1: The placement of the mare and youngster in the round-yard prior to being released.

Both mare and youngster were then released, the handlers left the round-pen and all responses performed by the horses were recorded on video for an 8 min period. This procedure was then repeated with each of the mares and youngsters with a ten minute rest period between each test pair (Table 1).

Mare	Youngster
A	1
A	2
A	3
A	4
A	5
A	6
B	6
B	5
B	4
B	3
B	2

Table 1: The order of testing of the mare-young-horse dyads that were released and then observed in a round-pen for an 8 min period. A and B represent the mares, horses 1 – 6 represent the youngsters. There was a ten minute rest period between each pair.

The procedures used in these trials were normal handling procedures, the experimental protocol being approved under Protocol Number 07/035 (Animal Care and Ethics Committee, Charles Sturt University, Australia).

Measurements and data analysis

The frequencies of all behavioral responses exhibited by the horses were recorded on videotape (Panasonic, NV-M7A, Matsushita Electric Industrial Co. Japan) for subsequent analysis on a continuous observation basis. The video camera was placed on a viewing platform located 10 m away on the outside of the round-pen. The behavioral responses recorded were head-lowering (HL), licking-and-chewing (LC), snapping (tooth-clapping), sniffing, snorting, vocalizations and yawning as defined by Waring (2003). Bite threats and kick threats (McDonnell and Haviland, 1995) were also recorded as well as the distance (m) the horses spent apart and locomotory approaches made by mares or youngsters.

The differences in the number of responses between mares and youngsters were analyzed using multivariate analysis of variance (MANOVA). The frequency of all responses for each 1 min interval during each part of the trial were analyzed by residual maximum likelihood (REML) methods using Constant+Time+Response + Time.Response as the fixed model. All statistical calculations were performed using Genstat (Genstat 8th Edition, Lawes Agricultural Trust, Rothamsted Experimental Station).

Results

The duration of periods that the mare-young-horse dyads spent greater than 10 m apart did not change over time ($p = 0.423$; Figure 2). The time the horses spent less than 1 m apart was greatest in the first minute (2.8 s) and then decreased to a mean of 0.3 ± 0.1 s for the remaining time ($p < 0.001$; Figure 3). The mares and youngsters spent more time further than 10 m apart, than they did less than 1 m apart, per minute of testing (41.7 s and 0.6 s respectively; $p < 0.001$, 46 d.f.). Mares occupied the centre of the round-pen and chased youngsters (that were thus forced towards the perimeter) for only 0.73% of the test period ($p < 0.001$).

