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# Behavioural reactions of horses (*Equus caballus*) to separation stress in conspecifics. A pilot study on emotional contagion in the horse

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**The aim of this study was to assess whether horses are aware of and affected by emotional states of their stable-mates. Four mare-foal pairs and one gelding were subjected to two types of treatment: (I) - a stress caused by separation of the foal and the dam, or (II) - observing the reactions to separation stress in a horse in a neighboring box. Control observations (III) were conducted on the same horses not undergoing the abovementioned treatments. Behaviours and heart rate (HR) were recorded continuously during 5-minute baseline periods and 5-minute treatment periods on two consecutive days. Horses under both treatments spent significantly less time eating ($P<0.001$), significantly more time standing vigilant ($P<0.001$) and vocalized more frequently ($P<0.001$) compared with the control conditions. Only in foals a significant increase of mean HR was recorded under treatment A compared with the controls ($P<0.01$). These findings suggest that horses demonstrate some emotional contagion, mainly in the form of changes in behaviour, when conspecifics are stressed.**

KEY WORDS: **emotional contagion / heart rate / horse / separation stress**

Horses as prey and social animals live in herds because of the benefits of group living. Benefits of group living include an increased rate of reproduction, better protection of offspring (increased passing of genes), reduced chance of predation and thus increased survival rates. Since safety is high priority for equines, mutual watching

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over the safety of other herd members is an important feature of horses. When a horse notices a real or imaginary danger, the primary alert response is an elevated head and neck, with intense orientation of the eyes and pricked ears. An increased vigilance of one herd member immediately leads to more individuals looking out for danger. If one herd member recognises the threat as excessive, then the animal will take flight, which will be immediately followed by the whole herd. This may be labelled as emotional contagion.

However, emotions in animals are related not only with danger. The ability to experience other types of emotions has been seen in many species. Domestic hens have a capability for emotional contagion [Edgar *et al*. 2011], chimpanzees perform acts of altruism [Warneken *et al*. 2007] and elephants mourn their dead herd members [Bekoff 2007]. It has been shown that laboratory rats and mice feel a sort of compassion for one another [Church 1959, Langford *et al*. 2006, Bartal *et al.* 2011]. It is still not known to what extent horses are capable of experiencing emotional contagion when a conspecific is stressed not because of a perceived danger, but because of isolation from other conspecifics, specifically from those to which a special bond exists. According to Zeitler-Feicht [2004], horses as social animals have the ability and the need to form friendships. However, a special mutual bond exists between neonatal foals and their mothers. This bond decreases as foals are becoming older. Formation of relationships and a need for social contact, as well as the readiness to follow others may give rise to a question if a simple form of empathy exists in horses. However, the concept of "empathy" having many definitions that encompass a broad range of emotional states, including caring for conspecifics and expressing a desire to help them, applies to humans rather than animals. Other definitions say that empathy denotes experiencing emotions that match another person's emotions; discerning what another person is thinking or feeling. Thus, in relation to animals it seems more proper to use the term "emotional contagion".

There is some anecdotal evidence of horses grieving the loss of friends and displaying symptoms akin to those of clinical depression in humans, such as cessation of eating, lack of interaction with the surroundings and aggravation of health problems [King 2013]. As social animals, horses experience stress and display visible arousal upon complete separation from conspecifics. Additionally, for foals as typical follower-types, staying always in close proximity to their mothers and following them when moving, separation from their mothers is a strong stress factor both for the dam and the foal.

The aim of this study was to examine if horses are able to recognize through observation of the behavioural responses of conspecifics subjected to isolation that the isolated conspecific is under stress and if the horses observing that event would demonstrate behavioural and cardiac reactions that may be considered as signs of emotional contagion.

**Material and methods**

The experimental procedure was approved by the 3rd *Local Commission* for *Ethics* in *Animal* Experimentation, Warsaw, Poland, decision No.1/2007.

Four Hutsul mares with their foals at feet in a pre-weaning age of approximately 6 months and one Anglo-Arab half bred gelding kept in one herd existing for 8 years were used in the experiment. The horses were stabled in individual, roofed boxes of 4x3 m. The boxes were separated by wooden partitions of 145 cm in height so that horses could see one another. For most of the day the horses were either pastured or stayed in a paddock.

The testing took place in two adjacent boxes where the horses were usually housed. The pairs, each comprising a mare and her foal, were randomly assigned to treatments I and II.

In treatment A mares and foals were separated, leaving in the box randomly either the mare or the foal that wore a heart rate monitor, while the other horse was taken away out of the sight of the remaining horse.

In treatment II mares and foals were not separated and could observe the reactions of the separated horse in the neighbouring box. Control observations (III) were conducted on the same horses not undergoing the abovementioned treatments.

All four mare-foal pairs were subjected to treatments I, II and III, whereas the gelding was used only as a single "observer" horse (treatment II and III).

Behaviour of horses was recorded using two digital video cameras (Sony Handycam, Sony, Japan) during 5-minute baseline periods and 5-minute treatment periods on two consecutive days early in the afternoon, after being fed oats. The total time (in seconds) spent on the following categories of behaviour was recorded:

– standing vigilant, with the elevated head and neck, intense orientation of the eyes and pricked ears;
– food intake, eating hay from the trough or straw from the bedding;
– walking, moving slowly within the box, making one or several steps;
– looking outside the box, putting the head out of the box over the box door;
– looking to the neighbour, putting the head over the partition to the neighbouring box of the stressed conspecific;
– agitated movement, moving around within the box.

Additionally the number of behavioural events (vocalisation and defecation) was recorded.

