

Grouping horses according to gender—Effects on aggression, spacing and injuries

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ABSTRACT

Many horse owners tend to group horses according to gender, in an attempt to reduce aggressive interactions and the risk of injuries. The aim of our experiment was to test the effects of such gender separation on injuries, social interactions and individual distance in domestic horses. A total of 66 horses were recruited from 4 different farms in Norway and Denmark and divided into six batches. Within each batch, horses were allotted into one mare group, one gelding group and one mixed gender group, with most groups consisting of three or four animals. After 4–6 weeks of acclimatisation, a trained observer recorded all social interactions using direct, continuous observation 1 h in the morning and 1 h in the afternoon for three consecutive days. Recordings of the nearest neighbour of each horse were performed using instantaneous sampling every 10 min. The horses were inspected for injuries before grouping, day 1 after grouping and after 4–6 weeks. No significant effect of gender composition was found on social interactions ($P > 0.05$), spacing ($P > 0.07$) or injuries ($P > 0.23$). Eighty percent of all aggressive interactions recorded were threats, not involving physical contact. Horses with the smallest space allowance showed the highest mean number of aggressive interactions (28.6 ± 6.1 interactions per 6 h) compared to the mean of all the other batches (8.3 ± 1.0 interactions per 6 h). Very few injuries were found and most were superficial. In conclusion, gender composition does not seem to have any effect on aggression level, spacing or injuries. However, the early social experience of horses, management of feeding and space allowance probably represents more important factors for successful group housing of domestic horses.

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1. Introduction

The most common way of housing horses today is individually in tie-stalls or boxes with limited possibility for physical contact with other horses (Bachmann and Stauffacher, 2002; Søndergaard et al., 2002). Since horses naturally are group living animals, social contact with conspecifics is an important element of behaviour for which

they seem to exhibit a strong motivation (Heleski et al., 2002). Lack of social contact is thought to be one of the most serious stressors for horses and can lead to abnormal behaviour patterns like redirected sexual behaviour (Luescher et al., 1991) or weaving (Nicol, 1999; Cooper et al., 2000). In addition, social isolation can lead to increased aggression when later being mixed with other horses (Christensen et al., 2002b). This has also been shown in cattle, where socially experienced animals established dominance relationships faster and in a less aggressive manner compared to individuals without experience with strangers (Bouissou, 1975; Veissier et al., 1994).

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In general, limited access to resources will induce aggression and social competition. For instance, aggression has been shown to increase with increased number of animals per feeding place (e.g. cattle: DeVries et al., 2004; Huzzey et al., 2006; goats: Jørgensen et al., 2007) and with decreased space allowance per animal (e.g. cattle: Kondo et al., 1989; pigs: Weng et al., 1998). Invasion of another horse's personal space is a common source of aggression (Tyler, 1972; Keiper and Sambras, 1986; Heitor et al., 2006) and less space per animal has been reported to give a higher level of aggression in horses as well (Keiper, 1988; Keiper and Receveur, 1992).

Group composition may influence behaviour, as shown in several studies on different species. The level of aggression is higher in weight homogeneous groups compared to weight heterogeneous groups in pigs (Andersen et al., 2000) and bulls (Mounier et al., 2005), but Færevik (2008) found more displacements in heterogeneous age groups compared to homogeneous age groups of calves. Another aspect of group composition is gender. In groups of Merino sheep, individuals in a mixed gender group were more scattered in the terrain compared to homogeneous gender groups, and the nearest neighbour was commonly a sheep of the same gender (Michelena et al., 2008). Experiments with pigs indicate that male pigs in mixed gender groups show more aggressive interactions compared to pigs in single gender groups following regrouping (Giersing and Andersson, 1998; Colson et al., 2006).

Many horse owners do not mix geldings and mares because they are afraid of more aggression and injuries occurring. Van Dierendonck et al. (2004) observed free ranging Icelandic horses and found no behavioural problems related to keeping them in mixed gender groups. However, in feral horses living in harem groups it has been reported that mares show aggressive interactions more often, whereas stallions show more forceful aggression when it occurs (Feist and McGullough, 1976). There also seem to be effects of earlier social experience on aggression when grouping unfamiliar horses, where young stallions that previously were stabled singly showed more aggressive behaviours than group housed stallions (Christensen et al., 2002b).

The aim of this study was to investigate the effect of gender homogeneous grouping versus gender heterogeneous grouping on social interactions, injuries and spacing between horses. We hypothesized a difference in social

interactions between treatment groups and predicted that more aggressive social interactions and injuries should be found in the mixed gender groups compared to the gender homogeneous groups.

