

Assessment of affiliative behaviour in mares

**Iwona Janczarek^{1#}, Marcjanna Wiśniewska², Izabela Wilk¹,
Marta Liss¹, Elżbieta Wnuk-Pawlak¹, Marta Dybczyńska¹**

¹University of Life Sciences in Lublin, Faculty of Biology, Animal Science and Bioeconomy,
Department of Horse Breeding and Use; #e-mail: iwona.janczarek@up.lublin.pl;
ul. Akademicka 13, 20-950 Lublin

²University of Science and Technology in Bydgoszcz, Faculty of Animal Breeding and Biology,
Department of Pig and Horse Breeding;
ul. Mazowiecka 28, 85-084 Bydgoszcz

The first aim of study was to assess the feelings of friendship and companionship among mares released into a paddock in different combinations by analysing the duration of behaviours occurring there as well as changes in heart rhythm. The second aim of the study was to develop a procedure for creating different herd configurations based on the individual affiliative needs of horses, expressed as a score. The study was conducted on 12 one-year-old Thoroughbred mares. It was carried out on three consecutive days during the horses' 30-minute stay in the paddock. On the first day, all mares were in the paddock together. On the second day, they were released in pairs, and on the third day, they were released individually. Expressions of affiliative behaviours (feelings of friendship and companionship) towards another horse were timed. The activity of the parasympathetic system was measured as well. The results were used to score the mares' affiliative behaviour using a procedure of our own design. Feelings of friendship and companionship were found to be most strongly expressed when a herd of horses with an established hierarchy including each individual was present on the paddock. Releasing horses in pairs is a good substitute for releasing the entire herd, but cannot replace true herd relations, due to decreased expression of feelings of closeness and companionship, such as play or grooming. Releasing horses into the paddock individually is not recommended because it disturbs social behaviour, thus increasing emotional excitability. Emotional excitability is calmed when horses are released in pairs, so this configuration can be used for excitable horses. The best solution, however, seems to be the use of the affiliative behaviour score proposed in the study, as an indicator of the individual needs of mares when creating various herd configurations.

KEY WORDS: horse / behaviour / emotional excitability / mutual relations

Hierarchy is formed in every horse herd, even the smallest, as a result of scuffles and fights between its members [5, 6]. This specific system is considered to be one of the factors determining the preservation of well-being [18]. Owing to the hierarchy, internal fighting is reduced, which ultimately leads to stabilization of the group [11]. Order of a hierarchical nature is recognized as the sum of individual and dominant-submissive relationships between each pair of animals in the herd [7].

Horses feel best in close community, while living alone causes feeling of uncertainty or even suffering [12]. Horses recognize the herd as a family whose individual members care for one another. The need for mutual relationships is additionally intensified by increased skittishness in these animals [7].

Behaviour characterized by qualities classified as typically friendly is natural for most horses occupying the same or similar hierarchical positions [2]. This type of behaviour towards other members of the herd is on the one hand an expression of well-being provided by humans, while on the other hand it shapes this well-being [9, 18]. However, despite the need for mutual contact, each horse maintains an individual distance, which is most clearly manifest in a large pasture [6]. Hence, an area that is too small triggers conflicts and aggressive situations among horses [14]. It is then necessary to choose horses for the pasture according to their degree of their gentleness and their mutual relations [3].

During undisturbed herd relations, affiliative behaviours associated with friendship and companionship are clearly visible in horses [4]. Horses express friendship in small subgroups and companionship in larger groups, sometimes including all the horses. Exceptions are individuals rejected for various reasons by other horses, or those that have chosen solitude [3]. Solitary horses usually have a melancholy temperament, and thus can be difficult for people to use [9]. Sometimes they are even dangerous. Individuals that are eager to establish relationships with one another are mostly sanguine or choleric. The sanguine individual easily enters into relationships with the majority of the herd members, while the choleric horse keeps the company of a smaller number of very close-knit animals.

The behaviour of horses is correlated with their overall use value [10,16] and significantly affects their welfare, but also depends on the often inadequate spatial infrastructure of the facilities in which they are kept. Therefore observation of these animals when they express mutual feelings in the herd can be considered important and multifaceted.

In this study it was assumed that the expression of feelings by horses is determined not only by their psychological traits, but also by various configurations of the herd. For this reason horses should be placed together in such a way as to improve their satisfaction and thus their welfare [6]. Therefore the first aim of the study was to assess feelings of companionship and friendship among mares released into the pasture in various configurations by analysing the duration of behaviours occurring at that time as well as changes in heart rhythm. The second aim was to develop a procedure for creating different herd figurations based on the individual affiliative needs of horses, expressed as a score.

