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Effect of an open window and conspecifics within view on the welfare of stabled horses, estimated on the basis of positive and negative behavioural indicators

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Abstract

The effect of environmental enrichment on the welfare of stabled horses was estimated on the basis of positive and negative behavioural indicators. Six stabled horses were exposed for seven days to each of two conditions in early spring: i) a window at the back of the loose box was opened, but no horses were within the view of the subject horses (OW) and ii) the window in the loose box was opened and two horses that had been in the same stable as the subject horses were turned out to the paddock next to the stable and were within view of the subject horses (OWH). The window in the loose box had been closed prior to the start of the study for protection against the cold during winter months (CW condition) but horses could see outside the loose box through the grille door. The behaviour of the subject horses was recorded by video camera from 1300 to 1530h, firstly, in the CW condition for the three days prior to treatment as the control condition, and then for the last three days of each week in the OW and OWH conditions. The behaviour was focal- and instantaneous-sampled at 30-s intervals. Significant differences between the effects of the loose box conditions on the mean percentage of time spent in standing behaviour, looking behaviour, and bedding investigation behaviour (which may be an indicator of frustration) were observed but no significant difference in the mean percentage of time spent in standing-sleep behaviour (which may be an indicator of behavioural satisfaction) was observed. When the window was opened, bedding investigation and standing behaviour decreased and, when the conspecifics were within view, bedding investigation behaviour decreased and looking behaviour increased. The results suggested that the OW and OWH treatments suppressed the frustration of stabled horses which did not perform any abnormal behaviour, but may not increase the behavioural satisfaction of stabled horses.

Keywords: *animal welfare, bedding investigation, environmental enrichment, frustration, sleep, stabled horses*

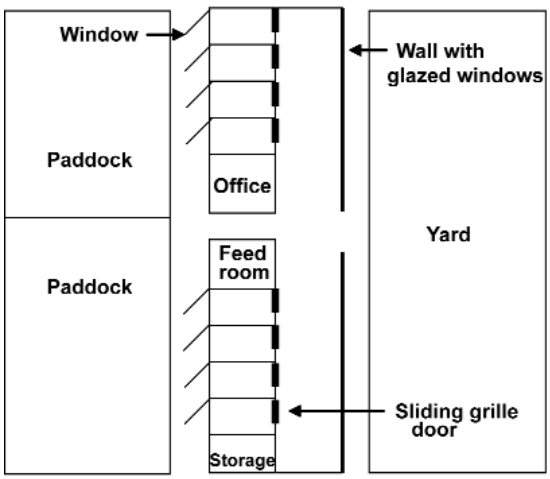
Introduction

The environmental conditions of stabled horses, which differ from natural conditions, are a known source of stress (Morgan & Tromborg 2007) and likely to adversely affect the physical and psychological well-being of these animals. The restrictions associated with captive conditions may be associated with failures in behavioural, physiological, and neurological systems in animals (Webster 2005; Morgan & Tromborg 2007), and some gut diseases (Mills & Clarke 2002; Nicol *et al* 2002) and reductions in learning ability (Hausberger *et al* 2007; Hemmings *et al* 2007) have been reported in stabled horses.

Recently, the effects of environmental enrichment on the behaviour of stabled horses have been investigated. It was found that improved feeding methods stimulated natural feeding behaviour and reduced the frustration of these animals (Goodwin *et al* 2002; Cooper *et al* 2005; Thorne *et al* 2005). The use of mirrors, pictures, or windows to allow stabled horses to interact visually with themselves or other horses, decreased the amount of time that the horses spent weaving (Cooper *et al* 2000; McAfee *et al* 2002; Mills & Davenport 2002; Mills & Riezebos 2005). It is thought that environmental enrichment may help improve the behavioural, physiological and neurological health and the overall welfare of stabled horses. The behaviour of animal species is thought to be one of the most readily observable measures of their welfare (Mench & Mason 1997).

