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Horse's emotional state and rider safety during grooming practices, a field study

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Abstract

Care given to animals, such as grooming for horses, can be a source of well-being when carried out correctly. However, it can cause discomfort when badly perceived lead to potentially dangerous reactions. This study aimed to describe how grooming is conducted in the field, in terms of the horse's emotional state and also rider safety. Our observations carried out on 69 horses in riding centres and sports stables show that grooming produces more negative than positive emotions. Indeed, only 5% of horses showed mutual grooming, approach or relaxed behaviour, whereas four times more horses expressed avoidance and threatening behaviours. These results have consequences for handler safety. Regarding threatening behaviours, nine incidents (a hoof or teeth passing within 10cm of the rider's body or head) were recorded. Concerning riders, 100% behaved in a risky way at least once: passing behind or under the head of the horse without keeping it in the field of view (97%) or squatting by its feet (42%). On average, riders carried out 6.7 $\pm$ 0.49 dangerous behaviours per session, and sometimes up to 19. Moreover, only 7% of them wore a hard hat when preparing their horse, while the risk of concussion is just as high on foot as in the saddle. Finally, 88% of them showed posture which was risky for their backs when picking out hooves. Surprisingly, riders' experience had no effect on the parameters recorded. In particular, horse professionals were just as exposed to risky situations, did not protect their backs, and their horses showed similar levels of defensive behaviours or signs of discomfort as the less experienced riders ($p>0.05$). This result is undoubtedly linked to the lack of importance granted to this practice and little teaching about reading horse signals indicating comfort and discomfort. We hope that our results will make riders aware of how important grooming is for the horse's welfare as much as for their own health and safety.

Key words

Equus caballus, welfare, emotion, accidents, riding activity

Highlights

- Grooming should constitute a source of well-being for the horse.
- However, in the field (n=69) grooming was observed to be a source of discomfort.
- Numerous dangerous behaviours were observed, from the rider as well as the horse.
- Riders do not improve their practice with experience.
- This study aims to raise awareness of the importance of good grooming practices.

1. Introduction

Grooming is a basic practice, but generally little training is provided for this. Yet, it can impact both the horse's welfare and the rider's health and safety.

Regarding the welfare, since grooming is often repeated daily throughout the life of many horses (20-30 years) it can have a cumulative effect. This can result in a long-term incidence on the horse's welfare and its relationship with humans. Welfare can be defined as an individual's subjective perception of its physical and mental state regarding how it copes with its environment (Broom, 1998). It can also be viewed in terms of affective states and their balance over time (Ahloy-Dallaire et al., 2018). Thus, improving welfare not only involves reducing negative affective states, but also fostering positive states (Boissy et al., 2007; Fraser, 2009; Mellor and Beausoleil, 2015). To induce positive emotional states in animals is difficult and few methods to achieve this have been described in the literature. However, tactile contact through grooming has been reported to be successful in different species (Nielsen, 2018), including horses (Feh and De Mazières, 1993; McBride et al., 2004; Schmied et al., 2008; Reefmann et al., 2009). When grooming is appreciated by the horse and regularly repeated, it can improve general welfare and lead to physiological changes such as changes in basal levels of blood oxytocin (Lansade et al., 2018). However, if badly perceived by the animal, grooming can result in negative emotions (Lansade et al., 2018). One way of determining how an animal perceives grooming is by observing approach and avoidance behaviours. These behaviours are indicators of positive and negative emotional valence respectively (Mendl et al., 2010; Corr, 2013). To date, no study investigating horses' perception of grooming in the field has been conducted. This information could play and important role in improving horse welfare.

