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Effects of feeding management and lying area on the behaviour  
of group-housed horses

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### **Summary**

Environmental, spatial and social needs of horses as gregarious steppe inhabitants have changed only to a very small extent within 6000 years of domestication. Accordingly, group housing in spacious stables appears to be the most appropriate form of stabling horses. However, the composition of such groups typically does not correspond with natural herd structures and the space allowance of group housing systems as well as the amount and duration of forage availability usually being restricted. Social incompatibilities, i.e. increased frequencies or intensities of agonistic behaviour, are reported particularly frequently from group housing in practice. Possible consequences of social incompatibilities include an increased risk of injury as well as disturbed feeding and lying behaviour. In view of this, the present thesis aimed to identify key factors influencing the welfare of group-housed horses by examining the effects of group composition, feeding management and space of the lying area in group housing systems on the behaviour of the horses.

When assessing the welfare of horses in terms of management and husbandry conditions, locomotor activity and resting behaviour are often involved in addition to social behaviour. For this purpose, the suitability of an accelerometer (MSR145 data logger) for automated activity measurement was validated in a first step of this thesis (see chapter 4). In order to define unique acceleration value ranges for different gaits, 20 horses of various breeds and height at withers (125-169 cm) were exercised in stand, walk, trot and gallop for five minutes each. The accelerometer was attached to the cannon bone of left foreleg and the acceleration of the vertical leg movement was measured at a sampling rate of 10 Hz with a maximum sensitivity of  $\pm 10$  g. The absolute values of the measured accelerations of each horse in each gait were summed up per second and averaged over the entire five minute interval. For the analysis, three breed classes were defined based on breed and height at withers: Horse ( $> 148$  cm), Pony ( $\leq 148$  cm), and Icelandic horse. When Icelandic horses were considered separately from other horses and ponies, results showed no overlaps between acceleration values of the different gaits and allowed the determination of gaits by definition of distinct acceleration value ranges for stand, walk, trot and gallop. The validation revealed a clear suitability of the MSR145 accelerometer for automated activity measurement in horses and the device was used in the two subsequent studies.

Regarding the feeding management, it was investigated how the arrangement of hay provision and the duration of the forage availability (hay and straw) as well as the characteristics of the group composition affect agonistic behaviour and locomotor activity of adult horses in group housing (see chapter 5). Agonistic behaviour was divided into aggressive behaviour with the risk of injuries by physical contact (bite, kick, attack, chase), threatening behaviour (threat, bite threat, kick threat), displacement, and push. The study was conducted on 50 groups of 4 to 21 adult horses. Each group

was observed for 30 minutes before and for the first 30 minutes after a hay feeding. Main factors affecting frequencies and intensities of agonistic behaviour proved to be the feeding system and the duration of forage availability. Hay was provided mostly 2 to 3 times per day but the duration of hay availability varied from 1.5 to 24 hours. Only 26% of the groups had access to hay for 12 hours or longer, whereas straw was available *ad libitum* in 78% of the groups. Aggressive behaviour was highest in the feeding system 'floor' and lowest in 'net'. Threatening behaviour was highest in the feeding systems 'floor', 'fodder rack' and 'feed fence' and lowest in 'feed stalls'. Displacements occurred most in 'floor' and least in 'feed stalls'. In conclusion, feeding systems requiring individuals to feed in close proximity, i.e. 'fodder rack' and 'feed fence', generally resulted in increased agonistic behaviour, most likely because horses were not able to maintain their perceived individual distances during feeding. Furthermore, the availability of foraging opportunities led to lower levels of agonistic behaviour during feeding, regardless of the feeding system. Displacements decreased substantially with an increasing duration of straw availability, whereas aggressive behaviour with the risk of injuries by physical contact decreased with an increasing duration of hay availability. This effect of the duration of hay availability on aggressive behaviour indicates that hay is still perceived as a limited resource, even when straw is available *ad libitum*. Contrary to expectations, results showed that these characteristics of group composition only had minor impact on agonistic behaviour. The most relevant effect was found for sex ratio, as the proportion of horses showing threatening behaviour was increased with an increased ratio of mares in the groups, whereas hardly any effect of group size, age of an individual or period of residence on agonistic behaviour was present. Locomotor activity was affected by the compliance of time-bound feeding times and the feeding system. Groups fed at time-bound feeding times tended to show more locomotor activity in the 30 minutes before feeding than horses with no time-bound feeding times, whereas no difference was found during feeding. Locomotor activity during feeding was highest in horses fed in the feeding systems 'fodder rack' and 'feed fence' and lowest in horses fed in 'feed stalls', however, differences were minor.

In a further study an experimental approach has been used to investigate the effect of different space allowances of the littered area on the lying behaviour of group-housed horses (see chapter 6). Although horses can sleep while standing, recumbency is required for REM sleep. Since all stages are necessary for physiological and psychological recovery, recumbency is essential for horses. The few existing studies on sleep in horses indicate a minimal duration of recumbency of 30 minutes per 24 hours in order to perform the minimal duration of REM sleep. Nonetheless, unsuitable environmental conditions or social insecurity are reasons for which horses are reluctant to lie down. Accordingly, the provision of a suitable lying area is a welfare issue which has to be taken into account. In this regard, requirements for the quality and the minimal dimensions of the littered area have been implemented in the animal welfare legislation in Switzerland. Based on these, 38 horses in eight groups were each exposed to four different treatments; no litter provided, 0.5x minimal dimensions littered, minimal dimensions littered, and 1.5x minimal dimensions littered. Litter materials used were straw or wood shavings and non-littered areas were covered with hard rubber mats. Each treatment was applied for 11 days and the lying behaviour was observed continuously during the last 72 hours. Results showed a clear preference for recumbency on litter, as rubber mats were only reluctantly used for recumbency, mainly when no littered area was available. Increasing dimensions of the littered area resulted in overall increased durations of recumbency, increased proportions of lateral recumbency and increased synchronization of recumbency between group members. Furthermore, high-ranking horses showed consistently low proportions of forcibly terminated lying bouts across the four treatments, whereas low-ranking horses had considerably higher proportions with minimal dimensions but were similar to

high-ranking horses with 1.5x minimal dimensions. In summary, the lying behaviour was clearly affected by the provision of a soft and deformable surface for recumbency and enlarged dimensions of the littered area were further shown to be beneficial, specifically for low-ranking horses. Nonetheless, a number of individuals showed durations of recumbency of less than 30 minutes per 24 hours, even with 1.5x minimal dimensions.

By obtaining a greater depth of knowledge about the effects of group composition, feeding management and space allowance of the littered area on the behaviour of group-housed horses, the present thesis allowed an improved insight into the functioning of group housing systems and, therefore, contributes to the further improvement of the welfare of group-housed horses. The feeding system and the duration of forage availability were identified as key factors to reduce agonistic behaviour around feeding times. Feeding systems should either offer feeding places with more distance between them or provide individually separated feeding places which limit or prevent physical contact between individuals. Results further indicated that, from an ethological point of view, horses should be provided not only with straw but also with hay over an unlimited period. As social factors had only minor impact on agonistic behaviour around feeding times, it appears that group-housed horses are relatively tolerant towards the characteristics of group composition during feeding. The study on lying behaviour showed that undisturbed recumbency relies greatly upon the provision of a soft and deformable surface as well as the space allowance of the littered area. Assuming that the provided lying area should ensure undisturbed lying behaviour for all members of a given group, results indicate that the Swiss requirements for the dimensions of the littered area of group housing systems should be perceived as minimal dimensions.