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Movement behaviour of horses in group housing husbandry

The group housing of horses enables the animals to move freely as far as possible and to have social contacts with herd members. That's why the system is enjoying increasing popularity in Germany. In these studies the impact of group size and the impact of design of the housing system on the behaviour of horses should be quantified. It has been shown that increasing the group size is associated with an increase in movement activity. Also the structuring of the housing systems in functional areas might contribute to an increase in activity.

Keywords
Horse husbandry, movement, behaviour, discharge husbandry

Abstract
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It is often discussed that the inactivity of horses causes diseases of their musculoskeletal system. Due to these problems the objective of the investigations was to quantify if the size of a group and the design of the housing system have an effect on the movement behaviour of horses. Foals and young horses have to be reared in groups because of their social development [1].

However, findings indicate the significance of movement for the health of horses. Wilke [2] examined 694 foals and their mothers under different housing conditions with regard to the occurrence of osteochondrosis. Foals with a deficit of movement within the first 4 months of life had significantly more common osteochondrosis in the fetlock as compared to foals with adequate movement opportunities.

Lack of movement and feeding deficits are also known to contribute to the development of colics [3]. Nevertheless, investigations showed that providing additional movement, like pasture or horse walker, resulted in a lower stress load of group-housed horses [4]. The factor stress could also trigger a colic of a horse. However, lack of free movement is often the result of deficiency in area, so that in spite of increasing group housing systems sufficient movement possibilities are missing [5; 6; 7].

In the present investigations the movement behaviour of horses in different group housing systems has been analysed considering specific conditions. The aim of the first experiment was to investigate the effect of group size on behaviour and activity of horses. The second investigation analyzed the impact of the stable design on the animals' behaviour.

Material and methods

Animals and housing conditions in trial 1

Data from 42 one- to two-year-old horses have been included in the first investigation about the influence of group size. All horses were kept in group housing divided into three different group sizes. The trials take place at three national stud farms. The data of two small groups A and C (eight and eleven horses) were compared with data of one big group of 23 horses (group B). On farm A 8 horses and on farm B and C 10 horses were used during the trials and equipped with measuring technique.

Animals and housing conditions in trial 2

During the second trial different arrangements of group housing systems were compared. Therefore investigations took place in three different open barns (O1–O3) and two movement stables (B1 and B2, HIT GmbH, Weddingstedt, Germany) with a total of five groups of horses.

Additionally one group of horses was initially grouped together in a paddock system (PS) and then the same horses were relocated into a new-built movement stable (B2). The measured data were collected there during four weeks.

The open barns were less structured stable systems with one or two shelters and an outdoor area. In the movement stables the areas were divided by different elements, such as hedges or tree trunks, and equipped with automatic feeding systems. The area information and kinds of structuring or equipment of the trial farms are shown in **table 1**. All animals were kept under field conditions. The group sizes ranged between 5 and 20 horses **(table 1)**. The minimum requirement of floor space for lying in open barn stables with division of lying- and feeding area of 3 x withers^2 per horse [1] was met in each of the examined systems.

Age of the test animals ranged between 3 and 23 years. Each experimental group contained mares and geldings and was of heterogenic structure in terms of body height and breed (warm-blooded breed types as well as ponies). In each group

five to six animals were fitted with a pedometer and observed for ten days. In total, the movement behaviour of 26 horses was investigated.

Measuring technique, statistical analyses

Activity-Lying-Temperature-pedometers (ALT-pedometers, engineering office Holz, Falkenhagen, Germany) were used to record movement activity of the horses as well as lying duration and temperature at the horse leg **(figure 1)**. Animal data were recorded during the complete test periods and during 24 hours a day. The count of activity impulses was automatically summed up after 10 or 15 minutes and saved as a data set, respectively. The pedometers are attached to the horse's rear leg to avoid gathering activity impulses from scraping and pawing hooves. The stored data were red out from the pedometer by radio transmission and were stored in an MS Access database for further processing. Statistical evaluation was carried out with the software program SAS, version 9.1.3 (SAS Institute Inc., Cary, NC). All traits were tested for normality with the Shapiro-Wilk-Test and were found to not follow normal distribution. Thus all hypotheses were tested for significance with the Kruskal-Wallis-Test (significance level of $\alpha = 0.05$).

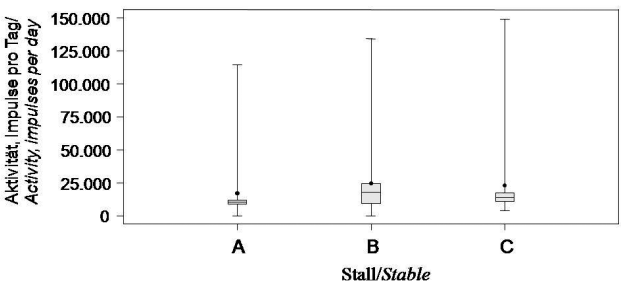
Results

The investigations about the group size for young horses showed that movement behaviour increased with number of animals **(figure 2)**. A doubled group size leads to twice the recorded activity impulses.

