



Conflict behaviour in Icelandic horses during elite competition

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ABSTRACT

Sport horse welfare is currently under scrutiny. Among other issues, it has been pointed out that behavioural signs of discomfort are frequently overlooked during training and competitions. Previous studies reported a relatively high prevalence of these types of behaviour (e.g., tail swishing, mouth opening – typically jointly labelled ‘conflict behaviour’) in elite level dressage and show jumping warmblood horses. This study aimed to investigate the prevalence of conflict behaviour in Icelandic horses competing at elite level in breed-specific gait competitions. We used online video recordings from a competition in Iceland, including two different competitions (MD22, Fivegait F1: $n = 25$, and Loose-rein Tölt T2: $n = 24$ participating horses). The recordings were viewed at slow speed ($\times 0.25$) enabling a detailed recording of the horses’ behavioural expressions. Mouth opening was the most frequently observed behaviour and occurred more in pace and tölt (Fivegait F1, $P < 0.001$). In T2, mouth opening was more frequent in short-rein tölt than during loose-rein tölt ($P < 0.001$). Sudden head movements, tail swishing and undesired gait changes also occurred, but less frequently. An elongated upper lip was observed in 12 of the 24 participating horses in T2, but only in short-rein tölt, suggesting that upper lip elongation is related to rein tension. We conclude that mouth movements (mouth opening and an elongated upper lip) are common behavioural expressions in Icelandic horses competing at elite level. Further studies are required to reveal the significance of these behaviours in terms of horse welfare.

1. Introduction

Sports horse welfare is currently under scrutiny. Public concern following incidences such as the pentathlon case at the 2021 Olympic Games, where a distressed horse was punished by a rider and trainer, and media coverage of horses showing signs of discomfort and pain, have led sports horse organisations to revisit their guidelines for the use of horses in sports (e.g., [Fédération Équestre Internationale, 2022](#)). A recent report by the Danish Animal Ethics Council reviewed the current literature on sport horse welfare and concluded that immediate action should be taken by horse sport organisations to ensure horse welfare ([Danish Animal Ethics Council, 2023](#)). Recommendations include restrictions on equipment that force horses into a specific position or that may mask conflict behaviour (such as draw reins, or tight nosebands; [Doherty et al., 2017a](#)); training of riders, trainers and judges to improve recognition of conflict behaviour, and a change of judgement criteria to include absence of conflict behaviour (i.e., deduction of scores for exercises where a horse displays any type of conflict behaviour, which is not currently the case; [Hamilton et al., 2022](#)). The council recommends

that if appropriate action is not taken within 1 year (as of March 2023), political action in terms of stricter legislation for the use of horses in sports should be implemented ([Danish Animal Ethics Council, 2023](#)).

Conflict behaviour is often used as a joint term to describe various types of horse behaviour that may result from frustration, e.g., from conflicting or unclear cues from the rider, discomfort or pain. In the ridden horse, behaviours can include opening of the mouth, tail swishing, shaking of the head and evasive behaviour such as a sudden change of direction or gait, bucking, rearing, etc. ([von Borstel et al., 2009](#); [König von Borstel and Glißmann, 2014](#); [Górecka-Bruzda et al., 2015](#); [Christensen et al., 2021](#); [Hamilton et al., 2022](#)). Horses are most frequently trained via negative reinforcement and appropriate training relies on the rider’s ability to release pressure in response to desired behaviour, and to avoid the use of imposing cues, such as leg pressure and rein tension. Unfortunately, if a horse fails to respond with the desired response, riders may adopt other types of equipment that are designed to inflict more discomfort. A recent study found associations between commonly used equipment (e.g., harsh bits and spurs) and behaviours indicative of conflict ([Condon et al., 2022](#)). In a study on 75 horse-rider combinations

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(up to elementary level, British Dressage), conflict behaviours were observed in 97.6% of the movements analysed, with horses displaying two or more conflict behaviours in 83% of the movements (Hamilton et al., 2022). At elite level, the prevalence of conflict behaviour is also surprisingly high; dressage and show jumping horses displayed on average 19 and 14 conflict behaviours/min, respectively, during elite competition (Górecka-Bruzda et al., 2015). There is currently a lack of knowledge on the prevalence of conflict behaviour in many other horse sports disciplines, such as breed-specific gait competitions which are common for e.g. Icelandic horses.