Material and methods

The research was conducted on 12 thoroughbred mares kept in two stable buildings, in 3.5 x 3.5 m boxes, with openwork walls in every other box. They were attended to by two grooms. The horses were fed three times a day with meadow hay and crushed oats with the addition of complete pellet feed. The horses were in pastures or paddocks from 7:00 to 19:00, with a break for midday feeding.

The experiment was carried out in early autumn on three consecutive days, while the mares were in the pasture. On the first day all mares were in the pasture. On the second day the mares were released in pairs consisting of animals that stood next to each other in the stable, in boxes separated by openwork walls. On the third day the mares were released individually. On each day of the experiment, the mares stayed in the pasture for 30 minutes.

While the horses were in the pasture, each horse's affiliative behaviours towards another horse were timed (in seconds). Behaviours associated with the expression of this type of feeling were play, mutual grooming, and proximity – keeping a distance of no more than 200 cm [13].

Heart rate measurements were made using Polar ELECTRO OY RS800CX telemetric devices. The data were then transferred to computer memory using an IrDA USB 2.0 Adapter peripheral device, and then analysed in Kubios HRV software ver. 2.0 [17]. The heart rate was measured at rest (5 minutes in the stable) and in the pasture (from the moment the horse was released into the pasture until it left the pasture). Two parameters of heart rhythm variation indicating the activity of the parasympathetic part of the autonomic nervous system were analysed:

1) rMSSD (expressed in ms) – the square root of the mean sum of the squares of differences between successive RR intervals of the QRS complex, i.e. the largest complex of waves in the electrocardiogram (ECG). The QRS complex describes the depolarization (stimulation) of the ventricular muscles. The occurrence of waves depends on the location and direction of the deflection. The R wave illustrates the first positive deflection of the QRS complex.

2) HF – high frequency spectrum power in the range from 0.15 to 0.4 Hz (expressed in ms^2)

In the final stage, a procedure was developed for creating different herd configurations based on the affiliation needs of individual horses, expressed as a score:

1. The situation in which all mares were present in the pasture at the same time was considered to enable standard expression of feelings of friendship and companionship; being in the pasture in pairs was considered to allow comfortable expression of feelings; and time spent in isolation from other horses was considered uncomfortable for expression of feelings.

2. The following features were taken into account in the assessment: mean time spent for play, grooming, and proximity, and the mean value of rMSSD and HF, under the assumption that their desired values during expression of feelings of friendship should be high.

3. Within each type of possibility of expressing feelings, three ranges of values for the analysed features were calculated: mean minus SD (assigned 1 point), mean \pm SD (2 points), and mean plus SD (3 points).

4. Tabular comparisons were made of the ranges of values of the features and the points assigned to them for each type of possibility of expressing feelings.

The data were tested for normal distribution using the Shapiro-Wilk test. Statistical analyses were based on models of multivariate analysis of variance for data with repeated measurements [15]. Significance of differences between means was verified using Tukey's multiple t-tests, with a significance level of $P = 0.05$ (SAS Institute Inc, 2003). Means, standard deviation (SD) and extreme values are given.

Results and discussion

The Shapiro-Wilk test confirmed that the distribution of the analysed traits was in agreement with the normal distribution. The chi-square test confirmed the normality of the distribution of the data. The average times spent on play were significantly different (Table 1). The lowest value was noted during uncomfortable expression of feelings, and the highest during standard expression of feelings. The highest standard deviation was found during uncomfortable expression of feelings. Hence the results indicate that only in the situation of uncomfortable expression of feelings, i.e. when the mares were alone in the pasture, was the time spent on play significantly shorter than when the group consisted of the entire herd of mares or when mares were released in pairs. The low SD value indicates that the desire to be alone is rare in horses. The results are therefore unsurprising, as horses are herd animals [8]. Separation from the herd is not a comfortable situation for horses, as shown by Cooper and Albentos [3].

Time devoted to grooming differed significantly in situations with different opportunities for expressing feelings (Table 2). The lowest value was recorded during comfortable expression of feelings, and the highest value during standard expression of feelings. The SD was also highest during standard expression of feelings.

Table 1

Time spent playing (s)

Expression of feelings	Mean	SD	Min	Max
Standard	124.45 ^a	67.86	110	234
Comfortable	119.56 ^a	43.26	90	178
Uncomfortable	78.56 ^b	23.56	60	320

Means marked with different letters are significantly different at $P=0.05$

In this case, the results were completely different from those obtained during the analysis of the time spent playing. Mares that were released in pairs spent the least time on this activity, while mares in the entire group spent the most time grooming. An intermediate value was obtained for the time spent grooming in mares released individually. The results indicate that the configuration in which horses are let out significantly affects this feature. This may be because self-grooming and mutual grooming cannot be blocked by factors limiting social contact of horses. Cooper and Albentosa express a similar opinion [3].