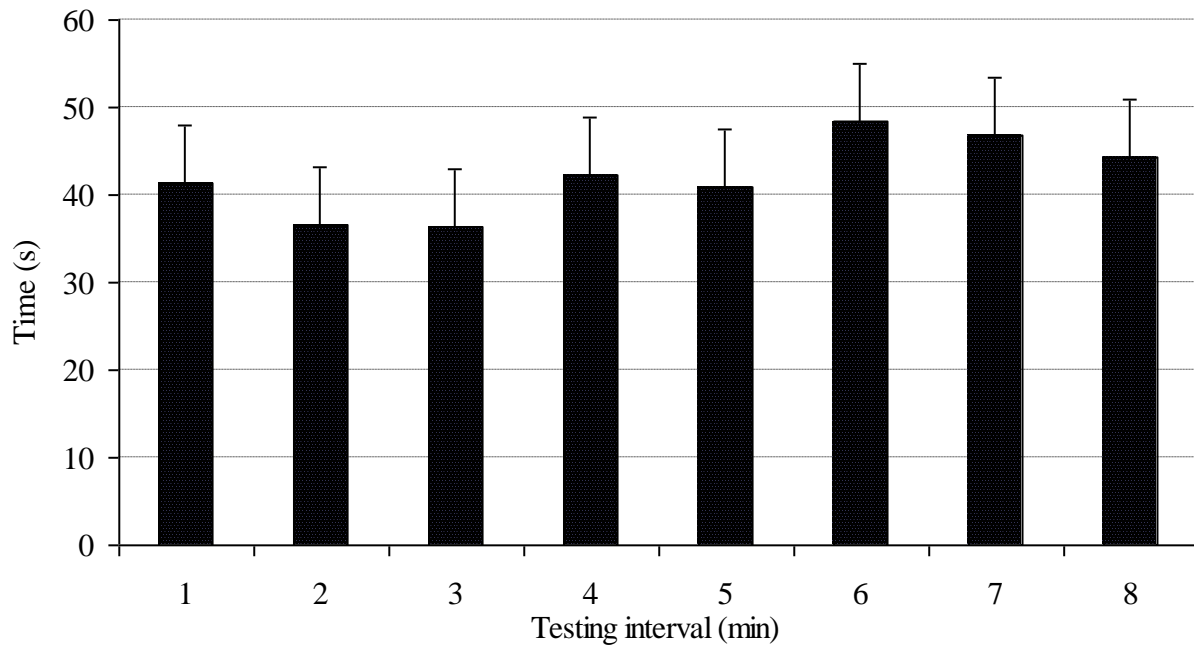


Figure 2: The time the mare and young-horse dyads spent being greater than 10 m apart in a round-yard during an 8 min period.

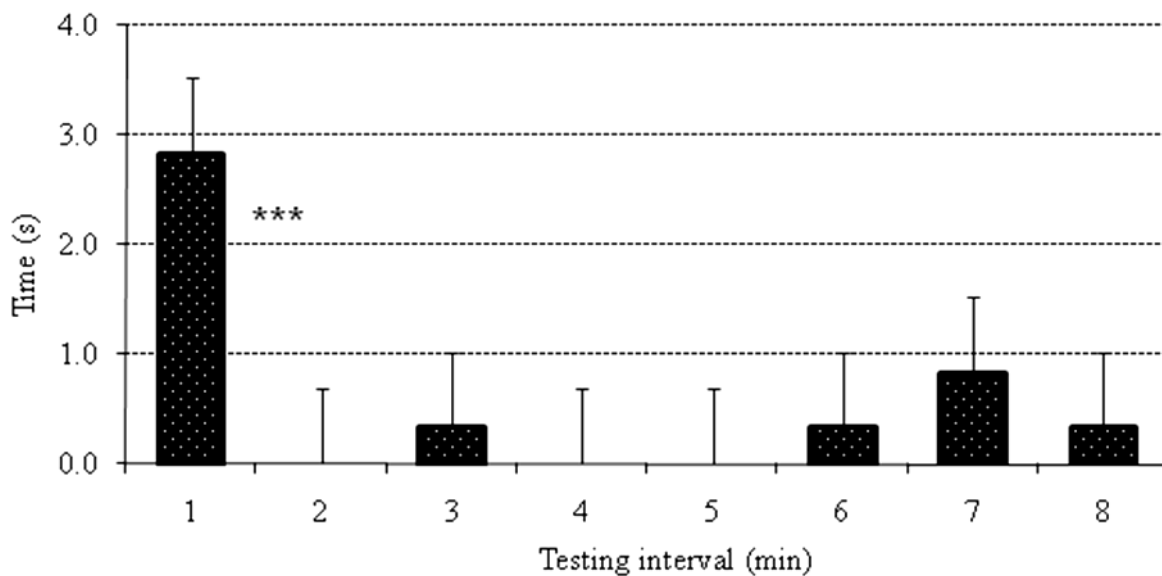


Figure 3: The time the mare and young-horse dyads spent being less than 1 m apart in a round-yard during an 8 min period. Points are significantly different where indicated *** ($p < 0.001$).

Upon initial release, the mares always (100%) immediately turned away from the youngsters whereas the youngsters turned away from the mares on 62.5% of the releases ($p < 0.001$). Neither mares nor youngsters showed a preference for turning away to the left or right. There was no difference between mares and youngsters in terms of which member of the dyad made the initial approach ($p = 0.141$). When youngsters made the initial approach, they did so within 10.4 s of being released whereas mares made the initial approach within 229.7 s of release ($p = 0.040$). Mares made the greatest total number of approaches compared with youngsters ($n=33$ to 3, respectively; $p < 0.001$) and made them mostly to either the rump or head of the test youngster rather than its side ($p = 0.010$). There was no difference between whether the approaches by either mares or youngsters were made at the walk or the trot ($p = 0.887$).

