

On the significance of puzzling behaviours: what do yawning and adult play tell us about horse (*Equus caballus*) welfare?

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Some behaviours remain a mystery and their determinants are still uncertain. Here we propose a critical interpretation of two puzzling behaviours, *i.e.* yawning and adult play, recorded in large samples of domestic horses kept in sub-optimal conditions (*e.g.* time-restricted feeding practices, social isolation). Yawning is involved in behavioural state changes, especially in quiet contexts of motor relaxation, but seems also to be triggered by stress and emotional contexts. Thus, we investigated specific correlates of yawning and stereotypic behaviours in two large samples of working horses ($n_1 = 87$, $n_2 = 59$). A clear co-occurrences of yawning and stereotypic behaviours appeared: stereotypic horses yawned more than the non-stereotypic horses (Fisher test, $p < 0.02$), yawning increased at the same time periods as stereotypic behaviours did (Wilcoxon tests, $p < 0.05$ to 0.001) and yawning frequency was even sometimes positively correlated with stereotypic behaviour frequencies (Spearman correlations, $p < 0.005$). Play, more typical of young stages in healthy individuals, occurs rarely at adult stages but then more often in captive/domestic animals (which can be challenging to welfare) than in animals living in natural conditions. Thus, we tested the hypothesis that adult play may reflect altered welfare states in horses, where, as in several species, play rarely occurs at adult stages in natural conditions. We observed the behaviour (in particular social play) of 29 adult riding school horses during occasional outings in a paddock and measured several stress indicators (health-related, behavioural and physiological) when these horses were in their home individual boxes. Results revealed that the number of horses and rates of adult play appeared very high compared to field report data and that most stress indicators measured differed between “players” and “non-players”, revealing that most “playful” animals were more prone to suffer from chronic stress contrarily to “non-playful” horses (Fisher, Chi-square, Mann-Whitney and Spearman

correlation tests, $p < 0.05$ to 0.001). Altogether, these results show that yawning and adult play can both reflect altered welfare states in horses, highlighting that these puzzling behaviours should not be considered, as currently thought, as reliable indicators of good welfare states and / or expression of positive emotions.

Key words: welfare indicators, yawning, adult play, altered welfare, horse

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