Icelandic horses are common across Scandinavia and sizable populations also exist in other European countries as well as in North America. The horses stand at 132–142 cm at the withers and weigh 330–380 kg. Despite their small size, Icelandic horses are considered hardy and able to carry adult riders (Gunnarsson et al., 2017; Stefánsdóttir et al., 2017). The breed is well-known for its ability to perform the lateral four-beat gait tölt as well as pace, which are two additional gaits that are genetically determined (Andersson et al., 2012). Icelandic horses are typically competed in breed-specific gait competitions as described by Albertsdóttir et al. (2007). Competitions take place on an oval-shaped 250 m track where the rider requests the horse to show the various gaits, sometimes at a very high speed. Judges are placed in the middle of the ring where they observe and score the quality of the gaits. Due to the speed of movement and the distance between judges and the horse, subtle conflict behaviour is easily overlooked.

This study aimed to investigate the prevalence of conflict behaviour in Icelandic horses competing at elite level. In addition to previously described conflict behaviour, we also observed for other types of behaviour that may be shown by this horse breed during movements and exercises used in the breed-specific gait competitions. We hypothesized that similar to other competition horses, Icelandic horses show various types of conflict behaviours and that the display of some gaits will be more demanding and potentially lead to an increased frequency of conflict behaviour.

2. Materials and methods

The study was based on recordings of a national competition in Iceland (MD22 via www.alendis.is). Since the study only included online recordings available to all from an event that had already taken place, no specific animal experimental or ethical permission was required according to national legislation. The study included the disciplines Fivegait F1 and Tölt T2. In both competitions, the riders competed on an indoor 250 m oval track as standard for the breed-specific competitions. Tölt T2 consists of three tasks: free speed tölt, i.e. the rider can choose the tempo, slow tölt with rein contact and tölt at slow to medium speed without rein contact, i.e. the reins must hang completely loose. In Fivegait F1, the rider can choose the order in which they show the various gaits, but each gait must be shown according to a set of rules; Walk: one long side of the oval track, tempo must be medium speed; Trot: One round, tempo must be slow to medium speed; Tölt: One round, tempo is chosen by the rider; Gallop: One round, tempo must be slow to medium speed; Pace: Two long sides, using the short sides to prepare the transitions, tempo must be as fast as possible. All riders are alone on the track. There are five judges in the middle of the track assigning scores from 0 to 10, according to the rules and regulations by the International Federation of Icelandic Horse Associations (<https://www.feif.org>).

We monitored the behaviour of the 24 participating horses in T2 (11 mares, 9 stallions, 4 geldings, aged 7–16 years, and ridden by 7 female and 17 male adult riders) during the two standardised exercises, i.e. loose and short-rein tölt (in the other exercise, the rider can choose the tempo) as well as in the 25 participating horses in F1 (9 mares, 14 stallions, 2 geldings, aged 7–13 years, and ridden by 5 female and 20 male adult riders).

2.1. Behavioural recordings

The online recordings were viewed at slow speed (x 0.25) enabling a detailed recording of the behaviour of each horse during the various exercises/gaits (Table 1). Since the horses' heads were not always visible on the recordings, and the riders can have a slightly variable time in the arena, the duration of each exercise was recorded in addition to the total duration where the relevant body part was visible to the observer. All videos were observed by the same trained student (DJ). Further, 14 random videos were re-observed by the student, and the same 14 videos were recorded by a horse ethologist, enabling an analysis of both intra- and inter-observer reliability. For each horse, it was noted whether the horse was ridden with a curb bit or a snaffle bit.