All agonistic approaches were made by the mares and all investigative approaches were made by the youngsters ($p < 0.018$). While the frequency of investigative approaches decreased over the testing time ($p = 0.027$), the frequency of agonistic approaches did not change ($p = 0.391$). Prior to agonistic approaches, youngsters were most likely to be standing at the fence, with their ears pointed forwards while looking away from the direction of the mare compared with looking in the direction of the mare ($p = 0.05$; Figure 4). Mares were most likely to be in locomotion before an agonistic interaction and least likely to be still ($n=37$ and 6 , respectively; $p = 0.018$; Figure 4). Mares were more likely to approach youngsters that had their heads held above wither height compared with when their head was lowered ($n=37$ and 2 , respectively; $p < 0.001$). When approaching a youngster, a mare's ears pointed backwards when she was within a mean of 4.3 ± 0.6 m of a youngster and this did not change over time ($p = 0.073$). On only 2 of 36 occasions did mares lower their heads when pointing their ears back toward youngsters ($p = 0.023$). The distance between the mares and youngsters immediately prior to agonistic interactions increased over time ($p = 0.004$).

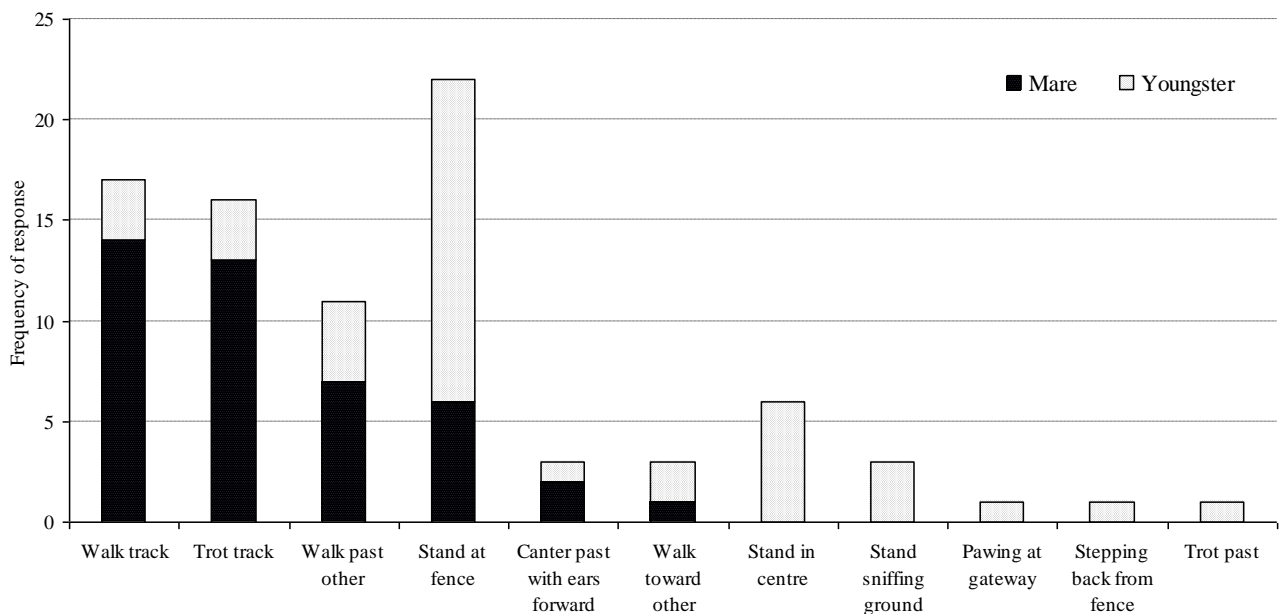


Figure 4: The frequency of responses exhibited prior to an agonistic interaction when mare and young-horse dyads were observed in a round-yard for an 8 min period.

Youngsters showed more HL than mares ($p = 0.002$; Figure 5). The frequency of HL did not change during the testing period ($p = 0.144$). Head-lowering was exhibited most when youngsters were facing away from mares compared with facing towards the mares (25.0 and 1.0 respectively; $p < 0.001$; Figure 6). Head-lowering was exhibited most while walking and least while trotting ($p < 0.010$; Figure 5). The distance between horses when exhibiting HL was least during minute 5 of testing ($p < 0.001$; Figure 7). HL was only exhibited once by a youngster after an agonistic interaction (Figure 8).