2. Materials and methods

The study was conducted from September 2007 to March 2008 on four farms located in Norway and Denmark.

2.1. Animals and housing

In each of six batches, horses were allotted into three different social groups according to gender: one group with only mares (mare group, ♀), one with only geldings (gelding group, ♂) and a mixed gender group with both mares and geldings (mixed group, ♀♂).

A total of 66 horses, aged 1–26 years in six batches were included in the study. Three of the batches consisted of Icelandic horses (batch 1, 3 and 4), and the remaining batches (batch 2, 5 and 6) consisted of riding horses and riding ponies (largely warm blood riding horses and some Norwegian Fjord horses). All horses had social experience with other horses prior to the study. Most Icelandic horses were group housed from birth, while early social experience for the riding horses varied. The groups consisted of 3–9 horses (mean \pm SE number of horses, mare groups: 3.5 ± 0.2 , gelding groups: 3.6 ± 0.2 , mixed gender groups: 3.8 ± 0.2).

All farm facilities (Table 1) were set up to meet the national regulations for welfare of horses in Norway (Landbruks-og matdepartementet, 2005) and Denmark (Justitsministeriet, 2007).

Enclosures were mostly open areas or had some scattered trees. Horses in batch 4 only used a smaller area of the enclosure because of deep snow. Except for batch 5, all horses could feed simultaneously and free access to water was provided for all batches. In batch 5, horses were given roughage in a circular feed barrel (measuring 1.90 m in diameter) that even though it had 10 openings (0.30 m/opening), could not accommodate the 9 horses simultaneously because of social distances and rank.

Groups were kept stable and horses in training were exercised normally during the experimental period. In batch 5, one horse from the mare group was excluded prior

Table 1
Information on paddocks and horses.

| Gender groups | | ♀ | | ♂ | | ♀♂ | | Month observed | Roughage feeding |
|---------------|------------------|------------|---|------------|---|------------|---|----------------|---------------------------------------|
| Batch | Breed | Group size | Paddock size (m ² per horse) | Group size | Paddock size (m ² per horse) | Group size | Paddock size (m ² per horse) | | |
| 1 | Icelandic horses | 3 | ~5000 | 3 | ~5000 | 4 | ~5000 | September 2007 | Pasture grazing |
| 2 | Riding horses | 3 | ~350 | 3 | ~350 | 4 | ~350 | November 2007 | Silage ^b <i>ad libitum</i> |
| 3 | Icelandic horses | 4 | ~5000 | 4 | ~5000 | 4 | ~7500 | November 2007 | Silage <i>ad libitum</i> |
| 4 | Icelandic horses | 4 | ~75,000 | 4 | ~25,000 | 5 | ~9000 | March 2008 | Silage <i>ad libitum</i> |
| 5 | Riding horses | 5 | ~200 ^a | 6 | ~170 ^a | 9 | ~100 ^a | March 2008 | Hay and straw <i>ad libitum</i> |
| 6 | Riding horses | 3 | ~1300 | 4 | ~3700 | 3 | ~1400 | March 2008 | Silage <i>ad libitum</i> |

^a Estimated paddock size.

^b Silage = ensiled grass forage or haylage.

to the observations because of the skin condition called “grease heels”.

2.2. Injury score

All horses were scored for injuries by a veterinarian or an experienced lay person, before grouping, day 1 after grouping and after the behaviour observations 4–6 weeks later. The severity of the injuries was categorized as follows:

- 0: no visual wounds/injuries;
- 1: hairloss only, without damage to skin or deeper tissue;
- 2: lesion involving a moderately swollen area (with or without hairloss) and/or a superficial wound where the skin is not perforated (underlying tissue is not visual, i.e. bites, kicks, scrapes, etc.);
- 3: injury with a (minor) cut through the skin, or a larger crush with obviously swollen parts;
- 4: wound through the skin which involves damage to deeper tissue (muscles, tendons) or a cut through the skin so big that it would normally be stitched;
- 5: extensive and serious injury that may cause loss of function over a long period of time, e.g. (serious damage to a tendon or joint, fracture) or even death/euthanasia.

Lameness was scored when observing the horse in walk, using the following categories; 0: no lameness visual in walk; 1: lame, the horse puts weight on the whole hoof on the lame leg; 2: very lame, the horse barely moves, moves only on three legs and only puts weight on the toe.