Regarding the rider's safety, how grooming is perceived can also have an impact. In particularly, if the horse perceives grooming negatively it can gradually develop reactions and defensive behaviours which in the long-term make it dangerous to handle (review: Hall et al., 2018). A study showed that 70% of accidents with horses result from the horse's behaviour (Silver and Parry, 1991). Handling a horse on foot can be as dangerous as riding it. A quarter of accidents involving horses that require hospital treatment take place while the rider is on foot (Giebel et al., 1993). Furthermore, against all odds, when on foot children had significantly more severe injuries and were also twice as likely to require intensive care or surgery, and were eight times more likely to sustain a severe head injury than when riding (Wolyncewicz et al., 2018). In a study conducted on 284 patients who were victims of an accident involving a horse, three deaths were recorded (Carmichael et al., 2014). All of these happened while the rider was on foot (being knocked over, or kicked in the head or chest). To prevent tragedies and for riding to remain a pleasure, care should be taken when interacting with horses, during grooming especially.

Although not involving accidents, when incorrect gestures are performed repeatedly while preparing a horse there can also be long-term consequences for the rider's back. A causal link has been highlighted between back pain (concerning 75% of professional riders) and activities around horses including grooming, whereas no link has been established with riding itself (Biau et al., 2016). This back pain often becomes chronic in professional riders and can affect the length of their career (prevalence in this population: 9% of chronic neck pain, 13% of chronic thoracic spine pain and 23% of chronic low back pain). To avoid this pain, recommendations include avoiding a risky

posture when carry a load (such as picking out hooves) by bending the knees when your back is inclined forward at an angle greater than 30 degrees. In this way the back can be kept straight, respecting the natural curve of the spine. However, we do not know whether riders apply this recommendation in the field.

The present study aimed to assess grooming as carried out in the field to: 1) analyse the emotional perception of horses through observing approach and avoidance behaviours, 2) quantify rider and horse behaviours or postures that could be at the root of accidents and back pain, 3)determine whether riders improve their practice with experience. The effect of horse's gender and breed was also tested.

2. Material and Methods

2.1 Subjects

The study investigated 69 rider-horse pairs in 12 different riding establishments in France. There were 12 mares and 57 geldings (46 horses and 23 ponies). They were divided into groups according to the rider's experience: beginners in a riding school (n=18); intermediate to advanced riders in a riding school (n=25); horse owners with an advanced level (n=9); horse professionals (n=17). The beginners were people who rode horses once a week in a riding school, and had a low level of riding (the French riding qualification "*Gallop 1 to 3*"). The intermediate to advanced riders rode horses once or twice a week in a riding school and had an intermediate to advanced riding level (the French riding qualification "*Gallop 4 to 7*"). The horse owners had their own horse and all of them had an advanced riding level of (the

French riding qualification "*Gallop 7*"), they rode their horse several times a week. Horse professionals could be either professional riders, or professional grooms who worked with different horses every day. The pairs were independent of each other. The mean ages of horses and riders were 11.7±0.67 years and 24.31±1.75 years (mean ±sem), respectively.

2.2 Video recording protocol

On arriving at a riding establishment which had previously been contacted, we asked riders who were getting ready to ride if they agreed to be filmed while they groomed their horse (brushing and picking out hooves). Each grooming session was filmed in its entirety using a digital video camera recorder (DCR-SR21E, Sony) on a tripod at a distance of 3.5m (horses were filmed in profile).

2.3 Behavioural observations

The behaviours or postures of each horse and rider were recorded by the same observer from the video footages of the whole grooming sessions (mean±sem duration: 11min40 ±0.47).

2.3.1 Horse behaviours

The horse behavioural repertoire consisted of two behavioural categories: avoidance behaviours and approach/relaxed behaviours (Table 1). These behaviours were recorded continuously during the whole session, as described in Lansade et al. (2018). When a behaviour lasted more than three seconds without interruption, the observer noted its occurrence every three seconds.

2.3.2 Handler safety

The observer recorded the number of dangerous behaviours for each rider continuously: passing just behind the horse or under its neck without having the horse in their field of view, squatting beside the horse's foot, kneeling on one knee next to the horse's foot. We also recorded the number of times a potentially dangerous incident was narrowly avoided when a horse showed threatening behaviour, that is to say when the horse's hoof or teeth came within 10cm of the rider's body or head. For the ergonomic data, by using freeze frames during hoof picking we record whether the rider took a risky position for their back: bending over more than 30 degrees without bending their knees. Finally, we also recorded whether the rider was wearing a hardhat or protective jacket.