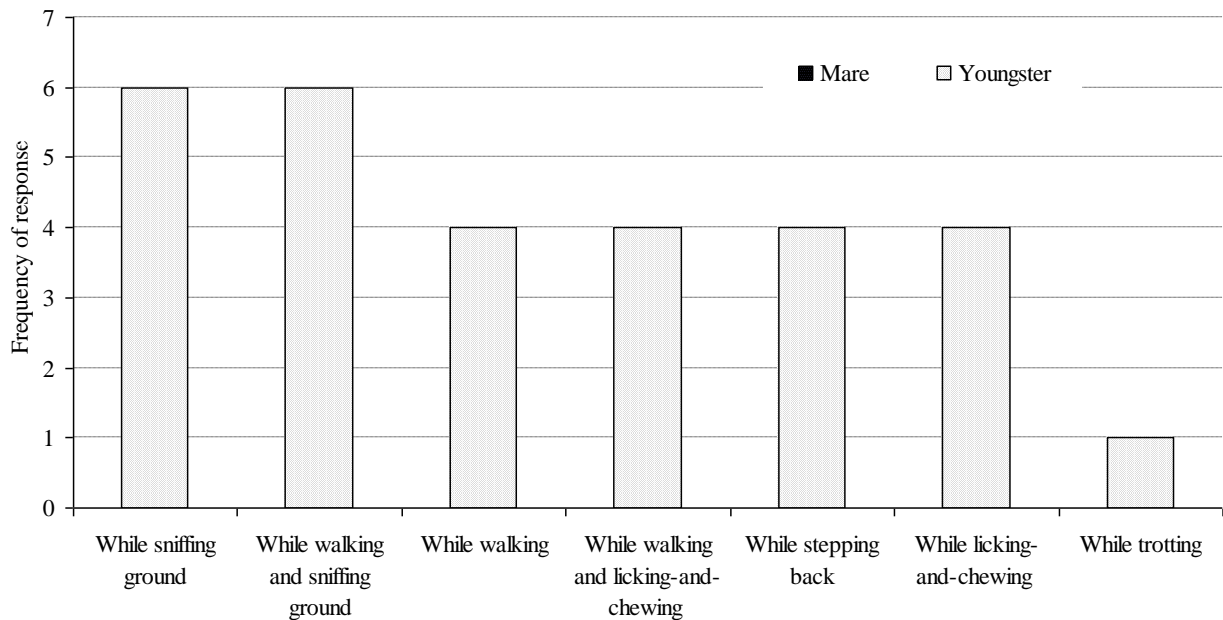


Figure 5: The frequency of head-lowering with other responses exhibited by mares and youngsters when mare and young-horse dyads were observed in a round-yard for an 8 min period.

Mares exhibited less LC than youngsters ($p < 0.001$; Figure 9). LC was not exhibited by youngsters prior to any of the agonistic approaches by mares and was only shown once after an agonistic interaction (Figure 9). The frequency of LC did not change over the testing time ($p = 0.423$) nor did the distance between mares and youngsters when LC was exhibited ($p = 0.375$). Licking-and-chewing mostly occurred when youngsters were looking away from the mares compared with looking towards mares (32 and 2 respectively; $p < 0.001$; Figure 5). Licking-and-chewing occurred mostly while the youngster was walking ($p = 0.026$) and least with head-lowering ($p = 0.020$; Figure 9). Of the total testing time, HL occupied 3.84% and LC 2.71%. Approximately 0.45% of HL was accompanied by simultaneous LC.

