REDUCING EQUINE STEREOTYPIES USING AN EQUIBALL™

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Abstract *Animal Welfare 2001, **10:** 73-80*

It is believed that environmental enrichment techniques can play an important part in creating suitable captive environments for horses. There has, however, been little scientific investigation into the effectiveness of 'stable-toys' which claim to reduce the performance of equine stereotypies. This study investigated the effect of a foraging device known as 'The Equiball™' on equine stereotypies. Six horses were given their evening feed in an Equiball, and the occurence of stereotypic behaviour recorded using scan sampling of video observations. Pre-enrichment, horses spent a mean (± SD) of 5.27 ± 8.17 per cent of their time in the stable performing stereotypies; and significant individual variation in mean time performing stereotypic behaviour was found ($P < 0.05$). Several peaks in stereotypy over the day were found, the two main ones corresponding to the times before feeding. A reduction in stereotypic behaviour in five horses, and a small increase in stereotypic behaviour in one horse was observed during enrichment. During enrichment, there was an overall trend for stereotypic behaviour to decrease ($P < 0.1$). When used in conjunction with other measures such as behaviour therapy, companionship, increased exercise, and so on, the Equiball may help to create an environment less likely to lead to the development of stereotypic behaviours.

Keywords: *animal welfare, enrichment, Equiball™, horses, stereotypic behaviour*

Introduction

Although we do not yet fully understand the causal factors relating to equine stereotypies, it is believed that environmental enrichment techniques can play an important part in creating suitable captive environments for horses (Waran & Henderson 1998). However, while there are numerous 'stable toys' which claim to reduce behaviours such as crib-biting and weaving, the effectiveness of most of these devices has not been scientifically assessed. One enrichment method that has been tested scientifically is a foraging device known as 'The Equiball™'. The Equiball increases species-typical foraging behaviour in stabled horses (Winskill *et al* 1996) and it has been suggested that it may have potential to reduce the performance of stereotypic behaviours (Winskill *et al* 1996).

Time spent feeding is believed to be one of the most important causal factors in equine stereotypies. In the wild, horses will feed for short periods throughout most of the day and night (Frape 1986), whereas most domesticated horses receive all their daily food in just two concentrated rations. While this may satisfy the horses' nutritional requirements, reduced time manipulating and ingesting food may contribute to the development of stereotypies. Indeed, it has been found that time spent performing abnormal behaviour is negatively correlated with time spent foraging (Marsden 1993) and time spent feeding has the single most significant effect on the performance of stereotypies in the horse (Marsden personal communication 1995).

Turning a horse out to pasture is one way to reduce stereotypies, but may not always be possible. Even if a horse is turned out to pasture, stereotypies are likely to return when the horse is put back in its stable. Traditionally, equine stereotypies have been controlled by devices such as crib-collars, anti-weave bars, and shock-collars, which physically prevent an animal from performing the behaviour. Physical prevention of stereotypies has, however, been found to lead to a rise in corticosteroid levels (Kennes & De Rycke 1988), and preventing a horse from performing a stereotypy in this way is likely to increase frustration. Some researchers feel that stereotypic behaviours are mechanisms that help an animal to cope with particular situations or environments, and that if animals' expectations are not met by their environment they will work (stereotype) to change their internal state. Therefore, if we are to treat equine stereotypies, it would seem better to aim to examine the cause of the behaviour, rather than just the symptoms. A behavioural enrichment technique that increased foraging time (without increasing food intake) could be a useful tool in preventing and/or reducing equine stereotypies. This study investigated whether using an Equiball could reduce the performance of stereotypic behaviour in horses.

Methods

Six horses known to display stereotypic behaviour were chosen as study animals (Table 1). Horses 1–5 were stabled for at least 20h per day; horse 6 was stabled for approximately 15h per day. Visual contact with horses in adjacent stables was possible for all study animals.

Table 1 **Details of the study animals. For a detailed description of each stereotypic behaviour category see Winskill *et al* (1995; 1996).**

Horse	Breed	Sex	Age	Bedding	Stereotypic behaviour
1	Anglo-Arab	g	20	S	weave
2	Exmoor /TB	g	15	SH	crib-bite
3	TB	m	11	S	weave
4	TB	g	4	S+SH	crib-bite
5	Dartmoor	m	3	S	wind-suck
6	TB	m	9	S	box-walk, paw, wood-chew

TB =thoroughbred, g = gelding, m= mare, S = straw, SH = shavings.