2.4 Statistical Analyses

For the horse behaviours, many individuals had zero values (between 97% and 78% zero values according to the variable). Thus, we transformed the continuous data into binary data (expressed / did not express this behaviour). We compared the number of horses which expressed one of the behaviours mentioned above at least once between the categories of behaviours (approach/relaxed attitude vs avoidance) using Z tests. The proportion of horses which expressed these behaviours were also compared between gender and category of breeds (ponies vs horses) using Z tests and between groups of riders using the Monte Carlo method to compare multiple proportions followed by a Marascuilo Procedure for post hoc tests. For handler safety, the data were analysed in the same manner (expressed / did not express), but also as continuous data and compared between groups using

Kruskal-Wallis tests (except for the number of riders kneeling, since they were 96% of zero values). The statistical analyses were performed with XLStat software (Addinsoft Software, Paris, France). The significance threshold was set at 0.05.

2.5 Ethic statement

The authors read the policy relating to animal ethics and confirm that their study complied. We only observed the horses during grooming in a field condition, and the animals underwent no specific experimental procedures for this research.

3. Results

3.1 Horse behaviours

There were four times more horses which expressed avoidance rather than approach/relaxed behaviours during grooming (avoidance: 15/69, approach/relaxed: 4/69, Z test for proportion z=-2.54; P=0.01). This indicates that only 5.7% of horses expressed approach/relaxed behaviours. Looking in detail at the avoidance behaviours, 12 horses were observed carrying out threatening behaviour, three moved away and two contracted their belly or back (some horses combined several behaviours). For approach/relaxed behaviours, two horses attempted to nibble the handler, two encouraged contacts and one showed a relaxed attitude. Some horses expressed avoidance behaviours up to 16 times during a single grooming session, compared to only a maximum of five times for approach/relaxed behaviours.

Gender had no effect on the number of horses expressing avoidance or approach/relaxed behaviours (avoidance: 4/12 mares vs 11/57 geldings, Z test for proportion z=0.62; P=0.54; approach/relaxed: 1/12 mares vs 3/57 geldings z=0; P=1). There were no differences between the horse and pony categories (avoidance: 5/23 ponies vs 10/46 horses, Z test for proportion z=0; P=1 approach/relaxed: 1/23 ponies vs 3/46 horses, z=0; P=1).

3.2 Handler safety

All the riders showed a behaviour considered to be dangerous at least once: 97% passed just behind the horse or under the neck without having the animal in their field of view, 42% squatted down beside the horse's foot and 4% knelt near the horse's foot. The riders carried out 6.7±0.49 (mean ±sem) dangerous behaviours in one session and this figure could be as high as 19. Regarding the threatening behaviours of horses, nine potentially dangerous incidents were observed (teeth or hoof passing within 10cm of the rider's body or head). Regarding risky postures for the back during hoof picking, 88% of riders demonstrated this. Finally, 7% of riders wore a hardhat to prepare their horse (three children in a riding centre and two horse professionals) and no one wore a protective jacket.

3.3 Experienced rider effect

Among the variables presented above, only two differed significantly according to the rider's experience. The other, including the length of the session, never differed significantly between groups (p>0.05).

236 Regarding horse behaviours, only the percentage of horses displaying
237 "encouraging contact" differed significantly between groups (Chi2=13.9;
238 p=0.01): this was only observed in privately-owed horses (Fig. 1). However,
239 given the fact that this behaviour was expressed at a very low level (two out of
240 the nine privately-owned horses, and none in the other categories) extreme
241 caution should be taken in interpreting this difference.

242 Regarding handler safety, the "percentage of riders squatting beside the
243 horse's foot" differed between groups (Fig. 2). Fewer beginner riders than
244 intermediate to advanced riders squatted (Chi2 = 8.09; p=0.04). No other
245 percentage of riders differed between groups. The Kruskal Wallis tests on the
246 number of dangerous behaviours carried out per rider gave no significant
247 difference between groups for any variable.