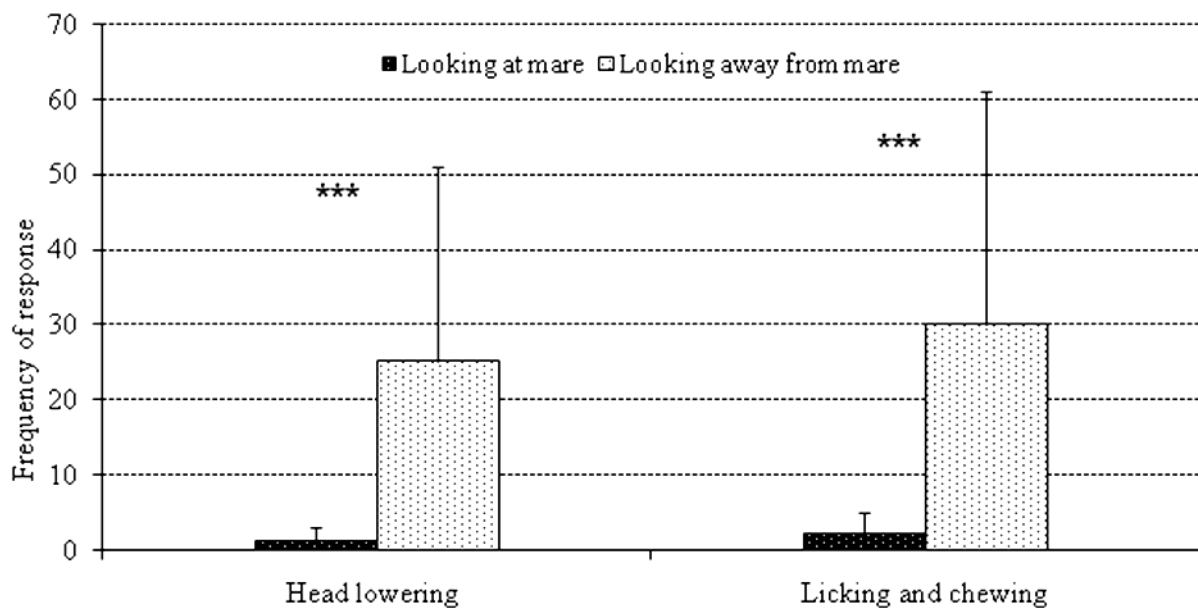


Figure 6: Head-lowering and licking-and-chewing were exhibited mostly when the youngster was facing away from the mare. Columns marked *** are significantly different ($p < 0.001$).

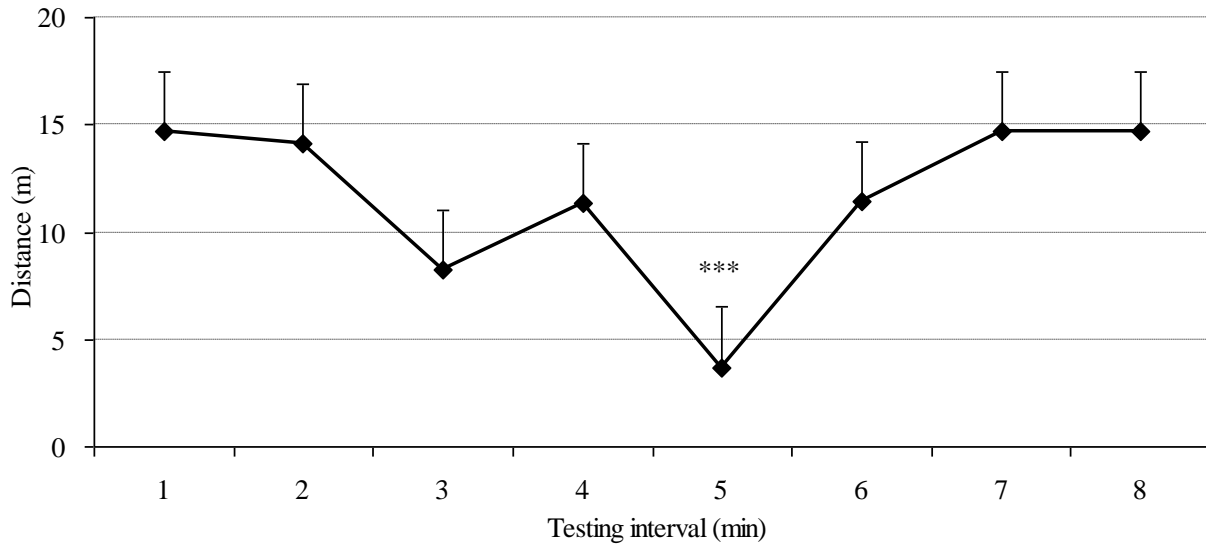


Figure 7: The distance between the mares and youngsters when head-lowering was exhibited when the dyads were released into a round-yard for an 8 min period. Points are significantly different where indicated *** ($p < 0.001$).

