The short-term effects of increasing meal frequency on stereotypic behaviour of stabled horses

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Abstract

In this study, we investigated the effect of increasing the number of meals of concentrate (whilst maintaining the same daily intake) on the behaviour of stabled horses with particular reference to stereotypic activities. The study was carried out on a working equestrian yard with stables for up to 50 horses. A pilot study was used to record incidence of stereotypic behaviour and to select subjects for the main study. In this, the behaviour of 30 warm-blooded horses was recorded during their morning (08:30 h) and afternoon (16:30 h) concentrate feeds. Whilst there was a low incidence of stereotypic behaviour (5.6% of scans) in the population, they were more commonly observed in the afternoon (7.1%) than the morning observations (4.2%; P < 0.05). The higher incidence in the afternoon observation appeared to be related to the lower availability of high fibre forage during the afternoon meal. In the main study nine horses were fed their normal ration of concentrate divided between two, four or six equally sized meals. Their behaviour was compared with seven control horses, which received two meals per day throughout the trial. As the number of meals increased, the treatment horses showed a decrease in oral stereotypies (P < 0.01), but an increase in weaving (P < 0.05) and nodding (P < 0.01) prior to feeding. The control group increased weaving, nodding and oral stereotypies (all P < 0.05) as their yard-mates received more meals. Consequently there was an overall increase in incidence of stereotypy in both treatment and control horses with the increase in meal frequency. The study, therefore, suggests that dividing the stabled horses’ concentrate ration into a number of smaller meals may be an effective means of reducing oral stereotypies, but that.
pre-feeding stereotypies may persist and that the practise may increase the frequency of stereotypic behaviour on unfed horses in visual contact.

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Keywords: Stabled horses; Meal frequency; Concentrate feeding; Stereotypic behaviour

1. Introduction

In the stabled horse, a number of lines of evidence link stereotypic patterns of behaviour such as weaving and crib-biting with feeding regime (Cooper and Mason, 1998; Nicol, 1999). Firstly, the feeding of high energy, low fibre concentrated feeds without access to high fibre forage has been associated with a higher incidence of stereotypic activities in both epidemiological studies (McGreevy et al., 1995; Nicol, 1999) and experimental studies (Gillham et al., 1994; Johnson et al., 1998). Secondly, the initiation of bouts of stereotypic behaviour has been associated with feeding time. Weaving, for example, has been found commonly to occur prior to receiving a concentrated feed (e.g. Cooper et al., 2000), whilst oral stereotypies have been described as a common post-prandial activity in horses with little fibre (e.g. McGreevy and Nicol, 1998).

This relationship between feeding and stereotypic activities can be explained in terms of control of feeding behaviour, conditioning or a combination of the two (Mason, 1991; Rushen et al., 1993; Lawrence and Terlouw, 1993; Cooper and Mason, 1998). Before feeding, the animal may perform species typical foraging or pre-feeding actions, such as rooting in pigs (Rushen et al., 1993) or locomotion in mink (Mason, 1991). These may persist in the captive animal’s behavioural repertoire if the feed fails to provide the necessary consummatory stimuli that would be experienced under natural conditions (Hughes and Duncan, 1988). Alternatively, the activities may become exaggerated within the animal’s behavioural repertoire if they are apparently rewarded by food (Savory and Mann, 1999; Mason and Mendl, 1997).