248

249 **Discussion**

250 This study highlights that in the sport stables and riding schools that we
251 visited, only 5% of the horses observed expressed mutual grooming, approach
252 or relaxed behaviour, whereas avoidance and threatening behaviours were
253 expressed by four times more horses. When considering the former as
254 indicators of positive emotional valence and the latter as indicators of
255 negative emotional valence (Feh and De Mazières, 1993; Mendl et al., 2010), it
256 can be concluded that in the field grooming induces less positive than negative
257 emotional states. These results are not linked to a bias in the observation
258 method because in a previous study using the same method, we observed that
259 100% of the horses expressed an approach response during gentle grooming
260 which was adapted to the horse's reactions (Lansade et al., 2018). Our results
261 also showed that the proportion of horses that expressed avoidance or

approach behaviours were independent of their gender or breed. This could suggest that these behaviours were less due to the horses' characteristics, than to the way they were groomed.

These results are far from insignificant for the horse or for the rider. For the horse, the fact that grooming sessions can be repeated daily throughout its whole life (20-30 years) could have a cumulative effect which when negatively perceived would be deleterious to its welfare (Boissy et al., 2007). Indeed, as little as two weeks of daily grooming has been reported to modify a horse's physiology, with a change in basal blood oxytocin level (Lansade et al. 2018). It has also been shown that the way a horse perceives handling sessions can have a long-term impact on its relationship with humans and how it perceives and reacts to subsequent situations involving people (Sankey et al., 2010; Lansade et al., 2018).

Concerning rider safety the way a horse perceives humans can influenced the level of risk during handling (Hall et al., 2018), and this is supported by our results. Indeed, regarding the threatening behaviours demonstrated by the horses, nine potentially dangerous incidents were observed (teeth or a hoof passing within 10cm of the rider's body or head). The riders often did not see what had happened, because the horse was not in their field of vision when the incident occurred. Fortunately, the incidents observed in our study did not lead to injury. However, when these data are compared with the rate and severity of accidents with riders on foot, which are much higher than for riders in the saddle, it can be seen that it is not always the case (Wolyncewicz et al., 2018). These results are also in line with research that has shown that 70% of accidents would be linked to horses' reactions (Silver and Parry, 1991).

In addition to horses' potentially dangerous reactions, this study also showed that 100% of riders demonstrated behaviours considered as risky, such as squatting beside the horse's foot. Moreover, only 7% of riders wore a hardhat when preparing their horse and none of them wore a safety jacket, while the risk of concussion is at least as high on foot as in the saddle (Wolyncewicz et al., 2018). Finally, 88% of riders demonstrated a risky posture for their back when picking out hooves. This could explain why riders' back problems are linked more to grooming than to riding (Biau et al., 2016). These figures underline that grooming practised in the field can cause discomfort for the horse, and is also a potential source of back problems and accidents for riders.

Surprisingly, almost none of the parameters considered in this study differed between the levels of rider experience. In particular, the horse professionals demonstrated just as many potentially dangerous behaviours and took no more care of their backs, and their horses showed no fewer defensive behaviours or signs of discomfort than the less experienced riders. This is in line with studies that have shown that horse professionals are as or more at risk of accidents than amateurs (Hausberger et al., 2008). This result is probably linked to the lack of importance given to grooming and learning to groom. However, a limitation of this comparison should be noted due to the relative low number of subjects in the "owners" group (n=9).

Nevertheless, it would be relatively simple to improve grooming practices to induce positive behaviours. In Feh and de Mazières' study (1993) many positive behaviours were induced when the horse was massaged in its preferred zones. To find the horse's preferred zones it is simply a question of being attentive to approach and avoidance behaviours and also facial expressions which constitute a particularly sensitive way to detect the horse's emotional state (Hintze et al., 2016; Lansade et al., 2018). An eyebrow that is

raised, low neck carriage, eyes half closed and lips extended are signs of positive emotional state during grooming, and should encourage the handler to continue brushing that area. By contrast, a raised neck, eyes wide open and even slight tensing of the corner of the mouth indicate a negative emotional state and should lead the person to change their way of brushing. Even worse, a grimace of pain, as describe by Dalla Costa (2014) should also alert the handler.