2.3. Behaviour observations

Four to six weeks after grouping a trained observer recorded all events of social interactions for 3–4 focal animals within each of the three groups in the batch by means of direct, continuous observations. Observations were performed 1 h in the morning (between 8 a.m. and 11 a.m.) and 1 h in the afternoon (between noon and 3 p.m.) for three consecutive days, giving a total of 6 h per group. The time of observation was randomized to prevent any effects of diurnal rhythm. Social interactions were categorized into 19 categories (Table 2) and in addition the actor/reactor involved was recorded.

Horses that were difficult to identify were marked with a standard colour marking crayon for animals on the back and flank, or with coloured ribbons in the mane and tale. The same person performed all observations from outside the horse's enclosure in a position with good view over the enclosure. Social interactions were merged into main categories as follows:

Table 2

Ethogram with social interactions (modified after McDonnell and Haviland, 1995; Christensen et al., 2002a).

| Behaviour | Description |
|--------------------------------|--|
| Aggressive interactions | |
| Displacement | Approach of one horse causes another to move away so that distance is maintained or increased, without overt aggression (also termed retreat/avoidance, depending on whether receiver or sender is noted). |
| Threat to bite | Bite intention movement with ears back and neck extended, with no actual contact. |
| Threat to kick | Kick intention movement, performed by swinging rump or backing up, and by waving or stamping hind leg toward another horse, without making contact. |
| Head threat | Head lowered with the ears pinned, neck stretched or extended toward the target horse and the lips often pursed. |
| Chase | One horse pursuing another usually at the gallop in an apparent attempt to overtake, direct the movement of or catch up with the other. The chaser typically pins the ears, exposes the teeth and bites at the rump and tail of the pursued horse that may kick out defensively with both rear legs. |
| Backing | Backward movement towards another horse with ears oriented backwards (description developed for this study). |
| Bite | Opening and rapid closing of the jaws with actual contact to another horse's body. The ears are back and lips retracted. |
| Kick | One or both hind legs lift off the ground and rapidly extend backwards toward another horse, with apparent intent to make contact. |
| Push | Pressing of the head, neck, shoulder, chest or body against another horse, causing it to move one or more legs to retain balance. |
| Friendly interactions | |
| Play | Play directed at another individual, which may or may not reciprocate; includes low intensity play movements such as nipping, grasping and pulling mane or tail. |
| Play fight | High intensity play, which is reciprocated by one or more partners; includes vigorous play movements such as rearing, boxing, circling, kneeling and chasing. |
| Social grooming | Reciprocal coat care in which the partners stand beside one another, usually head-to-shoulder or head-to-tail, grooming each other's neck, mane, rump or tail by gently nipping, nuzzling or rubbing. |
| Head rest | One horse rests its chin or entire head on the neck, body or rump of another horse. |
| Greeting behaviours | |
| Nasal sniff | Olfactory investigation. Two or more horses sniff mutually head to head. |
| Body sniff | Olfactory investigation. A horse sniffs the neck, withers, flank or tail of another horse, which may or may not reciprocate. |
| Genital sniff | Olfactory investigation. A horse sniffs the genital region of another horse, which may or may not reciprocate. |
| Strike | One or both forelegs are rapidly extended forward to contact another horse, while the hind legs remain in place. The strike is typically associated with arched neck threat and posturing. A horse may also strike when rearing. The strike is often accompanied by a snort or squeal. |
| Other behaviours | |
| Snapping | Submissive behaviour. Opening and closing mouth with lips retracted. Typically, the head and neck are extended, and the ears oriented back or laterally. |
| Mounting | One horse raises his chest and forelegs onto another horse's back with the forelegs on either side, just as during copulation. |

Threats = displacement, threat to bite, threat to kick, head threat, chase and backing.

Aggressive behaviours with physical contact = bite, kick and push.

Aggressive interactions in total are then Threats + Aggressive behaviours.

Play behaviour = play and play fight.

Greeting behaviour = nasal sniff, body sniff, genital sniff, strike.

Friendly interactions in total = play behaviour, social grooming, head rest, greeting behaviour.

In addition, the minimum distance to nearest neighbour of each focal horse was recorded every 10 min using the following categories: 1: 0–2 m; 2: 3–10 m; 3: more than 10 m.