In stabled horses, abnormal behaviour, such as stereotypies (Cooper & Mason 1998; Ninomiya *et al* 2007a), displacement behaviour (eg pawing: Waring 2003; Ninomiya *et al* 2007a), and appetitive behaviour (eg bedding investigation behaviour: Ninomiya *et al* 2004, 2007a, b) are reported to

Figure 1



The stable with loose boxes, paddock and yard.

be negative behavioural indicators. On the other hand, standing-sleep behaviour is reported to be a positive behavioural indicator (Ninomiya *et al* 2007b). Horses can sleep in the standing posture as well as in the lying position (Waring 2003) but it has been said that animals also increase resting behaviour, including sleeping, in a passive coping strategy to suboptimal environments (Webster 2005). Therefore, it is important for the accurate assessment of welfare of stabled horses to simultaneously use these behavioural indicators, especially when we consider that Mason *et al* (2007) also proposed that stereotypy should not be used as the sole indicator of animal welfare. However, few scientific studies have measured the welfare of animals on the basis of both these positive and negative behavioural indicators. In the present study, positive and negative behavioural indicators were used to assess the effects of an open window and conspecifics within view on the welfare of stabled horses.

Materials and methods

Animals and management

Six horses (four stallions and two geldings) were used as subjects at the Equine Research Institute of the Japan Racing Association in Utsunomiya, Japan. All of the horses were thoroughbred animals, ranging from five to ten years of age. The animals were kept individually in loose boxes (2.6 × 3.6 m; length × breadth) (Figure 1) and were turned out to pasture from 0900 to 1300h, in groups of three. The loose boxes were cleaned while the horses were in the pasture, and new bedding was provided daily. Each horse received a pelleted concentrate and an oat mixture (2.75 kg fresh weight), cut alfalfa hay (300 g fresh weight), and minerals at 0600 and 1530h and long hay (2.7 kg fresh weight) at 1300h; drinking water was available *ad libitum*.

Experimental design

The windows in the loose boxes had been closed for protection against the cold during the winter months (CW condition), but the horses could see outside the loose box through the grille door (Figure 1); the experiment was conducted in the early spring, and the average air temperature during the observation days ranged from 6.9 to 19.0°C. Each horse underwent seven days exposure to each of two conditions: i) a window ([40 × 260 cm; length × width] and 155 cm above the floor) at the back of the loose box was open, but no horses were within view (OW condition) and ii) the window in the loose box was opened and two thoroughbred horses, kept in the same stable as the subject horses, were turned out to the paddock next to the stable (Figure 1) from 0900 to 1530h and were within view of the subject horses (the paddock was 1.5 m away from the stable; thus, the subject horses had no tactile contact with the horses in the paddock) (OWH condition).

Half of the animals (one stallion and two geldings) were exposed to the OW and OWH conditions in this order. After this procedure, the remaining horses (two stallions and one gelding) were exposed to the OWH and OW conditions in this order.

The behaviour of each horse was recorded by video camera from 1300 to 1530h; firstly, in the CW condition for three days before the treatment of OW or OWH, as the control condition and, next, for the last three days of each week in the OW and OWH conditions. The behaviour was focal- and instantaneous-sampled at 30-s intervals. The behavioural categories are listed in the ethogram (Table 1).

Data analysis

The percentage of time spent in each behavioural category was calculated for each animal. Behavioural data were arcsin-transformed for normalisation and analysed with the use of a repeated-measures general linear model analysis of variance (ANOVA) using MINITAB 14 software (Minitab Inc, State College, PA, USA). A *post hoc* Tukey's HSD test was used to investigate the differences between the CW, OW, and OWH conditions.

Results

There were significant differences observed between the effects of the CW, OW and OWH conditions on the mean percentages of time spent in standing ($F_{2,10}$ = 6.49, $P < 0.05$), looking ($F_{2,10}$ = 9.93, $P < 0.01$) and bedding investigation ($F_{2,10}$ = 50.4, $P < 0.0001$) behaviour, (Figure 2) but not in the mean percentage of time spent in standing-sleep behaviour ($F_{2,10}$ = 0.09, $P > 0.05$) and the other behavioural categories. The mean percentage of time spent standing was greater during the CW than the OW (t = 3.25, $P < 0.05$) or OWH conditions (t = 2.98, $P < 0.05$) (Figure 2). The mean percentage of time spent in looking behaviour was less during the CW than the OWH condition (t = 4.43, $P < 0.01$) and less during the OW condition than during the OWH condition (t = 2.66, P = 0.06) (Figure 2). The mean percentage of time spent in bedding investigation behaviour was greater during the CW condition than during the OW (t = 6.45, $P < 0.001$) or the OWH conditions (t = 9.89, $P < 0.0001$), and greater during the OW than that during the OWH condition (t = 3.44, $P < 0.05$) (Figure 2).