Thus in the horse, activities such as pawing, door kicking or weaving may initially arise as anticipatory, appetitive activities and then become a conditioned response to feeding time with repeated delivery of their meal shortly following their performance (Cooper and McGreevy, 2002). Following feeding, particularly if this involved a nutritionally inadequate meal, then feeding or foraging behaviour may persist (Terlouw et al., 1993; Haskell et al., 1996; Savory and Mann, 1999) and in the absence of appropriate means of expression, animals may direct this to apparently inappropriate substrates. In the stable environment this may mean re-direction of feeding behaviour to fittings, to wood-chewing (Haenlein et al., 1966; Krzak et al., 1991) or to crib-biting (McGreevy and Nicol, 1998) in horses with limited access to alternative forages (Cooper and Mason, 1998). Re-directed feeding activities may also become exaggerated, repetitive activities through reinforcement, if as some authors argue they are rewarding. This may be because they have general rewarding properties associated with coping with an adverse environment (e.g. Broom and Johnson, 1983) or because they address a specific adverse response to the feeding of concentrates (Lawrence and Terlouw, 1993; Nicol et al., 2002).
Elucidation of the role of motivation and conditioning on the ontogeny of stereotypic patterns of behaviour requires careful experimental investigation over the period of the activity’s development (e.g. Waters et al., 2002). As the two behavioural mechanisms may have synergistic actions (Hughes and Duncan, 1988; Lawrence and Terlouw, 1993), and many stereotypic activities appear to become emancipated from their original causes over time (Cooper et al., 1996), it is often difficult to predict the effect of changes in husbandry practice on the incidence of these behaviours (Mason, 1991). It has, however, been argued that husbandry regimes that are sensitive to the biological background of the animal may reduce the incidence of stereotypic behaviours (Mason and Mendl, 1997; Cooper and McGreevy, 2002).

Horses are naturally trickle feeders and eat for 16–18 h per day (Davidson and Harris, 2002; Goodwin, 2002). If concentrated feeding is deemed to be a necessary component of a horse’s management (for example, to maintain energy intake and therefore condition in performance horses), then spreading the delivery of feed over a longer time frame may reduce the incidence of stereotypies or other problems associated with concentrated feeds (Tinker et al., 1997; Nicol et al., 2002). Dividing the concentrate ration into many smaller meals may be one approach to achieving this. Firstly, with shorter gaps between meals the horse’s feeding motivation may be lower at the time of delivery of each meal. Consequently the horse may be less likely to perform exaggerated anticipatory activities prior to feeding. In addition, each individual small meal may be better able to satisfy the horse’s feeding motivation than a smaller number of interspersed large meals. In which case, feeding motivation may not persist following consumption of the concentrate and be less likely to be re-directed into oral stereotypies. Alternatively, the horses’ response to feeding may be independent of its feeding motivation, for example a conditioned response to feeding time or emancipated from its original causal factors. Under these circumstances, the horse may persist with a similar amount of stereotypic behaviour before and after each meal. Finally, more frequent feeding may strengthen the conditioned association between stereotypy and feeding. Consequently, there may be an increase in the frequency of these activities particularly prior to feeding.

This study investigated these possible outcomes by comparing the incidence of stereotypic behaviour in stabled horses on a conventional feeding regime of two meals per day with horses on more frequent feeding regimes. The project was carried out on a working equestrian yard where up to 50 horses could be observed. A pilot study was first carried out on 30 stabled horses to identify suitable horses for the main trial. From this population nine horses were selected for treatments where they were observed for 6 h per day on various feeding regimes. In addition nine control horses were selected to sample the behaviour of horses on the same yard that were not exposed to the altered feeding regimes.

2. Pilot study

A pilot study was carried out on 30 horses that were housed on the Caythorpe Court Equestrian Yard, Lincolnshire School of Agriculture, University of Lincoln. The majority of these horses were bedded with straw (20), though eight horses had paper bedding and two horses were housed on shavings. All horses were housed in conventional stables, which
measured 12 ft × 12 ft with a single conventional half-door entrance. Observations were carried out on Saturdays and Sundays when the yard was less busy than on weekdays and the routine more fixed. On these days horses were fed fresh forage (1.5–4.0 kg of haylage) and their morning feed (2 kg of feed in a bucket made up of 1 kg soaked sugar beet pulp, 0.5 kg chopped hay/straw and 0.5 kg of a commercial pelleted feed) between 08:20 and 08:30 h and were exercised between 10:00 and 12:00 h. During the early afternoon there was little activity on the yard and horses received their afternoon feed (2 kg of sugar beet, chopped hay/straw and pelleted concentrate) between 16:20 and 16:30 h and a further ration of fresh haylage (same amount as in morning) at 17:00 h (Table 1). On weekdays when horses received more work, there was an additional feed of 1 kg of the sugar beet, chopped hay, concentrate mix at 12:30 h.