2.2. Data analysis

The frequency of behaviour was calculated per minute where the relevant body part was visible. The response variables (freq. mouth opening per min, freq. undesired head movements per min, freq. tail swishing per min, and freq. of gait changes per min) were analysed for an effect of gait (walk, trot, canter, tölt or pace) in F1. The same response variables were analysed for an effect of exercise (short or loose-rein tölt) in T2. Since the data did not meet the requirement for normality (Shapiro-Wilk Normality test) and/or variance homogeneity (Brown-Forsythe Equal Variance test) we used the Repeated Measures ANOVA on ranks test (SigmaPlot 15.0, www.alfasoft.com). For F1, the Tukey test was used for post-hoc testing. The effect of bit type (curb bit vs. snaffle) on mouth opening (total freq./min) and the effect of rider sex (female vs. male) on the total frequency of conflict behaviour were explored using t-tests (the total frequencies were normally distributed with equal variances). Intra- and inter-observer reliability were tested using Spearman correlations. Data are presented as median frequency per minute [25% and 75% quartiles]. A significance level of $P < 0.05$ was used throughout.

3. Results

In Fivegait F1, mouth opening was the most frequently observed behaviour with the highest occurrence in pace and tölt (median freq./min [25;75%]; pace: 31.1 [17;48]), tölt: 30.1 [12;46], canter: 20.2 [6;38], trot: 12.4 [5;30], walk: 6.0 [2;19]) in Fivegait F1 (RM ANOVA on Ranks, $\chi^2=27.0$, $P<0.001$; Fig. 1). Undesired head movements occurred less frequently but were also shown more often in tölt and pace (tölt: 7.1 [4;10], pace: 4.8 [3;9], canter: 0 [0;2], trot: 1.6 [0;4], walk: 1.3 [0;4], RM ANOVA on Ranks, $\chi^2=42.7$, $P<0.001$). In contrast to mouth opening and head movements, which were shown by all horses, tail swishing was shown by less than half of the horses (11 of 25) and medians are zero (tölt: 0 [0; 0.9], pace: 0 [0; 2], canter, trot and walk: 0 [0;0], RM ANOVA on Ranks, $\chi^2=20.0$, $P<0.001$). There was no effect of gait on the frequency of undesired gait changes.

Table 1
Ethogram of the recorded behaviours.

Behaviour	Description
<i>A-priori defined behaviour patterns</i>	
Mouth opening (freq)	The horse opens its mouth, i.e., teeth and/or the wall behind the horse is visible through the mouth.
Undesired head movement (freq)	Head raising, lowering and tossing (i.e., a clear movement of the head away from the position requested by the rider.
Tail swishing (freq)	Lateral, dorsoventral or circular motion of the tail that interrupts the rhythmical waving motion of the tail corresponding to the gait.
Change of gait (freq)	The horse changes gait to any other gait, not currently requested by the rider.
<i>Behaviour patterns defined during video-analysis</i>	
Lip elongation (yes/no)	The upper lip extends one to several cm from the lower lip for >3 sec, i.e., unrelated to vocalisations.