Fig. 1

Horse with ALT-pedometer in a movement stable

Fig. 2



Influence of group size (A = 8, B = 23 und C = 11 horses/group) on activity behaviour

Table 1

Stocking capacity, dimension and facility of the open barns and movement stables

	Offenstall *Open barn*				Bewegungsstall *Movement Stable*	
	O1	O2	O3	Paddock-System (PS)	B1	B2
Tierzahl *Number of horses*	8	9	5	14	20	7
Gesamtfläche [m²] *Total area [m²]*	1 000	750	600	80	4 500	2 000
Fläche pro Pferd [m²] *Area per horse [m²]*	125	83	120	57	225	285
Unterstände pro Stallsystem *Shelter per stable system*	2	1	1	3	1	1
Unterstandsfläche, insg. [m²] *Overall shelter area [m²]*	55	180	36	41	200	200
Unterstandsfläche pro Pferd [m²] *Shelter area per horse [m²]*	6,9	20	7,2	4,1	10	28,6
Einstreumaterial *Bedding material*	Sand *sand*	Stroh *straw*	Sand *sand*	Gummimatten *rubber mats*	Softbed® (HIT)	Sand *sand*
Auslaufstrukturierung *Paddock structuring*	+	0	0	-	++	++

0 = In verschiedene Flächen unterteilt/*Divided into different areas*.
- = Keine Strukturierung/*No structuring*.
+ = Funktionselemente/*Functional elements*.
++ = Funktionselemente und Futterautomaten/*Functional elements and automatic feeding systems*.

The results show that the median activity of horses in group A was 82 activity impulses per fifteen minutes. In group C this increased to a median of 101 and group B reached the highest median of 149. These differences are significant at an error level of $\alpha = 0.05$.

A comparison of the open barns with the movement barns in the second investigation displayed significant differences between the stable systems. The difference of means between both systems amounted to about 60 steps per 10 minutes. The comparison between two barns each shows that the reason for this difference can be attributed to the activity level in barn B2 mostly. This barn differs significantly from all other barns and the horses also showed the overall highest activity level. Although barn B1 comes in second place in this regard, there is no significant difference between barn B1 and barn O1, O3 or PS. The horses also showed a higher activity, but not significantly, in the structured open barns (O1 and O3) in comparison to the conventional open barn (O2). The median of movement activity was 20 % higher in this comparison.

The moving of the horses from PS to B2 leads to an obvious change of activity. The mean activity level based on mean 10-minute values was more than doubled. Furthermore, the maximum count of movement impulses in PS was lower than the minimum count of impulses in B2. The difference of means between both systems was about 96 steps per 10 minutes and statistically significant.

Discussion

International research studies have shown that keeping of horses in big groups is often not accepted and is described as "not natural" [8; 9; 10]. However, the German Equestrian Federation (Deutsche Reiterliche Vereinigung e.V.) refers, that herds with up to 50 animals are also possible in wildlife [11]. The results of the present investigations showed that horse keeping in big groups has no negative influence on the movement and social behaviour of horses. The observed increase of movement activity in the bigger group as a result of more interactions between the animals corresponds well to other studies that have found more voluntarily motion, this means not target-oriented movement, in group housing systems [12; 13; 14].

Additionally living in a social structure helps to promote metabolism, to strengthen joints and to prevent locomotive and respiratory diseases [5].

The hypothesis of our second trial that functional elements in a paddock system or in a movement stable increase the movement behaviour of the horses was confirmed. Other studies also present that a subdivision into functional areas can achieve an increase of the movement activity [15; 16].

However, space allowance is also important for horses' activity behaviour, but it is not the only factor that encourages the horses for running and playing [17]. Our results demonstrate that while both movement stables offer comparable space per horse (225 and 285 m²) and include same functional elements, the distribution of activity nevertheless shows differences. Reasons for the higher activity level could be the 60 m² less space per horse and possibly better arrangement of functional elements.

Additionally, Frentzen [15] demonstrated that not only functional areas help to increase activity, but also the feeding frequency in combination with distance between functional elements (e. g. lying- and feeding area) has a significant influence on the movement activity. These results correspond well with the present study. A similar effect could be observed in the difference of the activity in the conventional open barn (O2) in comparison to the structured open barns (O1 and O3). Additionally there have been some outliers and higher maximum counts of activity impulses in the open barns in comparison to the movement stables. Reasons for this could be running games as sprints or flight reactions. Maybe the horses try to compensate their movement deficit, because of the overall lower activity in the open barns throughout the whole day. On the other hand, an increase in activity can be achieved with a higher feeding frequency by using automatic feeding systems. Furthermore, the high frequency of feeding units per day comes closer to the natural feeding behaviour, because it is better for the horses' digestive tract to get many little portions of feed divided over the day [18].

To get a more holistic impression of horses' behaviour across different housing systems it would be necessary to supplement the experiments by more assessment factors and methods for evaluation. However, the present results clearly show that horses expressed more activity in movement stables with divided functional areas and increased feeding frequency than in open barn systems.

Conclusions

The results of this study indicate that housing of horses in bigger groups leads to an increase of movement activity. Using feeding automation for hay and concentrate in addition to well designed and structured paddocks also causes significantly higher activity behaviour in horses. Nevertheless further work is needed to investigate which particular functional areas have the strongest influence on movement behaviour and to identify other affecting factors with positive influences on health and well-being of animals.

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