The horses were observed from 08:00 to 09:00 h and from 16:00 to 17:00 h on both the Saturday and Sunday of a single weekend. During this time yard staff and students carried out normal day to day yard management. Each horse was scanned once every 2 min (30 scans per observation) and on each scan its behaviour was recorded according to a simple ethogram of 16 mutually exclusive categories of behaviour (Table 2). These covered general activity, feeding and other ingestive behaviour, stereotypic behaviour and other activities. Specific forms of oral stereotypy (e.g. wood-chewing, crib-biting, wall-licking) were rare and sometimes difficult to consistently differentiate. Consequently all incidences of stereotypic oral activities were added together for analysis.

2.1. Analysis

Data for each activity were converted to proportion of scans, then analysed using parametric statistics following angular transformation. The effects of day (Saturday versus Sunday) and time of day (morning versus afternoon) were analysed using a repeated measure ANOVA blocking data by individual horse. The effects of bedding type (straw, paper, shavings) was analysed using a one-way ANOVA on the average proportions for each horse over the four observations. Data is presented as percentage of scans in the results for clarity.

2.2. Results of pilot study

Horses tended to be active in the hour around feeding time. They spent most scans standing alert (38.6% of scans), with eating concentrate (14.9%), eating haylage (14.2%) and bedding directed activity (22.0%) also commonly observed. Horses were only recorded engaged in stereotypic activities in 5.6% of scans of which oral stereotypies were

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Typical events during observation periods in pilot study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning observation</td>
<td>Afternoon observation</td>
</tr>
<tr>
<td>8:00 Start morning observation</td>
<td>16:00 Start afternoon observation</td>
</tr>
<tr>
<td>8:20 Staff on yard: feeding begins</td>
<td>16:20 Staff on yard: feeding begins</td>
</tr>
<tr>
<td>8:40 Haylage added</td>
<td></td>
</tr>
<tr>
<td>9:00 Turning out begins</td>
<td>17:00 Haylage added</td>
</tr>
</tbody>
</table>
most common (2.1%), followed by nodding (1.9%) and weaving (1.3%). Door kicking or pawing was rarely observed (0.3% of scans) and horses spent little time on standing inactive (2.4%), locomotion (1.1%), drinking (0.3%) and other activities (0.8%) during the observation periods.

There was an effect of time of day on the percentage of scans spent standing alert, eating haylage, bedding directed behaviour and on oral stereotypy (Table 3). Horses spent less scans eating haylage in the afternoon observation than in the morning and more scans engaged in bedding directed activities (Fig. 1). Horses also spent more scans on oral stereotypes in the afternoon than the morning though there was no significant difference in the scans engaged in weaving or nodding (Fig. 2). There were no other differences in behaviour between morning and afternoon feeds and the day of observation had no effect on any activity.

Table 3
The percentage of scans (mean and S.E.) on standing active, feeding and stereotypic activities during the morning and afternoon feeds on the pilot study

<table>
<thead>
<tr>
<th>Activity</th>
<th>Morning</th>
<th>Afternoon</th>
<th>F, P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing alert</td>
<td>35.2 (4.0)</td>
<td>42.2 (4.8)</td>
<td>1.22 ns</td>
</tr>
<tr>
<td>Concentrate</td>
<td>16.3 (1.3)</td>
<td>13.5 (1.8)</td>
<td>1.01 ns</td>
</tr>
<tr>
<td>Haylage</td>
<td>22.7 (3.8)</td>
<td>5.7 (2.8)</td>
<td>35.3***</td>
</tr>
<tr>
<td>Bedding</td>
<td>14.5 (3.0)</td>
<td>29.5 (3.7)</td>
<td>20.7***</td>
</tr>
<tr>
<td>Weave</td>
<td>1.1 (0.7)</td>
<td>1.5 (0.5)</td>
<td>0.13 ns</td>
</tr>
<tr>
<td>Nod</td>
<td>1.6 (0.9)</td>
<td>2.2 (1.1)</td>
<td>0.37 ns</td>
</tr>
<tr>
<td>Oral</td>
<td>1.2 (1.0)</td>
<td>3.0 (1.2)</td>
<td>4.76*</td>
</tr>
<tr>
<td>Total stereotype</td>
<td>4.2 (1.5)</td>
<td>7.1 (1.8)</td>
<td>4.46*</td>
</tr>
</tbody>
</table>