Table 2

Time spent grooming (s)

Expression of feelings	Mean	SD	Min	Max
Standard	287.34 ^a	100.45	139	308
Comfortable	125.67 ^b	34.78	89	504
Uncomfortable	200.34 ^c	89.56	120	345

Means marked with different letters are significantly different at P=0.05

Time devoted to closeness also differed significantly in situations with different opportunities for expressing feelings (Table 3). The shortest times were noted during uncomfortable expression of feelings, and the highest during standard expression of feelings. The highest SD was also obtained during standard expression of feelings.

This parameter was measured only in the case of mares that were in the pasture in the group or in pairs. Being in a group was found to initiate closeness, while being in pairs limited it. It can be concluded that equines feel best in large herds, in which hierarchical relationships are formed to increase the comfort of safety [1].

Table 3

Time spent on proximity (s)

Expression of feelings	Mean	SD	Min	Max
Standard	167.45 ^a	54.09	120	321
Comfortable	108.45 ^b	34.67	98	345
Uncomfortable	0.00 ^c	0.00	0	0

Means marked with different letters are significantly different at P=0.05

Horses should therefore be released in the largest possible groups, which allows them to feel closeness and safety.

There were no significant differences between resting rMSSD and HF values during successive repetitions of the test. The values were 44.23 ± 17.4 and 82.07 ± 20.28 , respectively.

On the other hand, the rMSSD parameter differed significantly in situations with different opportunities for expressing feelings (Table 4). The lowest value was noted during the uncomfortable expression of feelings, and the highest during comfortable expression of feelings. The highest SD accompanied standard expression of feelings.

Table 4
rMSSD parameter (ms)

Expression of feelings	Mean	SD	Min	Max
Standard	56.67 ^a	23.71	31	87
Comfortable	76.56 ^b	13.45	45	98
Uncomfortable	45.23 ^c	10.56	23	88

Means marked with different letters are significantly different at $P=0.05$

In the case of HF, the mean value was significantly lower during uncomfortable expression of feelings relative to the other two types of opportunity for expressing feelings (Table 5). The highest SD was noted during comfortable expression of feelings.

Table 5
HF parameter (ms²)

Expression of feelings	Mean	SD	Min	Max
Standard	145.56 ^a	56.77	89	178
Comfortable	167.45 ^a	72.11	56	180
Uncomfortable	78.78 ^b	23.71	34	100

Means marked with different letters are significantly different at $P=0.05$

The rMSSD and HF parameters were lowest when horses were let into the pasture individually, and highest in horses released in pairs. It can be concluded that in order to reduce emotional excitability in horses, they should be let out in small groups of individuals with which they share bonds of friendship. Heleski et al. [8] express a similar opinion, stating that separating horses from the group triggers negative emotions. On the other hand, it is worth remembering that being in a large group may also cause frustration in individuals with a low position in the herd hierarchy. Grouping of horses to be released into paddocks and pastures should be previously thought out and have a specific goal. This can help to achieve both a positive effect in terms of animal welfare and improvement of the animal's performance.

Tables 6 and 7 present the ranges of values and the scoring system for timed features characterizing the behaviour of horses in the pasture and parameters defining the activity of the parasympathetic part of the autonomic nervous system.

Table 6

Tabular comparison of ranges of time features (s)

Expression of feelings	Points for ranges of values		
	1	2	3
Play			
Standard	≤ 56.59	56.60-192.30	≥ 192.31
Comfortable	≤ 76.30	76.31-162.81	≥ 162.82
Uncomfortable	≤ 55.00	55.01-102.11	≥ 102.12
Mutual grooming			
Standard	≤ 186.89	186.90-387.78	≥ 387.79
Comfortable	≤ 90.89	90.90-160.44	≥ 160.45
Uncomfortable	≤ 110.78	110.79-289.91	≥ 289.90
Closeness			
Standard	≤ 113.36	113.37-221.53	≥ 221.54
Comfortable	≤ 73.81	73.82-143.11	≥ 143.12
Uncomfortable	—	—	—

Table 7Tabular comparison of ranges of values for rMSSD and HF (ms; ms²)

Expression of feelings	Points for ranges of values		
	1	2	3
rMSSD parameter			
Standard	≤32.96	32.97-80.37	≥80.38
Comfortable	≤63.11	63.12-90.00	≥90.01
Uncomfortable	≤34.67	34.68-55.78	≥55.79
HF parameter			
Standard	≤88.78	88.79-202.32	≥202.33
Comfortable	≤95.34	95.35-239.55	≥239.56
Uncomfortable	≤55.07	55.08-102.48	≥102.49

The results were based on the procedure proposed in this paper for creating different herd configurations according to the affiliative needs of individual horses, expressed in points. These results are of a typically applicative nature, as the measurements used in the study are increasingly commonly performed by breeders and users of horses. However, if the proposed procedure is followed, it should be remembered that the higher the score assigned for a feature in a given horse, the greater the certainty of maintaining well-being in terms of affiliative behaviour.