Improving grooming practices could have numerous benefits on welfare and rider safety as discussed above, but also on the efficiency of the riding session that generally follows the grooming. Indeed, there is a huge amount of literature reporting the effects of emotions on learning abilities (example in horses: Christensen et al., 2012; Valenchon et al., 2017; Fortin et al., 2018; Hall et al., 2018). Thus, it is highly probable that the emotions induced during grooming could impact the subsequent training session, either by increasing or decreasing its effectiveness.

In conclusion, this study shows that in general riders pay little attention to their horse's threats and signs of discomfort, and thus sometimes put themselves in danger during grooming. Yet, it would be easy to enhance this practice to improve the horse's welfare and rider safety simply by observing the horse's behaviour and facial expressions and adapting the brushstrokes accordingly. Regarding the number and severity of accidents on foot linked to horses and the high prevalence of back pain, raising riders' awareness to grooming best practices in the field seems essential.

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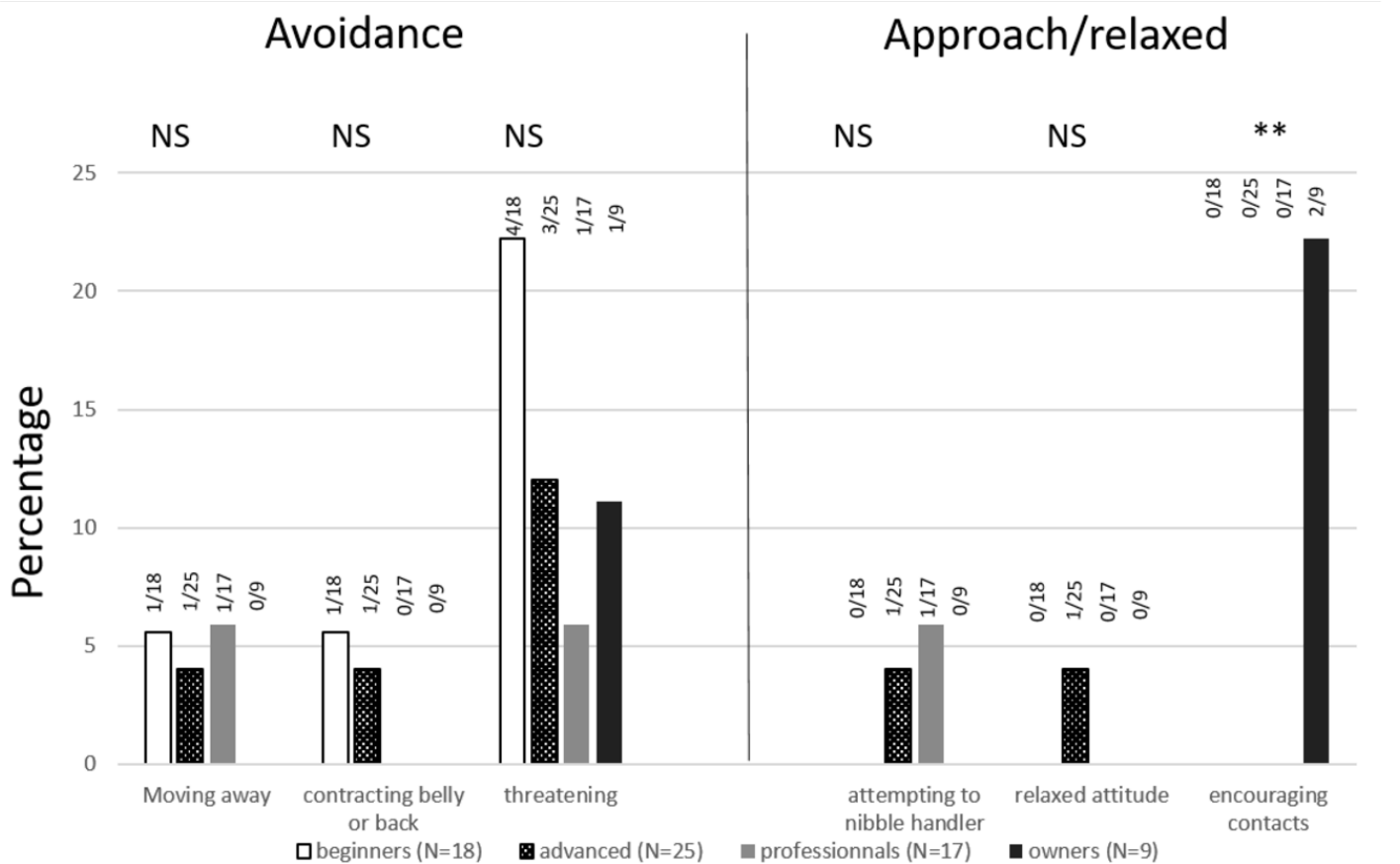
446 **Figure captions**