* p < 0.05
*** p < 0.001
There were also significant differences in the behaviour of horses on different bedding types. Horses on shavings (2.7% of scans) and paper (2.4% of scans) tended to show more oral stereotypies than horses on straw bedding (1.2% of scans: $F_{2,27} = 3.82, P < 0.05$). There was, however, no difference in the incidence of bedding directed behaviour between bedding types and no other effects of bedding on the horses’ behaviour.

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2.3. Discussion and conclusion of pilot study

The principle findings of the pilot study were that there was a difference in incidence of eating haylage, bedding directed activities and oral stereotypy between the two meal times and an effect of bedding type on oral stereotypy. The effect of observation period could be due to a number of factors such as simply the time of day, the time since rest/turning out or the level of human activity on the yard, though the yard activity was broadly similar between the two observations. One management factor that did differ considerably between the two observations was the presence of forage in the stable, as during the morning feed horses consistently received their haylage within 10–20 min of the concentrate, whereas in the afternoon horses often received haylage 40 min following concentrate feeding. As a consequence, following the morning presentation of concentrate horses had free access to haylage, whereas in the afternoon many horses had limited access to forage during the observation period. This may not only explain the low incidence of haylage eating during the afternoon but also the higher incidence of bedding directed activities during the afternoon. This in turn may represent the perseverance of foraging motivation following a concentrate meal (Goodwin et al., 2002) and is consistent with other studies relating persistent oral activities including stereotypy to redirection of feeding motivation in horses with low availability of forage (Willard et al., 1977; Krzak et al., 1991; Johnson et al., 1998; McGreevy and Nicol, 1998).

Our findings also support those of other studies of the relationship between stereotypy and bedding, which indicate that stereotypies are less common in horses bedded on straw relative to paper or shavings (McGreevy et al., 1995; Mills et al., 2000). It must, however, be noted that in the current study the horses had already been allocated their bedding types for health (e.g. dust allergies) or other management reasons (e.g. so-called “bed-eaters”). So this was not a true test of the effect of bedding on stereotypy, and other potential behavioural effects of bedding type, such as incidence of bedding directed behaviour might have been masked by these management decisions.

3. Main study

3.1. Subjects

For the main part of the study we chose 18 horses from the pilot study. These had to be available for observation over a 6-week period and maintained on broadly similar feeding, exercise and husbandry routines prior to the main study. Half the horses were allocated to the treatment group, which were to receive the same quantity of concentrated feed in a larger number of meals and half the horses were allocated to the control group who had no change to their feeding regime. Treatment and control horses were selected to control for breed, bedding type and type of stereotypy. Comparison of the two groups using data from the pilot study revealed that there was no difference in their behaviour prior to the main study.
3.2. Treatment group

The nine treatment horses were to be exposed to the regime of similar quantity of feed per day but divided into more meals. The horses first received their daily 4 kg ration as two conventional 2 kg meals at 10:30 and 16:30 over two successive weekend days. Two weeks later they received their full ration as four equally sized 1 kg meals at 10:30, 12:30, 14:30 and 16:30 on two consecutive weekend days. After a further two weeks they received their full ration as six equally sized 0.66 kg meals at 10:30, 11:30, 12:30, 14:30, 15:30 and 16:30, again over two successive weekend days. In addition to feeding times, treatment horses were turned out or exercised between 08:00 and 10:00 in the morning and received their rations of haylage at 10:00 and 17:00. On days between observations the horses received the same husbandry as all other horses on the yard (see Section 2). Table 4 summarises the meals times and yard activity of the treatment horses.

