Afwijkend gedrag

Cooper & McGreevy, 2002: The reasons for seeking to reduce the incidence of stereotypic behaviour in horses can broadly be divided into two areas. These are, firstly the undesirable physical or behavioural consequences of the activities for the horse and secondly the attitudes of horse owners. Reasons that fall within the former area offer good grounds for seeking to reduce stereotypy so long as the preventative measures are effective and so long as the costs of the treatment to the horse do not outweigh the benefits of prevention. Owner attitudes may seem to be not a good reason for treatment, however, they are a major factor in horse husbandry and ethologists and veterinarians need to be sympathetic to the culture of horse owners when delivering practical advice on managing stereotypy (McBride & Long, 2001). Performing stereotypies incurs costs on the horse in terms of time and energy. If stereotypies are merely a time-filling activity, then there should be little concern about an increase in time spent on their performance. If, however, performing stereotypy impinges on other activities (such as eating or resting) then it may interfere with the horse's ability to respond to its environment. All non-feeding stereotypic behaviours waste energy, so there is usually a reduced ability to sustain bodyweight in any horse that spends a significant amount of time in such activities rather than feeding and resting (McGreevy *et al.*, 2001). Weaving is also thought to cause excessive wear and tear on the hooves and the musculo-skeletal system. Boxwalking in a single direction can cause lateralised atrophy and hypertrophy of the lumbar musculature. Self-mutilation can lead to bite wounds and secondary infections. Crib-biting has been associated with digestive disorders, tooth erosion and failure to thrive. Unless specially modified sites are provided, tooth wear is an inevitable consequence of crib-biting. While such tooth wear is unlikely to be associated with pain since nerves are not exposed, it can result in difficulty in grasping and chewing forage, and this may ultimately result in loss of body condition.

Although the link between wind-sucking and/or crib-biting and digestive disorders such as colic has yet to be proved, it is commonly assumed by both horse owners and veterinarians (Ritzberger-Matter & Kaegi, 1998). This may be because the incidence of colic is low in both stereotypic and non-stereotypic populations of horses, but that the risk of colic is cited when justifying surgical or physical prevention of crib-biting and 'wind-sucking'.

Even if a relationship between digestive disorders and stereotypy were to be found, this would not mean stereotypies cause these problems as they may be correlational, with both symptoms sharing another root cause or it may even be that the gut disorder leads to stereotypy. For example, if low fibre diets cause high gut acidity, then increased oral activity may be a means of lowering acidity by saliva production (Nicol, 1999a; Nicol, 1999b). This is supported by the finding that crib-biting horses experience more gut erosion and mucosal erosion in comparison to non-cribbers (Nicol *et al.*, 2001). If the benefits to the horse of allowing the crib-biting outweigh the concerns felt by owners then it could be argued that allowing continued performance is desirable to outright prevention (McGreevy & Nicol, 1998a). This could be achieved by allowing affected horses to crib-bite, but to provide with adequate foraging opportunities. The damage done to incisors during a lifetime performing this behavior could also be minimised by the provision of cushioned cribbing-bars throughout the horse's environment. However, this would meet with opposition from those who feel that crib-biting is directly linked to an increased risk of flatulent colic. This supports the need for good education programmes for horse owners when introducing new practises. In some countries, stereotypic activities such as crib-biting and weaving are considered an 'unsoundness' when vetting horses (Hayes, 1968). The reason for this is the popularly held view that other horses may mimic these and other stereotypies, creating additional problems for the owner. Because of the perceived risk of copying and because stereotypies are thought to be associated with health and performance problems, horses exhibiting them are often further isolated from other horses, for example stabled

out of sight of conspecifics. This may exacerbate the behaviour if social isolation is a factor that increases stereotypy. Furthermore, isolating horses complicates management and contributes further to the unpopularity of stereotypic individuals and is a significant reason for their reduced market value. In spite of the desire to prevent stereotypies for aesthetic and occasional health reasons, no traditional remedy that is effective for every crib-biter has yet been found. In the search for a permanent cure for stereotypic behaviour, all kinds of prevention are regularly tried. When the behaviour is established, the motivation devices aimed at thwarting it.