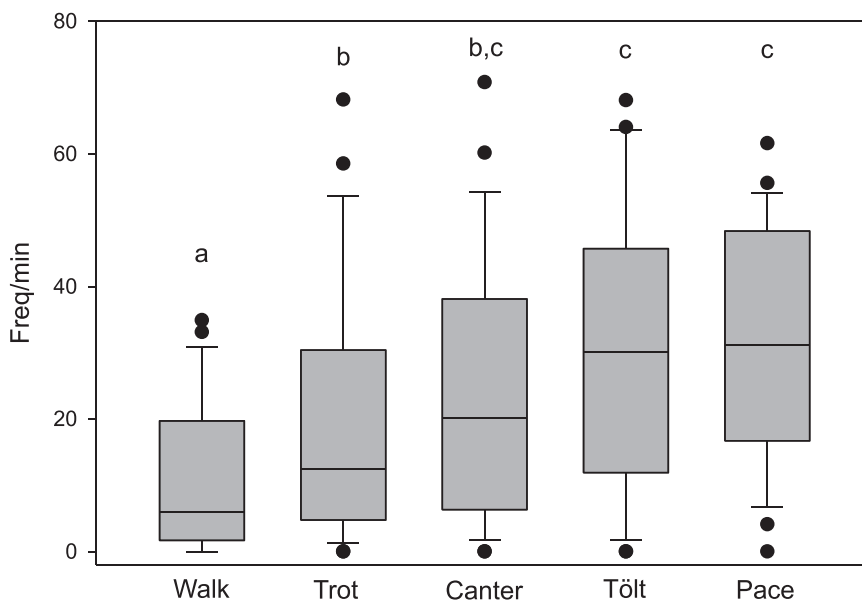


Fig. 1. Mouth opening (median freq. per min) in the five different gaits in F1. Different letters indicate a significant difference ($P < 0.05$).

In T2, mouth opening was more frequent in short-rein than in loose-rein tölt (short: 24.6 [18;36] vs. loose: 4.2 [1;7], RM ANOVA on Ranks, $\chi^2=16.7$, $P<0.001$; Fig. 2). Undesired head movements also occurred more frequently in short-rein than in loose-rein tölt (slow: 4.3 [3;6] vs. loose: 1.7 [0;2], RM ANOVA on Ranks, $\chi^2=13.5$, $P<0.001$). In contrast to mouth opening and undesired head movements, which were shown by all horses, tail swishing was shown by 14 of the 24 horses (of the 14 horses, four horses only swished their tail once during either short or loose rein tölt), and there was no effect of exercise (short vs. loose reins). Undesired gait changes occurred more frequently in loose-rein compared to short-rein tölt (loose: 3.4 [2;5], short: 0 [0;0], RM ANOVA on Ranks, $\chi^2=18.2$, $P<0.001$).

Further to the behaviours described in Table 1, an elongated upper lip (Fig. 3) was observed in 11 of the 25 horses in F1 in one or more gaits. In T2, 12 of the 24 horses were observed to show an elongated upper lip, but only in short-rein slow tölt.

There was no significant effect of bit type on the frequency of mouth

opening in the two competitions (total freq./min \pm SEM; Fivegait F1: Curb bit: 12 horses (23 ± 4.5) vs. snaffle: 13 horses (21 ± 3.3), $P = 0.74$ and in T2: Curb bit: 19 horses (20 ± 2.6) vs. snaffle: 5 horses (14 ± 3.1), $P = 0.30$). Further, there was no effect of rider sex on the total freq. of conflict behaviour; however, this result should be interpreted cautiously as there was a low number of female riders in both competitions (F1: 5 female vs. 20 male and T2: 7 female vs. 17 male).

There was a weak to moderate, negative correlation between the gait score given by the judges and undesired gait changes (T2: $r_s = -0.41$, $P=0.004$; F1: $r_s = -0.24$, $P=0.007$) whereas the other behaviours did not correlate to the score.

Both intra- and interobserver reliability were high (intra: $r=0.98$ for mouth opening and $r=0.90$ for undesired head movements; inter: $r=0.97$ for mouth opening and $r=0.81$ for undesired head movements).