3.3. Control group

A further nine horses from the yard with no change in their own management were also observed to record the effect of the additional meals on the rest of the yard. These horses received their normal 2 kg allowance of concentrate at 8:30 and 16:30 and haylage at 8:30 and 17:00. If they were exercised or turned out this was usually between 10:00 and 12:00 in the morning. After the first weekend of observations, two control horses were required for other purposes, which affected their meal times. These were therefore removed from the study and their data not used in analysis.

3.4. Data collection and analysis

The ethogram from the pilot study was again used and all horses were observed over six time periods on each test day. These were 10:00–11:00, 11:00–12:00, 12:00–13:00, 14:00–15:00, 15:00–16:00 and 16:00–17:00 (Table 4). There was little difference in yard activity at these times between Saturdays and Sundays except afternoon yard duties usually began at 16:00 on Saturdays and at 15:00 on Sundays. During observation periods the behaviour of each horse was scan sampled once every 2 min for 60 min (i.e. 30 scans per observation period). The total number of scans of each activity was calculated for the whole day and this was converted to proportion of scans then angular transformed for analysis using parametric ANOVA. Data from treatment and control horses were analysed separately to investigate the effect of meal frequency on the behaviour of the two groups.

Table 4
The six observation periods showing yard husbandry and treatment feeding during the trial

<table>
<thead>
<tr>
<th>Observation period</th>
<th>Yard activity</th>
<th>10:00–11:00</th>
<th>11:00–12:00</th>
<th>12:00–13:00</th>
<th>14:00–15:00</th>
<th>15:00–16:00</th>
<th>16:00–17:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two meals</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Four meals</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Six meals</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
4. Results

Horses spent much of the observation period standing alert (32.3% of scans), standing dozing (10.9%), eating concentrate (7.0%), eating haylage (17.4%) or in bedding directed behaviour (25.9%). Stereotypy only occupied 3.25% of scans, of which weaving made up 0.82%, nodding 1.50% and oral stereotypies 0.72% of scans. In addition a small number of scans of door kicking or floor pawing were also observed (0.21%), though box walking and wind sucking were not observed.

Table 5
The percentage of scans engaged in standing active, feeding activities and stereotypic activities by the treatment and control horses during the three weekends of the trial

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Active</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>36.5</td>
<td>29.8</td>
</tr>
<tr>
<td>Feed</td>
<td>5.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Hay</td>
<td>13.6</td>
<td>18.0</td>
</tr>
<tr>
<td>Bed</td>
<td>27.6</td>
<td>22.4</td>
</tr>
<tr>
<td>Weave</td>
<td>0.27</td>
<td>0.72</td>
</tr>
<tr>
<td>Nod</td>
<td>0.49</td>
<td>0.81</td>
</tr>
<tr>
<td>Oral</td>
<td>0.63</td>
<td>0.28</td>
</tr>
<tr>
<td>Kick</td>
<td>0.23</td>
<td>0.20</td>
</tr>
<tr>
<td>SS</td>
<td>1.62</td>
<td>2.21</td>
</tr>
</tbody>
</table>

* *p <0.05
** p <0.01
*** p <0.001

Fig. 3. The incidence of weaving, nodding and oral stereotypic behaviour in treatment and control horses when treatment horses are fed two meals per day.
There had been no overall difference in behaviour of the treatment and control horses in the pilot study or in the first week of observation when both received two meals per day, but differences in behaviour were apparent as meal frequency was increased in the treatment horses (Table 5). In these horses there was an increase in time spent feeding and eating haylage with more meals per day and a decrease in bedding directed behaviour. There was also a decline in oral stereotypies ($P < 0.05$) with the number of meals, but an increase in weaving ($P < 0.05$) and nodding ($P < 0.01$). Door kicking/pawing was not affected by meal frequency and overall there was an increase in stereotypic behaviour with number of meals. In the control population, the meal frequency had no effect on any non-stereotypic activity (Table 5). There was, however, an increase in weaving, nodding and oral stereotypic behaviours and consequently the total time performing stereotypy ($P < 0.01$).