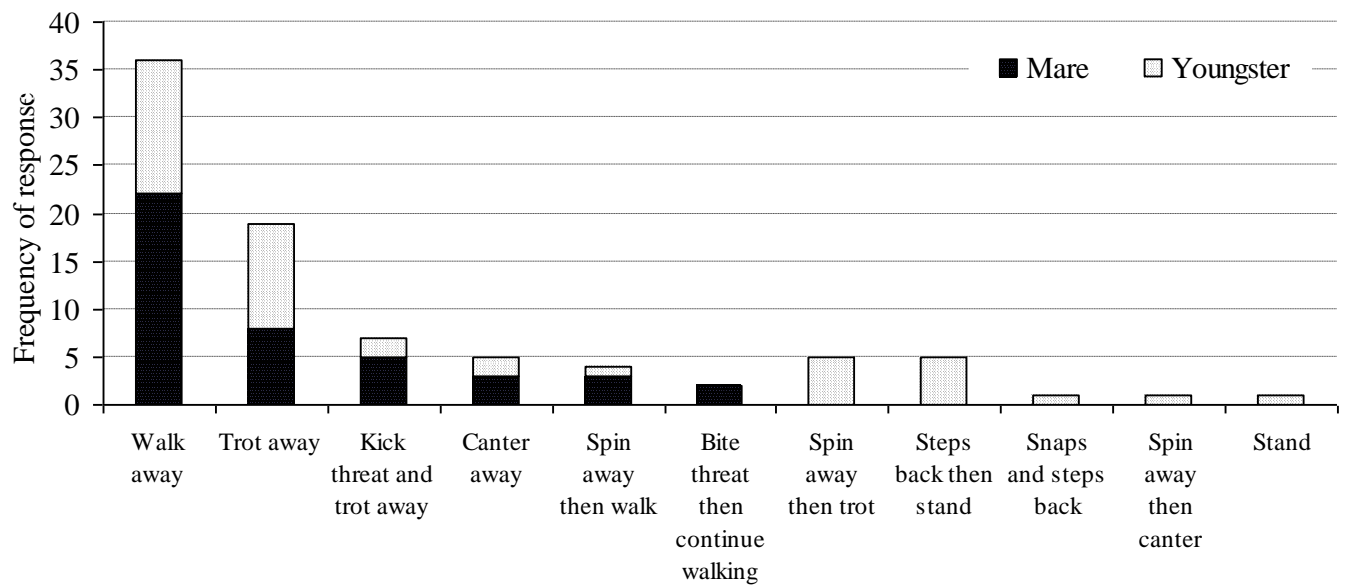


Figure 8: The frequency of responses exhibited after an agonistic interaction when mare and young-horse dyads were observed in a round-yard for an 8 min period.

Of the total occurrences of snapping ($n=6$), most occurred in the first minute ($n=4$; $p = 0.014$) after sniffing each other muzzle to muzzle. The distance between the mares and youngsters when snapping occurred did not change over time ($p = 0.333$). Both mares and youngsters exhibited threats after agonistic interactions ($p = 0.116$; Figure 8). Kick threats were exhibited more than bite threats ($n=9$ and 1 , respectively; $p = 0.018$; Figure 8). Youngsters were more likely to move away after an agonistic interaction ($p = 0.009$) and there was no difference in whether they moved forward (at the walk or trot) or stepped backwards ($p = 0.189$; Figure 9).