Lane, 1998: There is confusion in the veterinary literature concerning the definition of oral based stereotypies 'crib-biting' and 'wind-sucking' in horses and it is a matter of semantics whether horses are 'crib-biters' when they grasp fixed objects in the stable or field environment to facilitate the arching of the neck and emission of a characteristic pharyngeal sound, or 'wind-suckers' when the behaviour is performed without grasping objects between their incisor teeth. For the purposes of this presentation the two terms will be used as if they are synonymous. It has been widely stated that horses which exhibit either of these abnormal behavioural patterns swallow air (aerophagia) and it is also believed that the introduction of large quantities of air into the alimentary tract predisposes horses which crib-bite to colic andor to poor bodily condition.

The conditions in force at the leading public auctions of Thoroughbred horses in the United Kingdom and Ireland state that the sale of a horse shall be invalidated if 'it is a wind sucker, i.e. habitually swallows air whether in association with grasping fixed with its incisor teeth or not, or has been operated upon for the correction of this condition, including crib-biting'. Thus, there are important medico-legal reasons for accuracy in the description of the events which occur during the stereotypy. The purpose of this presentation is to report the results of endoscopic and fluoroscopic studies of the pharyngeal structures of horses during the act of crib-biting/windsucking. The major conclusion has been that deglutition does not occur as part of the stereotypy and that 'aerophagia' is an inappropriate synonym for this stereotypy.

Endoscopic and fluoroscopic studies during crib-bitingwind-sucking
The investigation reported here comprised the study of a group of known crib-biters by making separate fluoroscopic and endoscopic recordings of the pharyngeal region during the performance of the oral based stereotypy. The horses were stood in stocks for both stages of the investigation and a wooden bar covered with coconut matting was placed at the front of the stocks to provide an inducement to crib-bite. Complete cubes were also offered from a bucket adjacent to this bar. Fluoroscopic recordings of 6 horses performing a total of 102 stereotypic sequences were made and endoscopic records of 70 similar sequences from 4 horses, 3 of which had been used in the radiographic study, were also collected for analysis. In advance of the investigations the subjects had been examined by routine endoscopy and palpation to eliminate animals with identifiable structural or functional anomalies of the upper respiratory tract.

Video-fluoroscopic finding: Throughout the studies the recorded events were similar for each crib-biting/wind-sucking sequence in all of the horses used. Initially the upper oesophageal sphincter (the crico-pharynx) was closed and there was no air in the oesophagus distally. Immediately before the first stereotypic sequence appetitive behaviour was noted in the form of movements by the base of the tongue and by the soft palate as the horse licked the 'cribbing bar'. The onset of each stereotypic sequence was seen as retraction of the larynx caudally and slightly ventrally. Throughout each sequence the distance between the ventral border of the oesophagus and the dorsal margin of the trachea remained constant, the epiglottis remained in a resting position parallel with the tongue and the soft palate was in its normal sub-epiglottic position maintaining contact with the tongue rostrally. Thus continuity was invariably maintained between the nasopharynx and caudal nasal chambers. Coinciding with the emission of the characteristic noise associated with crib-biting/windsucking, the

proximal oesophagus abruptly filled with air to a maximal dorso-ventral diameter approximately 80% that of the diameter of the trachea. This was largely achieved by ballooning of the dorsal oesophageal wall rather than by movement of its ventral margin. The radiographic contrast provided by air in the nasopharynx and proximal oesophagus enabled observations of the palato-pharyngeal arch. The caudal pillars of this structure became dorsally displaced as oesophageal distension occurred and the crico-pharynx opened. The length of the crico-pharynx reduced causing a further increase in the dorso-ventral diameter of the rostral oesophageal sphincter. Maximal distension of the oesophagus coincided with the initial opening of the cricopharyngeal sphincter. During the process of eflation there was little evidence of primary or secondary oesophageal peristalsis and a ratio of one air bolus removed by peristalsis to 12 upper oesophageal distensions was recorded. Thus, it was concluded that the air returned to the pharynx by spontaneous deflation after most stereotypic sequences.