Figs. 3–5 shows in more detail the incidence of stereotypic behaviour in the control and treatment horses in each observation period. With two meals per day the majority of stereotypy in both control and treatment horses is seen around the treatment horses’ feeding time between 10:00 and 11:00 and between 16:00 and 17:00 (Fig. 1). Stereotypy is rarely scanned during the rest of the day. With four meals per day, treatment horses show weaving and nodding at each mealtime (Fig. 2). Oral stereotypies are also seen at each mealtime but these are infrequent, leading to the overall decrease in oral stereotypy compared with two meals per day (Table 5). Control horses show peaks in weaving, nodding and oral stereotypies at the 10:30, 12:30, 14:30 mealtimes, even though they are not actually fed, in addition to their own 16:30 feed delivery. These associations between stereotypic behaviour and mealtimes are also seen with six meals (Fig. 3). The treatment horses again show a high incidence of weaving and nodding with each meal, but a lower incidence of oral stereotypic behaviour. Control horses again perform weaving, nodding and oral stereotypy at a high rate each time the treatment horses are fed (Figs. 4 and 5).

![Graph](image_url)

Fig. 4. The incidence of weaving, nodding and oral stereotypic behaviour in treatment and control horses when treatment horses are fed four meals per day.
5. Discussion

Increasing meal frequency affected the behaviour of treatment horses in a number of positive ways with a decrease in oral stereotypy and more time taken to eat their ration of concentrate. Oral stereotypic behaviours have been associated with gut dysfunction including colic (Hillyer et al., 2002), ulceration (Nicol et al., 2002) and low pH (Willard et al., 1977), whilst slowing rate of ingestion of concentrates may reduce these problems (Davidson and Harris, 2002). There were also more scans of eating haylage and less scans on bedding directed behaviour, an activity that is considered undesirable by some horse owners (McBride and Long, 2001; Goodwin et al., 2002) due to perceived risks of parasite infection or impaction (Davidson and Harris, 2002). These changes in behaviour suggest that with a larger number of smaller meals, there is a lower tendency to show feeding behaviour following each meal and to re-direct this to alternative, potentially undesirable substrates. This contrasts with the findings of studies with pigs (Haskell et al., 1996) and broilers (Savory and Mann, 1999), which increase oral stereotypies when fed a larger number of small meals.

In the study, unlike those involving pigs and broilers, the horses were provided with forage in the form of haylage prior to the first morning feed, which usually lasted the horses until early afternoon. Therefore, if the horses continue to be motivated to eat following a meal of concentrates, they will eat haylage whilst it is available rather than re-direct their feeding behaviour to less suitable substrates. This explanation is consistent with the findings of the pilot study and with other studies investigating the effect of provision of forage on diet selection (Goodwin et al., 2002) and stereotypic behaviour (Willard et al., 2002).

Fig. 5. The incidence of weaving, nodding and oral stereotypic behaviour in treatment and control horses when treatment horses are fed six meals per day.
1977; McGreevy et al., 1995; McGreevy and Nicol, 1998; Johnson et al., 1998). It also points to a simple practical measure to reduce oral stereotypic behaviour in stabled horses, namely providing suitable high fibre forage at feeding times, as concentrated feeds alone do not provide an adequate, functional diet for horses.