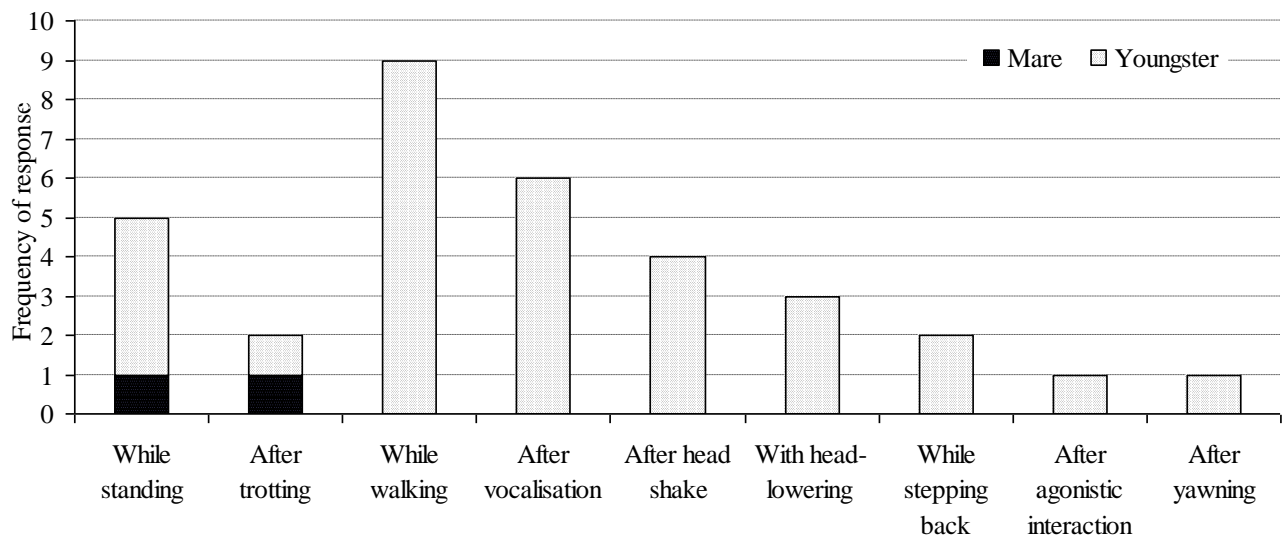


Figure 9: The frequency of licking-and-chewing with other responses exhibited by mares and youngsters when mare and young-horse dyads were observed in a round-yard for an 8 min period.

Discussion

Given that the members of the mare-young-horse dyads spent the majority of the testing time at opposite ends of the round-pen, it can be concluded that in the conditions employed in the current study, the mare-young-horse dyads did not seek closer proximity to each other, nor did the mare chase the youngster around the perimeter of the round-pen. While the behaviour of the youngsters could be interpreted as an attempt to seek social contact with the mares initially (i.e. during the first minute), they then made considerably fewer approaches toward the mares for the remainder of the period. If the youngsters were indeed seeking closer proximity to the mares, then the opposite should have occurred.

The general response pattern exhibited by the horses transiently paired in this trial was that, upon initial release, both turned and walked in opposite directions away from each other, with a youngster walking in the direction of the mare on only three occasions. In alignment with popular interpretations of round-pen training, all the investigative approaches were made by the youngsters that were also much quicker to make the initial approach. This suggests that the youngsters may have been seeking closer proximity with the mares. Given that the frequency of agonistic approaches remained constant throughout the testing time whereas the frequency of investigative approaches decreased, the emergence of a social bond that might be labeled 'join-up' seemed unlikely in the period studied. The mares' persistent agonistic interactions with youngsters appeared to reduce the frequency of these approaches. Furthermore, the distance between mares and youngsters immediately prior to agonistic interactions increased over time suggesting that, within this limited period, instead of accepting the youngsters, the mares were becoming sensitized to them. In this instance, it could be concluded that the mares' agonistic responses were an effective means of keeping the youngsters away from them.

It has been suggested that head-lowering and licking-and-chewing normally occur simultaneously, to indicate a horse's state of submission or signaling appeasement (Parelli, 1993; Miller, 1995c; Roberts, 1996). However, a number of outcomes from the current study serve to question this interpretation. Firstly, mares were less likely to approach youngsters that had their heads lowered. Secondly, the majority of head-lowering and licking-and-chewing occurred when the horses were facing away from each other. Even though horses have excellent peripheral vision (Harman, Moore, Hoskins and Keller, 1999), this is not the orientation one would predict during intentional

signaling. This suggests that both responses may be displacement activities performed by a horse confined with an aggressor. It could also support the view that neither are submissive signals as they are directed away from the aggressor. Thirdly, both head-lowering and licking-and-chewing occurred mostly whilst the youngsters were walking, whereas simultaneous head-lowering and licking-and-chewing occurred least of all; thus head-lowering and licking-and-chewing are not necessarily associated with each other. This result has also been reported by other researchers, including Houpt et al. (1978), Krueger (2006) and Warren-Smith et al. (2007). This suggests that the general interpretation of head-lowering and licking-and-chewing needs to be updated.