Endoscopic findings: Endoscopy confirmed that during each crib-bite the larynx was retracted caudally and that the rima glottides remained open with no active adduction or abduction by the arytenoid cartilages or vocal folds. The posterior pillars of the palatopharyngeal arch became visible as a curved structure which moved dorsally from its resting position caudal to the apices of the corniculate processes. The ventral border of these pillars was seen to vibrate in synchrony with opening of the oesophageal sphincter and the emission of the characteristic grunt. Again, the rostral margin of the palato-pharyngeal arch was seen to remain in a subepiglottic position throughout the stereotypic sequences and there was no constriction by the pharyngeal musculature on any occasion.

Conclusions

1. Deglutition is not a feature of crib-biting/wind-sucking: the events recorded during the stereotypic sequences did not remotely resemble swallowing.

2. The source of the characteristic noise associated with this oral based stereotypy results from an in-rush of air into the proximal oesophagus following dilation of the crico-pharyngeal sphincter.

3. The movement of air results from pressure gradients created in the soft tissues of the throat rather than by compression of the pharyngeal lumen.

4. Only a small proportion of the air which distends the upper oesophagus is conveyed towards the stomach.

Discussion

Although the investigation outlined above has clarified some of the events which occur in the pharynx and upper oesophagus during oral based stereotypic sequences, it has not addressed the motivation for the behaviour. Crib-biting, wind-sucking and grasping all include characteristic arching of the neck accompanied by contraction of the muscles on the ventral aspect of the throat. It seems likely that this muscular effort creates the pressure gradient in the oesophageal lumen and a resultant distension of the cranial oesophagus with or without the emission of a grunt. It is conjectured that is is the distension of the viscus which is the ultimate objective of this stereotypy and that this is more likely to be the source of gratification than grasping objects between the incisor teeth. This in turn begs the question as to what physiological mechanism might render such a distension a behavioural 'need'. The efficacy of surgical procedures oriented to ablate or denervate the strap muscles in the ventral throat region can be explained by the suggestion that it is the contraction of these muscles which creates a pressure gradient between the oesophageal lumen and the pharynx. Observations of crib-biting horses in the study above revealed little primary oesophageal peristalsis and only a small number of air boluses conveyed towards the stomach by secondary peristalsis. In addition in order to perform the studies, crib-biting was provoked by offering palatable food and thus, more swallowing may have taken place than during spontaneous demonstrations of the stereotypy. Thus, why is there an accepted association between crib-biting/wind-sucking and tympanitis colic? One explanation may be that the diagnosis is incorrect in

the first place. In horses with fourth branchial arch defects (4-BAD) the crico-pharyngeus and thyro-pharyngeus muscles are frequently absent or vestigial. This congenital defect predisposes afflicted horses to tympanitic colic. Radiographic studies of deglutition in horses with this form of 4-BAD shows a continuous column of air from the pharynx to the cervical oesophagus and the caudal propulsion of air by peristalsis is a consistent feature. This constitutes true aerophagia and the attendants of horses afflicted with this congenital disorder frequently believe that they are 'wind-suckers' because of the eructation\ noises which they occasionally emit. Accurate definitions in this area of behaviour are necessary in the context of horse sales and the results reported here confirm that the conditions of sale currently in use at public auctions require amendment if unnecessary litigation is to be avoided.

Marr (2012): Crib-biting has been associated with colonic obstruction (Hillyer et al., 2002) and epiploic foramen entrapment (Archer et al., 2004), while a study in a group of horses with various surgical and medical diagnoses showed that cribbing and windsucking were significantly associated with colic in general but not with any specific form of colic (Malamed et al., 2010). In the same study, investigators were unable to show any relationship between other repetitive behaviours or an anxious temperament and colic (Malamed et al., 2010).