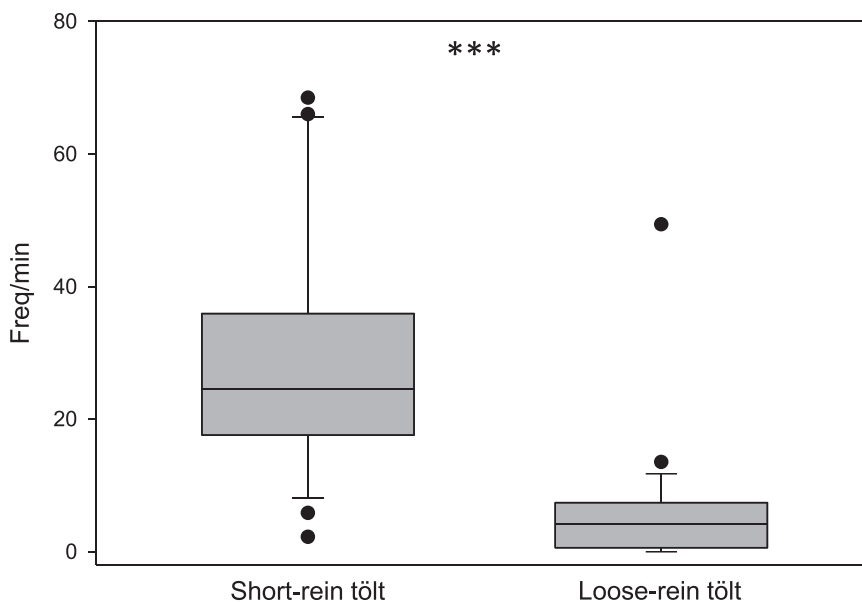


Fig. 2. Mouth opening (median freq. per min) in T2, short and loose-rein tölt. ***: $P < 0.001$.



Fig. 3. An elongated upper lip was observed in 12 of the 24 horses in T2 in short-rein tölt, whereas no horses showed the behaviour in loose-rein tölt (upper row: still photos from the video recordings used in this study, lower row: a similar behaviour can be noted in warmblood dressage horses and Icelandic horses in other competitions).

4. Discussion

Behaviours that may be indicative of discomfort, pain or frustration have previously been shown to occur at high frequency in warmblood sports horses (Kienapfel, 2011; Kienapfel et al., 2014; Górecka-Bruzda et al., 2015). This study reports similar high occurrences of potential conflict behaviour in Icelandic horses competing in breed-specific competitions. Particularly oral behaviour was shown at a high frequency in the faster gaits (canter, tölt and pace). Górecka-Bruzda et al., (2015) reported differences in the types of conflict behaviour shown by horses in different disciplines: In dressage horses, tail swishing was most frequent, whereas pulling the rein out of the rider's hands was the most frequently observed behaviour in show jumping horses; thus, it is likely that different disciplines give rise to different types of conflict behaviour. This may relate to differences in the type of equipment used, riding method or the type of exercise that the horse is requested to perform. In this study, the possibility to observe behaviour at 0.25 x normal speed enabled us to see behaviours that the eye could not catch at full speed; thus, judges that are placed further from the horse and observing horses live are less likely to catch the details that were observed in this study. Hall et al. (2014) noted that the visibility of behavioural signs to the observer is variable, with those associated with the mouth and facial expression being harder to see from a distance (Hall et al., 2014). Similarly, Doherty et al. (2017b) suggested that some behavioural indicators of horse's pain, stress or fear go unnoticed by humans. This calls for the use of short, standardised video sequences played at slow-speed, at competitions as well as regularly in connection with the daily training, which will enable the observer (judges and trainer/rider) to see the horses' behaviour in much greater detail. Increased awareness of behavioural signs of discomfort, pain and frustration, both during daily

training and during competitions can improve horse welfare and thereby help ensure continued public acceptance of horse sports.