In conclusion, feelings of friendship and companionship are most strongly expressed in a herd of horses in the pasture with an established hierarchy that includes each individual. Releasing horses in pairs is a good substitute, but cannot replace the herd relationships of the horses, as there is a decline in expression feelings of closeness and companionship, such as play and grooming. Individual release of horses into paddocks is not recommended because it disturbs social behaviour, thereby increasing emotional excitability. Emotional excitability is calmed when horses are released in pairs. Therefore, this configuration is recommended for excitable horses. However, the best solution seems to be to use the proposed affiliative behaviour scores among mares as an indicator of their individual needs in creating different herd configurations.

REFERENCES

1. CAMERON E.Z., SETSAAS T.H., LINKLATER W.L., 2009 – Social bonds between unrelated females increase reproductive success in feral horses. *Proceedings of the National Academy of Sciences* 106 (33), 13850-13853.
2. CHRISTENSEN J.W., LADEWIG J., SØNDERGAARD E., MALMKVIST J., 2002 – Effects of individual versus group stabling on social behaviour in domestic stallions. *Applied Animal Behaviour Science* 75 (3), 233-248.
3. COOPER J.J., ALBENTOSA M.J., 2005 – Behavioural adaptation in the domestic horse: potential role of apparently abnormal responses including stereotypic behaviour. *Live-stock Production Science* 92 (2), 177-182.
4. FEIST J.D., MCCULLOUGH D.R., 1976 – Behavior patterns and communication in feral horses. *Zeitschrift für Tierpsychologie* 41 (4), 337-371.
5. FRASER A.F., 1992 – The behaviour of the horse. CAB International.
6. GOODWIN D., 2007 – Horse behaviour: evolution, domestication and feralisation. [In:] The welfare of horses. Springer, Dordrecht, pp. 1-18.
7. HAFEZ E.S.E., 1975 – The behaviour of domestic animal. Bailliere – Tindale, London, pp. 42-43.
8. HELESKI C.R., SHELE A.C., NIELSEN B.D., ZANELLA A.J., 2002 – Influence of housing on weanling horse behavior and subsequent welfare. *Applied Animal Behaviour Science* 78 (2-4), 291-302.
9. HEMSWORTH L.M., JONGMAN E., COLEMAN G.J., 2015 – Recreational horse welfare: The relationships between recreational horse owner attributes and recreational horse welfare. *Applied Animal Behaviour Science* 165, 1-16.
10. JEZIERSKI T., 2013 – Mechanizmy zachowań zwierząt oraz możliwości ich modelowania. Uniwersytet Przyrodniczy we Wrocławiu, Wrocław, s. 27-28.
11. KALETA T., 2007 – Zachowanie się zwierząt: zarys problematyki. Wydawnictwo SGGW, Warszawa.
12. MCBRIDE S.D., MILLS D.S., 2012 – Psychological factors affecting equine performance. *BMC Veterinary Research* 8 (1), 180.
13. MILLS D.S., MCDONNELL S.M. (Eds.), 2005 – The domestic horse: the origins, development and management of its behaviour. Cambridge University Press.
14. ROMANIUK W., OVERBY T., 2004 – Systemy utrzymania koni. Poradnik. Wydanie I, Instytut Budownictwa, Mechanizacji i Elektryfikacji Rolnictwa, Warszawa, s. 5-6.
15. SAS Institute Inc. CNU SAS user's guide statistics: version 9.1.3. Cary NC; 2003.
16. VISSER E.K., VAN REENEN C.G., BLOKHUIS M.Z., MORGAN E.K.M., HASSMÉN P., RUNDGREN T.M.M., BLOKHUIS H.J., 2008 – Does horse temperament influence horse-rider cooperation? *Journal of Applied Animal Welfare Science* 11 (3), 267-284.
17. VON BORELL E., LANGBEIN J., DESPRES G., HANSEN S., LETERRIER C., MARCHANT-FORDE J., MARCHANT-FORDE R., MINERO M., MOHR E., PRUNIER A., VALANCE D., VEISSIER I., 2007 – Heart rate variability as a measure of autonomic

- regulation of cardiac activity for assessing stress and welfare in farm animals – A review.
Physiology & Behavior 92, 293-316.
18. WARAN N. (Ed.), 2007 – The welfare of horses (vol. 1). Springer Science & Business Media.