Enrichment device

The enrichment device was the modified 'Edinburgh Foodball' (British Patent No 9200499.3), as used by Winskill *et al* (1996). The modified Edinburgh Foodball for horses is now known as 'The Equiball™' (STT Ltd, Cupar, Scotland). This cylindrical device is designed to give small food rewards as it is pushed around the floor by the horse. It is filled with pelleted food cubes that can be dispensed through a number of small holes. Food can be obtained from the ball in two ways: by rolling the ball along the floor, or by spinning the ball

on its end. A detailed description of the mechanics of the Foodball is given by Young *et al* (1994).

Experimental protocol

Any devices normally used to control stereotypic behaviour, such as a weaving frame or cribbing strap, were removed, with the owner's permission. These devices were removed from the stables 1 day before the start of the study, for the duration of the study. As Winskill *et al* (1996) found no day-to-day variation in equine behaviour other than that related to Equiball use, we exposed each horse to two test periods: baseline (BS) and enrichment (EN).

Baseline (days 1–3): Normal management practices for each horse were followed for 3 days. Each horse's normal quantity of concentrated feed and hay was fed twice daily. Water was available *ad libitum*, with water intake (measured as the change in the volume of water in their water container) recorded twice daily.

Enrichment (days 4-8): On day 4, approximately 1h before the usual evening feed time, the study animal was trained to use the Equiball (as described by Winskill *et al* [1996]). The Equiball was then removed from the stable, and filled with a weight of Spillers™ Hi-Fibre Cubes (Spillers Feeds, Brighton, UK), calculated to be nutritionally equivalent to each animal's baseline evening feed. After training each horse to use the Equiball, it was then placed in the stable daily during the enrichment period, as a substitute for the usual evening feed of concentrates. The Equiball was only removed from the stable to be refilled, and remained in the stable when empty. Apart from the substitution of the Equiball for the evening concentrate feed, each horse's normal feeding practices were maintained; water was available *ad libitum* and water intake was recorded. Any food remaining in the Equiball in the morning was added to the morning concentrate feed.

Behavioural observations

A video camera (Panasonic 24 Time-lapse Recorder; Heriot Videos, Edinburgh, UK) was mounted in one corner of each stable, and 24h time-lapse video recording used to obtain a continuous record of behaviour. Stable lights were switched on throughout the study to facilitate 24h-observations. The horses were familiarized with this lighting regime for 4 days prior to the start of the study.

Two-min instantaneous scan sampling from the videotapes was used to record when horses performed a stereotypy, or were engaged in Equiball activity. An animal was recorded as performing a stereotypy during a scan if it was observed performing any of the stereotypic behaviours listed in Table 1 in the 5s either before or after the scan (see Winskill *et al* [1995; 1996] for a complete description of the stereotypies). Equiball activity was recorded when an animal was either manoeuvring the ball, feeding from food dispensed from the ball, or searching for food within a 1m radius of the ball during a scan (see Winskill *et al* [1996]).

Statistical analysis

Data were converted into the percentages of observations per hour that horses spent performing stereotypical behaviour and using the Equiball. Data were then averaged across treatments within horses for each hour. Kendall's coefficients of concordance (W) were calculated to analyse the degree of association between individual levels of stereotypy, and levels of Equiball use. Wilcoxon signed ranks tests were used to determine the significance

of differences in stereotypic behaviour between baseline and enrichment treatments. (Siegel & Castellan 1988). In all tests, n = 6.

Results

Stereotypic behaviour

Pre-enrichment, horses spent a mean of 5.27 ± 8.17 per cent of their time in the stable performing stereotypies. There was significant individual variation in mean time performing stereotypic behaviour ($W = 0.554$, $P < 0.05$). Several peaks in stereotypy over the day were found, the two main peaks corresponding to the times before feeding (Figure 1).

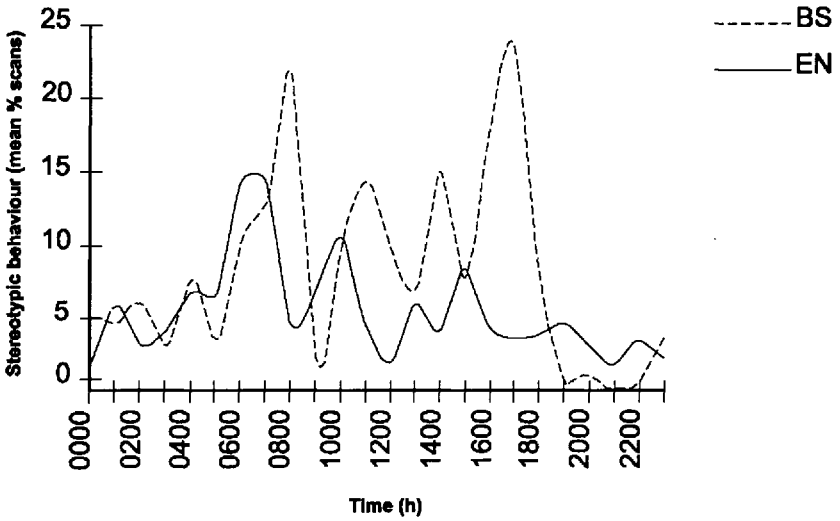

Figure 1 **Diurnal pattern of stereotypy during baseline (BS) and enrichment (EN) periods.**