Wickens & Heleski, 2010: Many equine behavior and welfare scientists remain in agreement that management of crib-biting horses should focus on addressing the suspected influential factors prior to attempts at physical prevention of the behavior.
Many owners attempt to physically prevent horses from performing crib-biting behavior (McBride and Long, 2001; Wickens, 2009). Specific methods used to stop the behavior, with varying success, include removal of crib bing surfaces and application of repellents or electric wire, cribbing straps and muzzles, aversion therapy (Baker and Kear-Colwell, 1974) and the surgical removal of the paired omohyoideus and sternothyrohyoideus muscles and transection of the accessory nerves, a procedure known as modified Forssell's technique (Delacalle et al., 2002). The primary problem with these methods is that they fail to address the underlying causes of crib-biting behavior and may further reduce equine welfare (McBride and Cuddeford, 2001; Nagy et al., 2009), particularly if the behavior serves a function in stress reduction or alleviation of gastrointestinal discomfort. Short-term prevention of crib-biting behavior using a cribbing strap has been shown to increase crib-biting rate upon removal of the device (McGreevy and Nicol, 1998c). It was suggested that this post-inhibitory rebound reflected an increase in internal motivation to crib-bite during the period when the behavior was thwarted. McGreevy and Nicol (1998c) stated that behaviors that display this pattern of motivation may be considered functional to the horse. Houpt et al. (2005) demonstrated that crib-biting horses will work to gain access to a crib-biting surface and the results suggested that crib-biting horses valued the behavior nearly as much as they valued food.

Cooper & McGreevy, 2002: If stereotypies are a response to specific challenges faced in the stable environment then simply preventing the behavioural symptoms of the problem is no cure and this can result in a number of undesirable side effects, including perseverance despite the obstacles to performance, expression in a modified form and behavioural or physiological indicators of distress. For example, within an environment that severely limits normal forage intake (for example, an intensive training programme characterised by the provision of a high-concentrate : minimal-roughage diet), an oral stereotypy such as crib-biting may provide a route to normal feeding and digestive activity. Clearly, prevention of the symptom does nothing to ameliorate the cause. Horses prevented from crib-biting by the use of a traditional cribbing collar showed significantly more crib-biting on the first day after prevention than did control horses (McGreevy & Nicol, 1998c). There was

also a highly significant increase in the crib-biting rate of the test horses on the first day after prevention in comparison with their baseline rate. This defines the increase as a post-inhibitory rebound and it is argued that it reflects a rise in internal motivation to crib-bite during the period of prevention. Behaviours that exhibit this pattern of motivation are generally considered functional, and their prevention may compromise welfare.

It is possible that if a specific stereotypy is prevented, it may precipitate the appearance of unwelcome behavioural side-effects. Horses in electrified stables may, for example, exhibit greater reactivity, whilst horses in projectionless stables may be unable to adequately scratch or groom themselves and therefore their welfare may be further compromised. In addition, individual horses may perform more than one stereotypy and elimination of one stereotypy may precipitate the emergence of a modified or alternative stereotypy. For instance, horses without physical substrates for crib-biting occasionally develop the ability to crib-bite on the bodies of conspecifics (Boyd, 1986). If crib-biting functions to reduce acidity of the digestive tract by the buffering action of equine saliva, as has been suggested by Nicol (1999a, b), then prevention of the opportunity to crib-bite may have harmful effects on the gut.

Finally, prevention of stereotypy per se may lead to distress, either because the activity is a general coping response to the captive environment or because prevention frustrates a highly motivated response to specific challenges encountered in the stable. Although evidence for the coping hypothesis in horses has been described as weak (Nicol, 1999a), there is good evidence that preventing specific stereotypies causes physiological responses consistent with increased stress such as raised heart-rate and adreno-corticol activity. These elevated responses have been found both for physical prevention, for example weaving bars and anti-cribbing collars (McBride & Cuddeford, 2001). These responses, elevated heart-rate and corticosteroids and perseverance of the activity in forms that can further damage the horse, raise obvious concerns about the indiscriminate use of preventative measures. If stereotypies need to be reduced, then prevention alone is no solution, and treatment is more likely to be effective by focussing on the requirements of the stabled horse to resolve the underlying motivational problem or if this is not possible, to redirect the behaviour to less harmful forms.