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Table 1 Study ethogram.

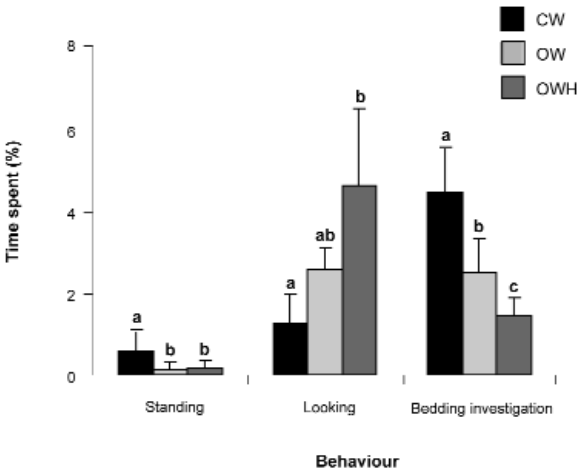
Category	Description of activities
Eating hay	Mastication, swallowing or prehension of hay
Eating bedding	Mastication, swallowing or prehension of bedding
Drinking	Drinking from water bucket
Walking	Movement of one limb or more
Standing	Standing without moving and one hind limb raised
Standing-rest	Standing with one hind limb raised and ears rotated laterally
Standing-sleep	Resting with ears rotated laterally and with a low neck position which indicates drowsiness or slow-wave sleeping (Waring 2003)
Resting-look	Standing with one hind leg raised and looking
Urinating	Urinating
Defaecating	Defaecating
Looking	Looking with ears rotated towards the outside of the stable
Bedding investigation	Smelling bedding or moving it with the nose
Others	Self-grooming, brushing flies off with nose or tail, sniffing at faeces and flehmen

Discussion

In this study, opening a window and having conspecifics within view of the subject horses produced significant behavioural differences in stabled horses. It was thought that the treatment effects would be either an increase in arousal or frustration, or a reduction in frustration. The treatments decreased the amount of time spent in bedding investigation behaviour. This is an appetitive behaviour (Ninomiya *et al* 2007a) and it is known that these increase with frustration (Hughes & Duncan 1988). It has been suggested that bedding investigation behaviour is related to a degree of frustration in stabled horses (Ninomiya *et al* 2004, 2007a). In this study, the amount of time spent in standing behaviour decreased during the period the window was opened, and looking behaviour increased while the conspecifics were within view. These results suggest that an open window decreased standing behaviour, due perhaps to the increase in air ventilation and the fact that having conspecifics within view stimulated social visual interactions between conspecifics and the stabled horses; thereby increasing looking behaviour. These treatments were thought, therefore, to have suppressed frustration in the stabled horses, serving as environmental enrichment.

These effects enhance animal welfare in terms of providing freedom from discomfort and freedom to express normal behaviour (Five Freedoms: FAWC [1992]; Mills & Clarke [2002]). But standing-sleep behaviour, which is associated with behavioural satisfaction (Ninomiya *et al* 2007b), did not increase after the treatments. It is thought, therefore, that these treatments may not have enough of an effect on behavioural satisfaction in stabled horses. In contrast, it is also possible that the time allowed for visual interaction with the conspecifics could have been too short to induce the behavioural satisfaction desired. Resting behaviour, including sleeping, will be also a response to suboptimal environments and, therefore, standing-sleep behaviour should not be used as the sole behavioural indicator in the assessment of welfare of stabled horses. In future, it would be useful to investigate the effects of a longer time period for visual interaction than investigated here, and to further investigate the effect of these treatments on more diverse groups of horses (different ages, breeds and sex).

Figure 2



The mean (± SD) percentage of time spent in each category of behaviour in all three experimental conditions (CW, OW and OWH). Means with different superscripts differ significantly ($P < 0.05$).

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Animal welfare implications

Although it has been reported that conspecifics within view of stabled horses decrease the amount of time stabled horses spent weaving (Cooper *et al* 2000; Mills & Davenport 2002), this study suggest that opening a window and having conspecifics within view were also effective in stabled horses that did not perform any abnormal behaviour.

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