2.4. Statistical analysis

In order to test the effects of gender composition on social interactions, spacing and injuries, a non-parametric Wilcoxon/Kruskal–Wallis test was applied with the class variables: group composition (mare-, gelding- or mixed gender groups) and batch (1–6). Batch was treated as a block effect and group was used as statistical unit. The same method was used to analyze the distribution of aggressive interactions within treatments (threats or aggressive interactions with physical contact) with group (mare-, gelding- or mixed gender groups) and batch (1–6) as class variables. All analysis was performed using the statistical analysis software JMP 6.0.2 from SAS institute.

3. Results

3.1. Social interactions

No significant differences were found between the group compositions in aggressive or friendly interactions; nor in threats, aggressive interactions with physical contact, social grooming or greetings (Table 3). There was however a strong tendency for female groups to show less play behaviour compared to male and mixed gender groups (Table 3).

In general, the level of aggression was low and threats represented more than 80% of total aggressive interactions in treatment groups (Fig. 1). Six horses were never involved in aggressive interactions and 25 horses were never involved in aggressive physical contact. Number of social interactions per individual ranged from 0 to 73, with a mean of 20.2 interactions (mare groups: 19.6, gelding

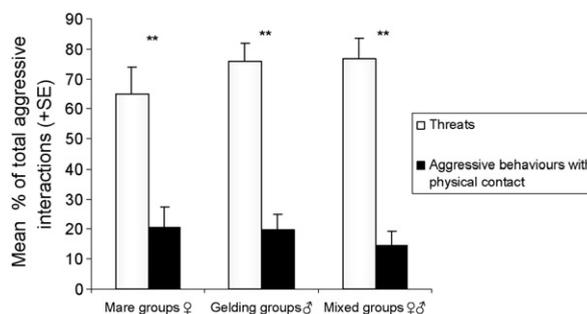


Fig. 1. Threats versus physical interactions within the mare-, gelding- and mixed gender groups (% of total aggressive interactions recorded + SE). Significant difference is given by $**P < 0.005$.

Table 4

Distance to nearest neighbour in the mare groups (♀), gelding groups (♂) and mixed gender groups (♀♂) given in percent of total recordings (mean ± SE).

| Nearest neighbour | ♀ | ♂ | ♀♂ | χ^2 | P-value |
|-------------------|------------|------------|------------|----------|---------|
| 0–2 m | 71.9 ± 4.8 | 63.6 ± 5.4 | 60.6 ± 5.4 | 2.4 | 0.297 |
| 3–10 m | 20.9 ± 4.0 | 17.8 ± 2.2 | 25.7 ± 3.9 | 1.3 | 0.510 |
| >10 m | 7.1 ± 1.8 | 18.6 ± 4.3 | 13.6 ± 3.6 | 5.3 | 0.070 |

groups: 22.2 and mixed gender groups: 18.8). Mounting and snapping were never recorded during the observations and striking and head rests were only seen on a few occasions.

3.2. Spacing

In general, horses kept in close proximity to one another. In more than 60% of the observations horses had their nearest neighbour within 2 m regardless of group composition. No significant effect of group composition on spacing was found, but geldings had a weak tendency towards being more than 10 m away from their nearest neighbour compared to mares (Table 4).

In the mixed gender groups, nearest neighbour was of the same gender in 45% and opposite gender in 51% of the cases. In the remaining 4% of the observations the horses had the same distance to both genders.

3.3. Injuries

No significant differences between group compositions were found in number and severity of injuries day 1 after

Table 3

Number of social interactions shown in the mare groups (♀), gelding groups (♂) and the mixed gender groups (♀♂) (mean ± SE).

| Behaviour | ♀ | ♂ | ♀♂ | χ^2 | P-value |
|----------------------------------|------------|------------|------------|----------|---------|
| Aggressive interactions in total | 13.7 ± 4.2 | 11.5 ± 2.0 | 10.8 ± 2.3 | 0.8 | 0.676 |
| Threat | 12.0 ± 4.0 | 9.8 ± 1.8 | 9.4 ± 2.1 | 0.2 | 0.884 |
| Physical contact | 1.7 ± 0.4 | 1.7 ± 0.5 | 1.4 ± 0.4 | 0.1 | 0.942 |
| Friendly interactions in total | 5.9 ± 0.9 | 10.7 ± 1.8 | 8.0 ± 1.5 | 2.2 | 0.331 |
| Play | 0.5 ± 0.2 | 5.4 ± 1.2 | 2.3 ± 1.1 | 6.0 | 0.050 |
| Social grooming | 2.7 ± 0.5 | 2.8 ± 0.9 | 2.6 ± 0.8 | 0.5 | 0.778 |
| Greeting behaviour | 2.7 ± 0.4 | 2.4 ± 0.4 | 3.0 ± 0.6 | 2.8 | 0.245 |