There was, however, an increase in weaving and nodding in the treatment horses and an increase in weaving, nodding and oral stereotypies in horses elsewhere on the yard. This appears to contradict the findings of McGreevy et al. (1995) owner-based epidemiological study of risk factors associated with equine stereotypy, where more frequent provision of forage meals reduced the risk of stereotypic behaviour. However, the horses’ behavioural response to provision of concentrate and provision of forage differs markedly, with a peak in stereotypy as concentrate feeding time approaches which is not seen prior to forage feeding times (Cooper et al., 2000). In our study, the treatment horses appeared to rapidly learn the new feeding regimes and performed pre-feeding actions in the anticipation of meals throughout the day (Figs. 3–5). This suggests weaving and nodding were an anticipatory response to feeding time (Cooper and Mason, 1998; Nicol, 1999) which may have been either learnt as a result of the feed reward or because the motivation to perform horse’s species specific pre-feeding behaviour has not been extinguished in the stable environment (Hughes and Duncan, 1988; Cooper and McGreevy, 2002). In this study we made no attempt to alter pre-feeding cues (apart from time of day) and removal of these cues may have reduced stereotypic behaviour particularly prior to feeding. This has been achieved in dry sows, where feeding without cues effectively extinguished pre-feeding stereotypic behaviour (Terlouw et al., 1993). Removal of overt pre-feeding cues such as activity in the feed room may be a means of reducing stereotypy in the short-term, though the usefulness of this approach in practise is debateable, as it may be difficult to completely remove pre-feeding cues from working yards and because the horses with time may learn to associate other cues with feeding and consequently persist with anticipatory activities.

Another approach to providing horses with their concentrated feed in a larger number of discrete meals is the use of operant foraging devices (Young et al., 1994). These devices allow horses to work for their food and have been found to produce some desirable changes in behaviour such as an increase in the time spent foraging (Winskill et al., 1996). Their effect on stereotypic behaviour is, however, equivocal. There is good evidence that they reduce pre-feeding stereotypies such as weaving (Henderson and Waran, 2001). This could be because of the removal of cues that predict feeding time, or because the horse can express anticipatory or appetitive feeding actions in a more meaningful way, such as working on the device to deliver feed. The evidence that they reduce oral stereotypies is less clear as horses, with no overall decrease in frequency compared with horses fed conventionally (Henderson and Waran, 2001). This may be because the performance of oral stereotypies is inherently associated with consumption of hard feed so animals are motivated to perform the activities after each meal (Lawrence and Terlouw, 1993; Savory and Mann, 1999). Under these circumstances, increasing mealtimes may lead to an increase in post-feeding stereotypy, unless the individual meal-sizes are large enough to be nutritionally satisfactory (Haskell et al., 1996) without being so large as to cause digestive dysfunction (Tinker et al., 1997), or the horses have access to an alternative more acceptable means of expressing feeding behaviour such as forage (Goodwin et al., 2002).
The increase in weaving, nodding and oral stereotypies in the control horses appeared to result from the visual cues of other horses being fed without the act of feeding themselves. The timing of these activities was centred on the feeding of the treatment horses rather than distributed across the day (Figs. 3–5), with weaving commonly preceding feeding times and nodding and oral stereotypies performed as the treatment horses ate their meals. These activities in the control horses may have represented a form of observational learning, such as observational conditioning (Sweeting et al., 1985; Nicol, 1995). In time this may decline as the association between the cues and feeding itself became extinguished. However, this may take many exposures for horses that have been performing pre-feeding stereotypic behaviour for long periods and is unlikely to be seen favourably by horse owners. Furthermore, where horses are exposed to feeding cues, but not fed, then the increased incidence of stereotypic may be an indication of behavioural frustration or conflict (Broom and Johnson, 1983).

This study demonstrates the difficulties associated with attempting to identify and resolve the causal factors underlying the performance of stereotypic behaviour in stabled horses or indeed other captive animals. It suggests that reducing the amount of concentrate fed at each meal has the potential to reduce oral stereotypy in stabled horses, but that this may be negated by an increase in pre-feeding stereotypic behaviour if pre-feeding cues are not removed. Furthermore, exposing stabled horses to feed cues without actually feeding them leads to an increase in the incidence of their stereotypic activities.

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References