As the physiological parameter in both horses of the mare-foal pair in treatment B and in one of the horses left in the box in treatment A the heart rate (HR) was recorded using a Polar 810i monitor (Electro Oy, Finland).

The mean HR values were calculated using the Polar ProTrainer 5 Software and the data processing was carried out using the SPSS 6.0 software. If no significant difference was found in the behavioural scores between adults and foals, the pooled values were evaluated for both age groups. The differences in behavioural scores and in HR between treatments and controls were evaluated using the Wilcoxon test.

## Results and discussion

Generally the behaviours characteristic of excitement, such as standing vigilant, vocalisation and elimination, increased under both types of treatments, while those typical for a relaxed state, such as food intake, decreased correspondingly in comparison to the control conditions (Tab. 1). In two cases it was observed that the separated foals were calmed down if relaxed behaviour was exhibited by the mare-foal pair in the neighbouring box, affecting the separated foal which also became relaxed and resumed eating.

Although the mean HR of adults was lower under the control conditions, the differences were not statistically significant probably due to great HR variability under treatment I . In foals the mean HR differed significantly between the controls and treatment I (P=0.01) and both treatments caused an increase of the mean HR.

**Table 1**. The mean time (in seconds) spent on various behaviours and its standard deviation (in parenthesis), mean frequency of behavioural events and mean heart rate (P values are given only for significant differences)

| Behaviour | Treatment I | Treatment II | Control III | Significance of differences |
|---|---|---|---|---|
| Standing vigilant | 45.3 (±32.3$^{A}$ | 68.5 (±48.1)$^{\underline{\mathbf{B}}}$ | 7.1 (±17.7)$^{A\underline{\mathbf{B}}}$ | A – A P=0.0057<br>$\underline{\mathbf{B}}$ – $\underline{\mathbf{B}}$ P=0.0008 |
| Food intake | 26.9 (±33.6)$^{a\underline{\mathbf{B}}}$ | 125.4 (±96.5)$^{ac}$ | 211.6 (80.2)$^{\underline{\mathbf{B}}c}$ | a – a P=0.0262<br>$\underline{\mathbf{B}}$ – $\underline{\mathbf{B}}$ P=0.0007<br>c – c P=0.0329 |
| Walking | 43.3 (±22.8)$^{aB}$ | 23.5 (±14.6)$^{a}$ | 18.8 (±14.9)$^{B}$ | a – a P=0.0222<br>B – B P=0.0045 |
| Looking outside box | 65.4 (±63.0)$^{AB}$ | 5.0 (±18.0)$^{A}$ | 5.8 (±18.7)$^{B}$ | A – A P=0.0019<br>B – B P=0.0030 |
| Looking to the neighbour | 1.4 (±3.8) | 13.3 (±23.9)$^{a}$ | 1.6 (±5.5)$^{a}$ | a – a P=0.0.0322 |
| Agitated movement | 55.4 (±26.9)$^{A\underline{\mathbf{B}}}$ | 10.0 (±24.50)$^{A}$ | 1.7 (±4.70)$^{\underline{\mathbf{B}}}$ | A – A P=0.0091<br>$\underline{\mathbf{B}}$ – $\underline{\mathbf{B}}$ P=0.0005 |
| Vocalization | 9.7 (±4.1)$^{\underline{\mathbf{AB}}}$ | 1.2 (±1.6)$^{\underline{\mathbf{A}}c}$ | 0.2 (±0.7)$^{\underline{\mathbf{B}}c}$ | $\underline{\mathbf{A}}$ – A P=0.0009<br>$\underline{\mathbf{B}}$ – $\underline{\mathbf{B}}$ P=0.0008 |
| Defecation | 1.4 (±0.8)$^{a}$ | 0.3 (±0.6)$^{aB}$ | 0.1 (±0.3)$^{B}$ | a – a P=0.0495<br>B – B P=0.0096 |
| Heart rate | | | | |
| in adults | 63.8 (±4.1) | 62.7 (±4.6) | 59.1 (±3.0) | a – a P=0.0495 |
| in foals | 87.0 (±4.5)$^{aB}$ | 70.0 (±1.9)$^{a}$ | 65.3 (±2.0)$^{B}$ | B – B P=0.0099 |

Bagshaw *et al*. [1994] reported a higher HR as well as increased vocalisations, defecation and movement in horses subjected to isolation and confinement. The highest HR was observed by Bagshaw *et al*. [1994] within 5 minutes after separation, but no such tendency was visible during the current investigations. Jezierski and Górecka [1999] found that during transient social isolation of adult horses an elevated HR was accompanied by an increased incidence of specific movements (turning and pawing) and vocalisations, with the highest HR in the tested horse observed while other horses were leaving the stable. Nevertheless, the HR was significantly higher throughout the whole period of transient social isolation and it depended on how many horses were left as company for the horse tested [Jezierski and Górecka 2000]. Moon**s** *et al.* [2005] studied weaning stress in foals and recorded elevated HR during the first day after weaning, with the highest values immediately after separation.

The observed changes in behaviour and the increased HR recorded under both types of treatment indicate that the dam-offspring separation caused stress not only in the horses experiencing it, but also in those observing the stress symptoms in their neighbours. Obviously, the impact of separation on the horse experiencing it is greater than on the horse observing it. The observed calming effect that the unconcerned behavior of the pair nearby had on a separated foal is similar to that documented by Erber *et al*. [2011].

The findings may be regarded as preliminary evidence for the existence of emotional contagion in horses. However, further studies using more horses, also those which are alien to each other or not associated pairs, as well as another type of stressor are needed to clarify whether it is a common phenomenon and whether its influence extends beyond the herd members.

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