Table 5

Number of injuries day 1 after grouping and 4–6 weeks after grouping in the mare groups (♀), gelding groups (♂) and mixed gender groups (♀♂) (mean ± SE).

| | ♀ | ♂ | ♀♂ | χ^2 | P-value |
|--------------------------|-----------|-----------|-----------|----------|---------|
| Day 1 after grouping | 0 | 0.5 ± 0.3 | 0.5 ± 0.5 | 2.5 | 0.283 |
| Category 1 | 0 ± 0.0 | 0.4 ± 0.3 | 0.5 ± 0.5 | 2.5 | 0.283 |
| Category 2 | 0 ± 0.0 | 0.2 ± 0.1 | 0 ± 0.0 | 2.5 | 0.283 |
| 4–6 weeks after grouping | 0.4 ± 0.2 | 0.9 ± 0.5 | 1.0 ± 0.4 | 3.3 | 0.191 |
| Category 1 | 0.1 ± 0.1 | 0.8 ± 0.4 | 0.7 ± 0.3 | 2.8 | 0.251 |
| Category 2 | 0.2 ± 0.1 | 0.2 ± 0.1 | 0.3 ± 0.2 | 2.9 | 0.231 |

grouping or 4–6 weeks after grouping (Table 5). In general, very few injuries were found and no injuries were serious (category 3, 4 or 5). Furthermore, no horses were found lame.

4. Discussion

No effect of gender composition was found on social interactions, spacing or injury score. In agreement with our findings in the present study, Vervaecke et al. (2007) did not find any differences in frequency of aggressive interactions between mare- and gelding groups, but Feist and McGulough (1976) have reported that stallions in feral harem groups show more forceful aggression compared to mares. In this study, we used only geldings and it has been reported that castration can eliminate aggression towards other horses by 40% probability. In addition, there are no reported differences in behaviour changes after castration of juvenile (<2 years old) compared to adult (>3 years old) stallions (Line et al., 1985).

Interestingly, our results indicate that horses in male groups and mixed sex groups performed more play behaviour than horses in female groups. The same relationship between sex and play has previously been reported in subgroups of Icelandic horses (Sigurjonsdottir et al., 2003), and male foals are much more likely to play fight compared to female foals (Rho et al., 2007).

When mixing animals, there seem to be a correlation between injuries and aggression (pigs: Weng et al., 1998). Hence, because of the low level of physical interactions 4 weeks after mixing in the present experiment, it is not surprising to find a relative low level of injuries. Similarly, Grogan and McDonnell (2005) found few injuries in groups of horses. Even though we did not observe social interactions during mixing, it is most likely that the number of physical interactions must have been low because of the low level of injuries found day 1 after mixing. Although studies on pigs indicate that heterogeneous gender grouping may cause a higher level of aggression at mixing (Giersing and Andersson, 1998; Colson et al., 2006), the study of Colson et al. (2006) also showed that these differences disappeared with time. In the present experiment we found that the majority of all aggressive interactions were presented as threats and not physical interactions. While injuries are easy to quantify as a result of aggressive interactions, a high level of threats might also affect the level of stress in subordinate individuals. On the other hand, we should keep in mind that smaller injuries and areas with hairless skin could be results of rough play, as well as aggressive interactions.

In general, keeping within an appropriate distance of neighbours and synchronising behaviour and motion is important in order for group consistency to remain (Deneubourg and Goss, 1989). Horses in gender homogeneous groups did not keep closer together compared to horses in gender heterogeneous groups and gender of the nearest neighbour within the mixed sex groups was just as often of the same as of the opposite gender. This is in contrast to findings from the study of Michelenia et al. (2008) performed with female and intact male sheep, where heterogeneous gender groups were more scattered in the terrain compared to homogeneous gender groups and that nearest neighbour in heterogeneous gender groups were most often of the same gender. This may be an indication that castration also affects spacing.

Management of feeding and ample space allowance are both important factors to consider when keeping horses in groups. Further studies should investigate if there is an effect of early social experience of young horses on risk of injuries when kept in groups as adults.

In conclusion, gender composition in groups of horses did not affect social interactions, spacing or injuries, but a tendency for more play in male groups were found. Most aggressive interactions performed between horses were displayed as threats, not involving physical contact.

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