In accordance with previous studies, Dyson and Pollard (2021) reported that dressage horses competing at elite level frequently displayed mouth opening (68% of horses) and tail swishing (29% of horses). The authors concluded that "most horses appeared to work comfortably for the majority of the test" because the observed number of pain-related behaviours were below a proposed pain threshold of eight behaviours (Dyson and Pollard, 2021). However, it is important to recognize that the occurrence of one type of conflict behaviour may be the only visible sign of an underlying welfare issue and this should not be neglected (Fureix et al., 2010). For example, Christensen and Uldahl (2023) reported that dressage horses with oral lesions had a higher frequency of mouth opening during a dressage test, compared to horses without oral lesions. Generally, high frequencies of oral lesions have been reported in sports horses across disciplines: 52% of horses had lesions after a cross-country test (Tuomola et al., 2021), 84% of trotters after a race (Tuomola et al., 2019) and 45% of horses after a dressage test (Christensen and Uldahl, 2023). In Icelandic horses, bit-related oral lesions were found in 31% of horses competing in the finals of a national event. The use of curb bits with a port was found to be a risk factor for lesions on the bars of the mandible, most of which were regarded as severe (Björnsdóttir et al., 2014). Indeed, certain training aids (such as strong bits and tight nosebands) has the potential to cause nerve damage, pain and lesions (McGreevy et al., 2012; Casey et al., 2013; Uldahl and Clayton, 2019). In this study, we did not find a significant effect of bit type (curb vs. snaffle bits) on the total frequency of conflict behaviour. This result should be interpreted with caution due to the limited number of horses (e.g. only five horses with snaffle bits in T2) and the fact that we did not have detailed information on bit type. Further studies are

required to understand the association between oral conflict behaviour, lesions and various types of equipment and bits.

We also noted a new behaviour which, to the best of our knowledge, has not previously been described by a scientific study as a potential oral conflict behaviour in ridden horses. Half of the horses showed an elongated upper lip when ridden in tölt with short reins whereas none of the horses showed the behaviour when ridden in the same gait with loose reins. It should be noted that the behaviour differs clearly from the stretched upper lip shown by horses that are groomed in a gentle way by humans (Lansade et al., 2018), self-grooming on an object or engaged in social grooming (Waring, 2003; see Fig. 3). An elongated upper lip has previously been described in situations in which horses experienced a frightening situation such as a novel object (Kiley-Worthington, 1987; Leiner and Fendt, 2011; Zeitler-Feicht, 2015). In our study, lip elongation was observed when the horses were ridden on a short rein, suggesting that this facial expression was related to rein tension - possibly caused by pain from bit pressure, the posture induced by bit pressure, or frustration from contradicting cues. However, frustration *per se* is likely not a sole cause of this facial expression, as a recent study by Ricci-Bonot and Mills (2023) did not find a significant difference in the occurrence of 'lip pucker', which may be a similar behaviour, in feeding situations designed to induce anticipation and frustration. Comparisons with photo and video material provided by Leiner and Fendt (personal communication, 2023) indicated that lip elongation in our present study was more severe than in the warmblood horses exposed to a novel object test by Leiner and Fendt (2011). The angular outline described by Bohnet (2007) as a sign of fear was likewise more pronounced in the horses of the present study, compared to the ones involved in Leiner and Fendt (2011). It is possible that stress or more specifically fear (related to rein tension or the induced pain and/or posture) is involved in producing this facial expression in ridden horses. It is worth noting that - based on casual observations - lip elongation is also commonly seen in horses performing dressage (Fig. 3), a situation that is likewise typically characterized by high levels of rein tension and unnatural head-neck postures induced by bit pressure (Christensen et al., 2014; Kienapfel et al., 2014). It remains to be investigated in further detail whether the intensity of upper lip elongation and/or the degree of angularity are valid indicators of the degree of tension or stress, or if the intensity of this facial expression is specific to certain situations and/or varies at an individual level.

We conclude that mouth movements (open mouth and elongated upper lip) are common behavioural expressions in Icelandic horses competing at elite level and suggest that increased awareness of behavioural signs of pain, discomfort and/or frustration can improve welfare in ridden horses. Thus, to ensure that future horse sports rewards performance that reflects appropriate training, consideration of behaviour indicative of conflict and discomfort should be incorporated into the judging criteria.

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CRediT authorship contribution statement

Christensen Janne Winther: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing. **Jensen Dehliä:** Conceptualization, Data curation, Formal analysis, Investigation, Writing - original draft, Writing - review & editing. **König von Borstel Uta:** Conceptualization, Formal analysis, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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