Cooper & Albentosa, 2005: Stereotypic activities are often treated by seeking to prevent performance of the activity (e.g., by using anti-weaving grilles or anti-cribbing collars) rather than by seeking to identify and resolve the underlying environmental challenges (McGreevy and Nicol, 1998a; Cooper and McGreevy, 2002). Prevention of stereotypy per se may lead to two problems. The first is that the horses may persist with the activity but in a modified form. For example, weaving horses may continue to weave but within the stable if antiweaving grilles are placed on the stable door (McBride and Cuddeford, 2001), and cribbing collars actually increase the number of bouts of crib biting (McGreevy and Nicol, 1998c). The second problem is that prevention can be distressing to the animals involved. There is good evidence that preventing specific stereotypies causes physiological responses consistent with increased stress, such as raised heart rate and adrenocorticol activity. These elevated responses have been found when methods of physical prevention are used, such as anti-weaving grilles (McBride and Cuddeford, 2001) and anti-cribbing collars (McBride and Cuddeford, 2001).

Is stereotypic behaviour an adaptive response?

Elevated heart rate and corticosteroids and perseverance of the activity in alternative forms suggest that these repetitive activities may have a general adaptive or coping function (Cooper and Nicol, 1993), e.g., by buffering the horse from noxious stimuli or regulating the level of arousal or psychological distress. Although an association between prevention of stereotypic behaviour and increased arousal has been found in the stabled horse (e.g., see Lebelt et al., 1998, McGreevy and

Nicol, 1998b, McBride and Cuddeford, 2001), evidence for a general coping function for stereotypic behaviour in stabled horses has been described as weak (Nicol, 1999). The finding that prevention of an activity leads to an increase in distress does not indicate that the activity originally developed as a response to distressing conditions. Instead, it demonstrates that its prevention, once it is part of the animal's behavioural repertoire, is potentially frustrating. One study only has shown more convincing evidence of a closer relationship (McGreevy and Nicol, 1998b) between stereotypic behaviour and a reduction in arousal. In this study, removing cribbing surfaces resulted in elevated corticosteroids except where horses had access to an alternative means of expressing postprandial oral activity, namely, a full hay net. Rather than having a general coping or stressbuffering function, individual stereotypies may be associated with specific environmental challenges. For example, oral stereotypies have been suggested to have some form of adaptive function specifically related to digestion (Nicol, 1999a). It has been known for some time that the feeding of concentrate diets (Rowe et al., 1994) and periods of food deprivation increase gastric acidity to harmful levels that can result in rapid ulceration (Murray and Eichorn, 1996). High-concentrate diets also alter caecal fermentation and increase caecal acidity (Willard et al., 1977). Early signs of abnormal wood chewing and stable biting were higher in horses fed with a predominantly concentrate diet than horses that received hay (Willard et al., 1977; Waters et al., 2002). However, this did not remain true if the horses fed with concentrates were given an additional supplement, virginiamycin, which suppresses lactic acid production in the hindgut and increases hindgut pH (Johnson et al., 1998). These lines of evidence suggest that crib biting may function to reduce acidity of the digestive tract. The exact mechanism by which crib biting could reduce the acidity of the digestive tract is not known, but it has been suggested that this activity may result in increased salivary flow (Nicol, 1999a). Finally, although these responses may be an attempt to solve environmental deficiencies, their continued expression does not mean they are wholly successful compared with related activities that might be performed in the wild, and that the horse's welfare is ensured. Endoscopic investigation of yearlings with a high incidence of wind sucking and crib biting revealed high levels of gut damage in these animals, including lesions, ulceration and damaged mucosal tissue despite the oral activities (Nicol et al., 2002). This finding suggests that the animals are not successfully coping. Under these circumstances, further intervention may be required, such as provision of a more appropriate (higher fibre) diet or dietary supplements, such as antacids, to aid gut function under such extreme nutritional challenge (Nicol et al., 2002; Mills and Macleod, 2002).

Henderson, 2007: When animals are provided an opportunity to perform another behavior (via enriched environment, reduced fear, and arousal-reducing drugs), stereotypical behavior is reduced or eliminated (Luescher et al., 1991).
Stereotypies may be an adaptive mechanism that offers some degree of perceived environmental control (Mason, 1991; Mason & Latham, 2004), acting as a buffer against psychological distress and thus providing a modicum of relief in an adverse environment (Cooper & Albentosa, 2005; Mason, 1991; McGreevy, 1997).