447 Figure 1. Percentage of horses expressing avoidance or approach/relaxed
448 behaviours according to rider experience
449 NS: Non-significant, **: $p<0.001$, the different letters indicate significant
450 differences between groups (Comparison of multiple proportions test, Monte
451 Carlo method followed by a Marascuilo procedure for post hoc tests)
452

453 Figure 2. Percentage of riders expressing dangerous behaviour according to
454 experience
455 NS: Non-significant, *: $p<0.05$, different letters indicate significant differences
456 between groups (Comparison of multiple proportions test, Monte Carlo
457 method followed by a Marascuilo procedure for post hoc tests)
458


Avoidance
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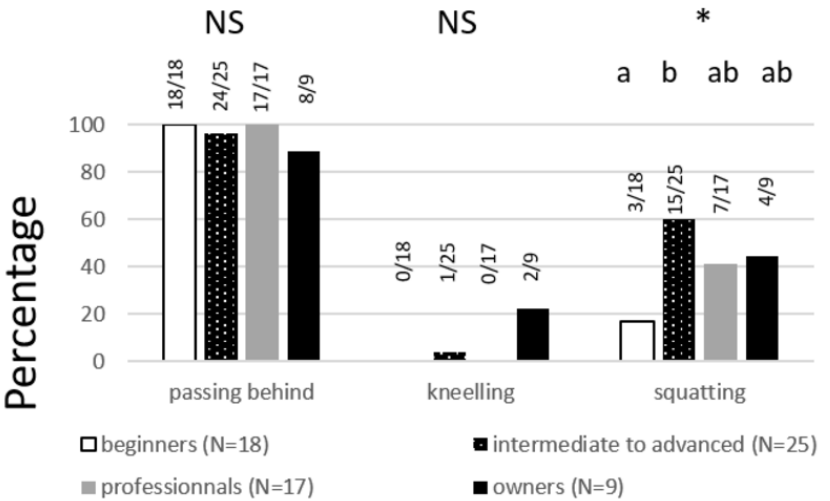
Moving away
contracting belly or back
threatening
attempting to nibble handler
relaxed attitude
encouraging contacts
beginners (N=18)
advanced (N=25)
professionnals (N=17)
owners (N=9)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kneelling
squatting
beginners (N=18)
intermediate to advanced (N=25)
professionnals (N=17)
owners (N=9)

Avoidance behaviours	
Moving away	Horse moves in the opposite direction to the handler's action
Contracting belly or back	Horse contracts its belly or back suddenly after a brush stroke
Threatening	Horse's ears are pinned back and a hind leg is lifted in the direction of the handler/Horse's ears are pinned back and lips are pulled back bearing the teeth in the handler's direction, the horse tries to bite the air or the leading rein
Approach and relaxed behaviours	
Encouraging contacts	Horse seeks contact with the handler with its head, without signs of threatening or biting / Horse moves part of its body to lean or rub against the handler, sometimes with a backward and forward movement
Relaxed attitude	Eyes half-closed, lower lip lose
Attempting to nibble handler	Horse's upper lip is extended and mobile, horse nibbles the handler or any other element in front of it (wall, leading rein, etc.)

Table 1. Behavioural parameters recorded during grooming