A NOTE ON REACTION TO NOVEL STIMULUS AND RESTRAINT BY THERAPEUTIC RIDING HORSES

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Abstract

Little research has been done to measure reactivity objectively in therapeutic riding horses (TRH). As individual reactivity and chronic stress could be assessed by exposing animals to acute, novel stressors, the authors of this work aimed at comparing reactions of TRHs and jumping horses (JH) to two challenges. Four TRHs and four JHs were exposed to a restraint covering their head with a hood for 1 hour and to a startling stimulus (a 40 cm long, red and white synthetic holiday garland shaken with a rustling noise inside the box). Heart rate (HR) and heart rate variability (HRV) were recorded continuously and telemetrically, the reaction was video-recorded and analysed with a software for behavioural analysis. Blood samples were collected before and after each challenge to determine lymphocyte proliferation and other biochemical parameters. Horses spent most of the time immobile during the challenges ($p<0.05$). TRHs had a significantly higher average basal HR than JH ($p<0.05$), probably due to their better condition. HR varied among different behaviours during the restraint ($p<0.05$): the average HR during "pawing" was higher than during other behaviours ($p<0.005$). A significant decrease in the proliferation of lymphocytes in samples taken after the removal of the hood ($p<0.05$) was found, while the other stress related parameters didn’t vary significantly after the challenges. The authors conclude that TRHs did not react less than JHs to the new stimuli and this should be taken into consideration while planning their daily work and management.

Keywords: horse, therapeutic riding, behavioural indicators, heart rate, lymphocite proliferation.

1. Introduction

Therapeutic riding (TR) is an animal-assisted therapy supporting or reinforcing motor, bio-chemical and mental functions in disabled people by means of horse-riding (De Lubersac and Lallery, 1977). Physical and behavioural characteristics, health conditions and management patterns associated with the horses being used in such therapy are critical to the program's quality as well as its success. In terms of reactivity, a therapeutic riding horse (TRH) should not be excessively reactive. Nor should it be excessively reactive to new stimuli or prone to sudden movements (Engel, 1992). Any reactivity variation in horses to behavioural tests may indicate the existence of stressful situations (Visser, 2001). If neglected, they might turn out to be a potential cause of problems for the horse's well-being as well as for the patients safety. So far few studies have been published aiming at measuring TRHs' behaviour and reactivity objectively as well as assessing whether these features might be used as selection criteria (Anderson et al., 1999). Furthermore, few researches have been carried out in order to emphasise whether the work performed by TRHs might negatively impact their well-being and, as a consequence, therapy quality. Since limited specific information is available concerning THRs, this article aims at assessing reactivity in some THRs. To that end, the horses were exposed to two challenges and their behavioural and physiological responses were compared to jumping horses' (JH) reactions.

2. Materials and methods

Eight horses were examined: five geldings and three female horses aged between three and nineteen years old. Four of them were therapeutic riding horses (TRH) and four were jumping horses (JH), used as controls. All the animals were housed in solid-sided boxstalls allowing them both visual and auditory contact and they all underwent a similar management pattern. The tests were carried out over eight days following a rest day in similar climate conditions. In every test day, two TRHs and two JHs underwent one test.

During the first test the horses were exposed to a restraint covering their head with a solid hood and they were tied by means of leads within their own boxes for one hour. In the second test a startle stimulus (a 40 cm long, red and white synthetic holiday garland shaken with a rustling noise inside the box) was introduced into each box where the animals were totally free to move. As soon as a horse approached the garland in order to explore it, the item was shaken by a person who was not visible to the animal. The test lasted 23 minutes.

The horses were continuously recorded as they underwent the behavioural tests. The video-recorder was placed on a tripod in front of each box door. The recorder's placement allowed observation of the whole body of each horse regardless of its position within the box. After starting recording, the operator left the box door in order to avoid any interference during the test. Video-recordings were analysed by means of the Observer Video-Pro software (Noldus et al., 2000). The following behaviours by the horses during the restraint test were considered: immobile, alert (ears stretched and leads strained, head and body still), head lowered, exploring the environment, pawing, head tossing, pulling back on the leads, moving. During the startle test, the following behaviours were examined: immobile, head lowered, looking at the garland, exploring the garland, moving, avoidance and flight attempts.

Heart rate (HR) and heart rate variability (HRV) were telemetrically recorded by means of two heart rate recorders Polar Vantage NV (POLAR ®) for each horse, during a basal period and during challenges. HRV describes variations of both instantaneous heart rate and interbeat intervals (Task Force of the ESC and the NASPE, 1996) and gives information about the sympathetic-parasympathetic autonomic balance. A preliminary visual analysis of data was carried out in order to identify artifacts caused by movements of electrodes on the skin or muscle contraction. For each horse, a five minute recording without artefacts was selected. The following time domain parameters were calculated (Marchant-Forde et al., 2004): average inter-beat interval (IBI), maximum and minimum R-R waves intervals (RRmax and Rrmin), standard deviation of the R-R intervals (SD) and the root mean square of successive differences (RMSSD). Frequency domain analysis was performed and the following parameters were calculated (Marchant-Forde et al., 2004): LF (0.01 – 0.07 Hz, Low Frequency, corresponding to the sympathetic nervous system activity), HF (0.07 –0.5 Hz, High Frequency, corresponding to the parasympathetic autonomic nervous system activity) and LF/HF (corresponding to the modulation of the sympathetic versus vagal branches).

Before and immediately after every challenge, venous blood samples were taken at jugular level and put into silicone Vacutainer ® test tubes containing EDTA (1 mg/ml blood). Lymphocytes proliferation, β-endorphins and cortisol were determined (Sacerdote et al., 1994).