Equiball use

During enrichment, horses used the ball for a mean of 6.3 ± 9.23 per cent of scans in the stable. This equates to using the Equiball for approximately 72min each day. All horses tended to use their nose to push the ball, and occasionally a foreleg. There was significant individual variation in Equiball use ($W = 0.497$, $P < 0.05$). Most horses used the ball as soon as it was filled, and ball use generally declined overnight, as the ball emptied, to reach a minimum value at 0800h. Only a small amount of ball use was seen once the device was empty (between approximately 0800h and 1600h).

Several individual patterns of ball use were observed: i) using the ball continually until almost empty; ii) alternating between bouts of eating hay and bouts of ball use; and iii) only using the ball once all the hay had been eaten. It was interesting to observe that horses tended to use the Equiball more in straw-covered areas of the stable, than in the cleared concrete area (where it would be easier to find dispensed food). It was also noticed that the time spent using the Equiball declined over the enrichment period, which appeared to be the result of horses becoming more efficient in their use of the ball.

Effect of the Equiball on stereotypic behaviour

A reduction in stereotypic behaviour in five horses, and a small increase in stereotypic behaviour in one horse was observed during enrichment (Table 2). During enrichment, there was an overall trend for stereotypic behaviour to decrease ($T = 2$, $P < 0.1$). During enrichment, maximum levels of stereotypy were reduced, in particular the two large peaks originally found prior to feeding (Figure 1). It appeared that between 1000h and 1830h, levels of stereotypy were consistently lower during enrichment, and between approximately 1830h and 2230h more stereotypic behaviour was seen during enrichment than during the baseline period (this was mainly seen in two individuals, horses 2 and 4, which were crib-biters).

Table 2 Performance of stereotypic behaviour by individual horses. (BS – baseline period; EN – enrichment period.)

Horse	Total observation time (min)	Stereotypic behaviour (mean ± SD % scans)	
		BS	EN
1	9826	20.8 ± 27.7	14.4 ± 12.26
2	9312	8.3 ± 7.2	6.9 ± 4.8
3	10247	16.4 ± 14.7	8.7 ± 9.2
4	9948	0.6 ± 1.1	1.6 ± 2.1
5	9746	3.7 ± 3.9	2.9 ± 4.2
6	7650	0.04 ± 0.11	0.03 ± 0.1
All	56729	8.02 ± 4.93	5.27 ± 8.17

Effect of the Equiball on water intake

No significant difference was found between baseline and enrichment rates of water intake ($T = 8$, $P = 0.675$).

Discussion

A previous study (Winskill *et al* 1996) found that horses spent approximately 3 per cent of their time in the stable ingesting concentrates when fed two meals a day, which equates to approximately 30min day^{-1}. The horses in this study, were normally observed spending approximately 10min feeding at each concentrate meal (J Henderson unpublished data). When the same horses were given their evening feed in the Equiball, however, they spent 6.3 per cent of their time in the stable involved in Equiball activity, which equates to approximately 72min day^{-1}. Therefore, giving the horses their evening feed in the Equiball extended foraging time from approximately 20min to 72min, which is an increase of 260 per cent.

We found that when horses were given their evening feed in the Equiball, there was a trend for stereotypic behaviour to be reduced. Although this reduction was not statistically significant, the Equiball still appears to be a useful enrichment device, since five out of six horses displayed a reduction in stereotypy, which must be considered an improvement in welfare.

There was individual variation in the effect of the Equiball on stereotypic behaviour. It appeared that the Equiball was most beneficial in the treatment of food-related locomotory stereotypies (eg the weaving which occurs before feeding). The most noticeable individual improvement during enrichment was seen in horse 1 (with a reduction of stereotypic weaving from 20.8% of BS scans to 14.4% of EN scans), despite his not learning to use the Equiball until late in the enrichment period. This horse's weaving appeared to be related to

anticipation of feeding. By extending feeding overnight, the Equiball appeared to reduce stereotypies by reducing levels of feeding motivation in the morning.

The reduction in weaving during enrichment seen in horse 3 (from 14.4% of BS scans to 8.7% of EN scans) may not have been directly related to Equiball use, as virtually no physical interaction with the device was seen during enrichment. However, it may have been due to the presence of a novel object in the stable. Another explanation is that the decrease in stereotypy was caused by the increased human contact facilitated by the enrichment routine, as this animal did not weave while people were in the stable. A lack of feeding motivation appeared to be the reason for this horse not using the Equiball.