Mason & Latham, 2004: Stereotypies should always be taken seriously as a warning sign of potential suffering, but never used as the sole index of welfare; non-stereotyping or low-stereotyping individuals should not be overlooked or assumed to be faring well; simple measures of frequency should not be used to compare stereotypies that differ in age, form, or the biological or experiential characteristics of the performing animal; enrichments that do not immediately reduce stereotypies should not be assumed failures with respect to welfare; and finally, stereotypies should not be reduced by means other than tackling their underlying motivations.

Mason et al., 2006: Stereotypic behaviours are better at revealing the poorest environments than they are at identifying the worst off individuals within those environments.

Christie et al., 2006: Prevalences of crib biting, wind sucking, and weaving were 3.8%, 3.8%, and 4.8%, respectively. Age (OR = 1.07, *P* = 0.08) and hours worked weekly (OR = 1.12, *P* = 0.03) were risk factors for weaving. Straw bedding (OR = 0.3, *P* = 0.03), daily hours at pasture (OR = 0.94, *P* = 0.02), and horse type (drafts and miniatures had a lower risk than light horses; *P* = 0.12) reduced the risk of horses showing oral stereotypies.

Nicol, 1999b: Generally, differences were found between populations within the same studies. Therefore, a greater prevalence of crib-biting and weaving was reported for Thoroughbreds than other breeds, and for stallions than mares. These variations in prevalence cannot be attributed solely to genetic factors, as the different breeds and sexes are subjected to radically different management conditions. The role of management factors can more easily be determined looking for differences within populations. The most significant management factors positively associated with equine stereotypies appear to be low forage ration, high concentrate ration, and limited social contact between horses. The results of the cross-sectional surveys are compared with preliminary data from the first prospective study of equine stereotypies. This shows a much higher incidence of crib-biting (10.5%) than revealed in the other surveys, with a median age of onset of just 20 weeks. Therefore, many foals develop crib-biting prior to weaning. The provision of concentrate feed from birth, or prior to weaning, appears to be a risk factor in these young animals in addition to its association with crib-biting in older horses.

McGreevy et al., 1995c: The behaviour of horses competing in different disciplines was studied and the relationship between the time they spent out of the stable and the prevalence of abnormal behaviour was examined. The owners of dressage, eventing and endurance horses were sent a questionnaire and a total of 1101 responses were received, giving data on 1750 horses. The behaviours studied were wood-chewing, weaving, crib-biting/wind-sucking and box-walking. The reported percentage prevalences of abnormal behaviour for the dressage, eventing and endurance horses were 32.5, 30.8 and 19.5, respectively. The relationship between the time spent in the stable and the prevalence of abnormal behaviour was examined by chi 2 tests which showed that there were significant linear trends for the eventing group (P < 0.001) and the dressage group (P < 0.05). It is concluded that the time a horse spends out of the stable is related to the discipline for which it is being trained and in dressage and eventing horses the time spent in a stable is correlated with an increased risk of abnormal behaviour.

Redbo et al., 1998: The aim of the present study was to identify relations between stereotyped behaviours (cribbing, weaving and box-walking) and wood-chewing in thoroughbred flat-racing horses (TB) and standardbred trotters and the different management, feeding and training factors to which these horses are exposed. There was a large difference between the two horse categories in the occurrence of behavioural disturbances. The TB had significantly more stereotypies than the trotters (P < 0.001) but there were no differences in the occurrence of wood-chewing. There were several differences in external factors between the horse categories, e.g. trotters had more opportunities for social contacts with other horses, they also had more free time outside the stable and they were trained a shorter time per week than the TB. The TB were given larger amounts of concentrate than the trotters. Wood-chewing within each horse category was explained by the amount of roughage (P < 0.05 in trotters and P < 0.001 in TB) together with other factors.

Stereotypies in the TB were explained by: amount of concentrate (positive relation), number of horses per trainer (positive relation) and amount of roughage (negative relation).

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