Hematochemical and immune parameters were analysed by non-parametric Wilcoxon Match Paired Test (SPSS, 2003). Integrated behaviour and heart rate analysis were carried out. For each behaviour average durations and relative heart rates (±SD) were calculated. The relevant data were analysed by means of the non-parametric analysis of variance. Heart rate data were analysed by means of the non-parametric variance analysis and General Linear Model analysis (GLM) for repeated measures (SPSS, 2003). Heart rate variability was calculated by means of the index method and the frequency method and the relevant data were analysed by Wilcoxon Match Paired test.

3. Results

The horses undergoing the tests did not show any aggressive behaviour and/or did not make any significant attempt to run off. During the challenges, both TRH and JH spent more time standing still then performing other behaviours (ANOVA: $F_{1,7}= 6.12$ $P<0.05$). Table 1 features time periods associated with behaviours. Altogether the two groups showed different values in terms of heart rate, which was lower in JHs (ANOVA: $F_{1,1}=9.25$ $P<0.05$). No statistically significant difference between behaviours during the startle test was found by analysing the relevant heart rates. Nevertheless, THRs adopting the "look at the garland" behaviour showed higher average HR values (55,5 bpm) with respect to other behaviours (31,8 bpm). During the first minute after shaking the garland TRHs had a larger increase in HR (135 bpm, WILCOXON: S=26 Z=2,17; $p<0.05$) than JHs (64 bpm, WILCOXON: S=26 Z=2,17; $p<0.05$). During the restraint test, HR values varied according to the behaviour (ANOVA: $F_{1,7}=3.32$ $P<0.05$). Figure 1 points out that the highest HR values were recorded in both groups while horses were "pawing” (GLM: $F_{1,7}=3.32$ $P<0.005$). Figure 2 features the HR evolution in both groups during the restraint. Time has a statistically significant impact on HR (GLM: $F_{1,11}=8{,}73$ $P = 0.0001$) despite similar patterns in both groups. Table 2 features the HRV average values. The table reports the comparisons made between the basal period and the recordings after the restraint and the startle test on both groups (TRHs and JHs). No significant difference was found in any of the parameters. Not even the LF/HF parameter, which is a well-known indicator of the modulation between the sympathetic and parasympathetic autonomic nervous system, showed a clear trend. Lymphocyte proliferation decreased significantly after removing the hood in both TRHs and JHs (WILCOXON: S=88 Z=2.05 P<0.05). Cortisol basal values showed no statistically significant differences between TRHs and JHs (5μg/100ml in TRHs and 4μg/100ml in JHs). Nevertheless, after the restraint JHs showed a trend towards increasing concentration (P = 0,06). As for the other hematochemical parameters, no significant difference was determined between basal values and test values.

4. Discussion

This study focused on various parameters since literature relating to stress indicators reliability in horses is quite fragmentary (Baucus et al., 1990; Colborn et al., 1991; Rugh et al., 1992; McCarthy et al., 1993; Canali et al., 1996; Thayer et al., 1997; Wolff et al., 1997; McGreevy and Nicol, 1998; Anderson et al., 1999; Minero et al., 1999; Vierin et al., 1999). Hence it was considered important to compare and combine various physiological and behavioural data. As for the behaviours recorded during the test, no excessive reactivity by the horses was shown. Should TRHs have been too reactive, their suitability as therapeutic animals should have been questioned. The horses were watchful and responsive to external stimuli. During the restraint they were "alert" for long periods of time. The HR difference shown by the two groups could be related to the effects of a more intensive training of the JHs with respect to TRHs, which are basically used only for therapeutic purposes. The highest HR values were recorded during the restraint test while the horses were "pawing". This behaviour is often seen as a reaction to frustration, a displacement activity (Ödberg, 1973). Horses normally behave this way while waiting for feed, as an attempt to get close to another animal, or to rouse a foal in prone position (Houpt, 2000). In this study, "pawing" can easily be interpreted as a response to restraint since the horses were tied. As for the fear reactivity test, the highest average HR was recorded during the "look at the garland" behaviour. This was probably due to an increase in the sympathetic nervous system activity, although the horses were not significantly aggressive and/or did not try to run off. A decrease in the lymphocytes blastogenic reaction to mitogens was observed during the restraint test in both TRHs and JHs. This might be due to the fact that the horses had to face a stressor they could not avoid. Literature (Laudenslager and Ryan, 1983) shows that in these cases lymphocyte proliferation decreases or disappears, while it actually increases when an animal is given the opportunity to react by adapting to the new situation (Laudenslager et al., 1983). The individual differences shown by the horses as a reaction to these challenges might be associated with different adaptation skills and temperaments (Visser et al., 2003) regardless of their ordinary activities. No statistically significant data were found in some parameters such as heart rate variability or cortisol. This might be due to high individual variability and to the limited number of horses being examined. This conclusion needs further investigation with a broader sample.

5. Conclusion

The horses reacted differently to the two challenges. During the startle test, differences were recorded between basal values and test values only for the most straightforward and sensitive parameters (behaviour and heart rate), while the restraint caused a stress reaction implying a behavioural and physiological response at various levels. It is possible to assume that TRHs are familiar with everyday stimuli associated with their specific activity. However they react to novel stressors as stated by Anderson et al. (1999). As a consequence, they might react to unfamiliar stimuli despite the specific training they should undergo and the routine work they perform. Such studies are difficult to plan as they demand a sufficient number of

TRHs with similar management patterns (which is not common) and active involvement and dedicated cooperation by the Center staff. However they are useful since limited information is available concerning horses' adaptation skills to this kind of work and since information is important in order to plan therapeutic activities and ensure their effectiveness.

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7. References

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