Head-lowering was exhibited least when the horses were in closest proximity, in minute five of testing. Lowering the head in close proximity to a mare that had been previously aggressive would be a risky strategy, as head-lowering to a potential predator (or aggressor) would be a poor survival strategy since it would increase the risk of being injured or killed. This may constitute further evidence that head-lowering is not a submissive signal (Goodwin, 2008; pers. comm.). After any interaction between the mares and youngsters, it was chiefly the youngsters that moved away, more frequently at the walk or trot than by stepping backwards. Of those recorded, the responses least likely to be performed after an agonistic interaction were head-lowering and licking-and-chewing, with only one occurrence of each; suggesting that these are not submissive signals. The low incidence of both head-lowering and licking-and-chewing after the agonistic interactions does not provide convincing evidence of their being useful as signs of submission.

The amount of time the horses spent in the position analogous with precipitating 'join-up' in inter-specific round-pen training (i.e. the mare in the centre of the round-pen, chasing the youngster around the perimeter) was very low. Both mares and youngsters engaged in locomotion during the testing period, so it is possible that the occurrence of their being in this particular position was due to chance. This is highlighted by its infrequency ($n = 1$) and brevity (35 s). Had the dyads been in the join-up position for longer, then an interpretation of intentional social bonding would have been more plausible.

Roberts (1996) proposed that grooming by the trainer increases the likelihood of horses following the trainer. However, allogrooming of horses by handlers did not have an effect on following behaviors in the study by Krueger (2006). At no point during the current trial did any mutual grooming take place between the dyads. Given that the dyads did not progress beyond the avoidance phase of interactions, mutual grooming would be unlikely in these circumstances.

Round-pen practitioners often assert that they are providing analogues of horse-horse interactions and that 'join-up' is achieved 'within just a few minutes' (Roberts, 1996; Miller, 2000). The current results suggest that active training on the part of handlers is more important than simple communication in round-pen training and that more emphasis should be placed on negative reinforcement in future examinations of the mechanisms that operate during round-pen training. Eight minutes of observation per mare-young-horse dyad may be less than some round-pen training sessions. However, repeatedly Roberts (1996) states that the phenomenon he dubbed 'join-up' should occur relatively quickly when applied in the round-pen. On a number of notations, the delay before this occurs is expressed in revolutions of a 50 foot (15.24 m) round-pen, with so-called 'good responses' occurring after 3 - 12 revolutions (Roberts, 1996). If the horse was trotting, it would be traveling at approximately 4 meters per second (ms^{-1} ; Evans, 2000). Given that the diameter of the round-pen was 15.24 m, then the distance of one revolution would be approximately 50 m. So, a horse travelling at 4 ms^{-1} in a 15 m round-pen would complete one revolution in approximately 12.5 s. Thus the time taken for 3 - 12 revolutions would be approximately 37.5 - 150 s. This periodicity aligns with the 'few minutes' cited as the latency for youngsters to seek social proximity with the trainer (Roberts, 1996), and is certainly less than 8 minutes.

The study presented herein provides evidence that the popular round-pen training method is not based on the behavioural interactions of unfamiliar senior and young horses. A deeper study of Natural Horsemanship training methods using tools of behaviour analysis may reveal important new information for behaviourists and equestrians (Farmer-Dougan and Dougan, 1999). In that vein, the mare-young-horse interactions reported here provide a useful baseline for the ethological interpretation of interactions commonly seen when humans train horses using this method.

Conclusions

The current study has shown that eight minutes is insufficient time for social bonding between mare–colt dyads in a round-pen. When mares and young colts were left alone in a round-pen, the mare was not likely to chase the youngster towards the perimeter of the pen. Simultaneous head-lowering and licking-and-chewing occurred very rarely. If head-lowering and licking-and-chewing are intra-specific signals, in this trial they were delivered predominantly when the most likely recipient was facing away. The ethological relevance of these responses in round-pen training may have been overstated at the expense of an appropriate consideration of negative reinforcement.

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