Between approximately 1845h and 2240h (ie after the evening feed), there was consistently more stereotypic behaviour during enrichment. There are a number of explanations for this. First, all the horses were conditioned to expect a bucket-feed twice a day. During enrichment, some horses appeared frustrated by the sight of other animals getting their usual evening feed. This may have caused an increase in stereotypy, as frustration is thought to be one factor associated with the development of stereotypies in horses (Kiley-Worthington 1983). A solution to this would be to give the Equiball to animals in addition to a small bucket-feed. Levels of stereotypy could also have increased due to the removal of crib-collars and anti-weave bars 1 day before the baseline treatment commenced. A third explanation for the increased stereotypy during enrichment is that feeding on concentrates over a longer period led to increased release of β-endorphins, which has been found to increase crib-biting (Dodman *et al* 1987). An examination of individual changes in stereotypy supports this theory, with noticeable overnight increases in stereotypy seen in the two crib-biters (horses 2 and 4), but not in the weavers (horses 1 and 3). However, it should be noted that while increased overnight crib-biting was observed in horse 2, its daytime crib-biting was reduced. This decrease may have been the result of increased exercise overnight through Equiball use; it has been shown (in human psychology) that exercise may lead to a reduction in mild anxiety, depression, and stress (Plante & Rodin 1990).

Equiball use was highly reinforcement-dependent. Most horses would rarely approach the ball once it was empty, apart from short bouts when they appeared to be 'checking' whether it had been refilled (this behaviour was most often seen as feeding time approached). This indicates that for equine enrichment devices to be useful, they must offer some reward for the animal, and cannot rely on novelty alone. The general decline in Equiball activity during enrichment may indicate that animals were using the ball less, as its novelty reduced. Alternatively, it could mean that horses were becoming more efficient in the way in which they fed from the ball.

The horses appeared to be highly motivated to search for their food in the straw. An increased risk of abnormal behaviour when bedding types other than straw are used has been identified (McGreevy *et al* 1995). Therefore, it appears that straw itself may be a useful aid to preventing the development of stereotypies in horses, as reported for sows (Spoolder *et al* 1995).

Our study has illustrated how variable equine behaviour problems are; each having its own causal factors and manifestations. Significant intra-individual, as well as inter-individual variation in the performance of stereotypies was observed. In this study, there appeared to be five main factors influencing stereotypy: i) increased arousal due to anticipation of feeding; ii) increased arousal due to the presence of other horses and/or humans (a) near the stable, and (b) in the stable; iii) removal of neighbouring horses; iv) physical restraint; and v) low levels of environmental stimuli. Anticipation of feeding was often a trigger for both oral and

locomotory stereotypies. It was interesting to note that while considerable frustration-related behaviour was seen in one crib-biter before feeding (horse 2), crib-biting did not often occur at this time. During general observations it was noted that stereotypic behaviour was reduced in all horses whenever hay was available, and weaving was usually associated with increased levels of arousal.

In this study, a stereotypy with the same visible characteristics appeared to have very different causes in individual horses. When planning the treatment of stereotypies it may, therefore, be better not to use purely descriptive categorizations of behaviour patterns, but to place individuals into categories according to known causes or similar aetiologies. There is an obvious need to know more about the development of different types of equine stereotypies, and to conduct Equiball studies using a larger number of horses to better understand the effect of the device on equine behaviour.

Although use of the Equiball is unlikely to 'cure' equine stereotypies, it has been shown to reduce their performance, and may help disrupt the pattern of established stereotypies, which become very fixed in their nature over time (Cooper & Odberg 1991). The treatment of equine stereotypies requires an assessment of each individual horse's history, to gain an overall picture of how stereotypies may have developed (Marsden personal communication 1995). Thus, the Equiball has potential as part of a combined treatment programme for affected horses. When used in conjunction with other measures such as behaviour therapy, companionship, increased exercise etc, the Equiball may help to create an environment that is less likely to lead to the development of stereotypic behaviour. The Equiball may be particularly useful in reducing the risk of stereotypy at times when (due to lack of storage space, expensive hay etc) owners wish to feed horses a pelleted, mainly concentrated, grain-based diet containing little long-stemmed fibre, such as hay. This study also indicates that the Equiball can be particularly useful as a short-term distraction to mildly 'stressful' events; for example, to prevent separation anxiety. It is likely that the Equiball has potential for preventing the development of stereotypies when horses have to be stabled for long periods of time, and clearly more long-term research into this area is needed.

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