

In: **Recent Advances in Companion Animal Behavior Problems**, Houpt K.A. (Ed.)
Publisher: International Veterinary Information Service (www.ivis.org)

Equine Stereotypies (7-Aug-2000)

C.J. Nicol

Division of Animal Health and Husbandry, Department of Clinical Veterinary Science, Langford House, Langford, North Somerset, United Kingdom.

Equine stereotypies such as weaving, Crib-biting and box - walking are frequently described as "stable vices" and veterinary interest has generally focussed on the deleterious effects that may be associated with their performance. Many owners and veterinarians have pursued strategies to prevent the performance of stereotypies that include the use of physically restrictive devices, electric shock, and surgery [1]. These methods are, in many cases, ineffective [2], they may cause distress or harm to the horse, and they address symptoms rather than underlying causation. Pharmacological approaches to treatment have also been suggested. Dopamine pathways are intimately related to the appearance of stereotypic behaviour and opiate transmission regulates dopamine release, such that agonists and antagonists of enkephalin receptors can induce or suppress stereotypy [3]. This has led to studies looking at the efficacy of opioid antagonists as "treatments" for equine stereotypy. One study found transient elimination of crib-biting in all subjects treated with naloxone, nalmefene or diprenorphine [4]. Another study reported that weaving was reduced by administration of an opiate antagonist, although a serotonin transport inhibitor, and a neuroleptic were also effective [5]. The difficulty with such findings is that these pharmaceutical agents have many additional effects e.g. naloxone is a cataleptic and an appetite suppressant, and may reduce the performance of other functional behavioural systems. The effects of such drugs on the horse's perception of its environment and on its overall welfare are not known. Of crucial significance to all attempts to treat the symptoms rather than the causes of stereotypy is recent work that suggests that some deleterious "effects" of stereotypy (e.g. digestive disorders, colic) may in reality reflect underlying problems that the horse is attempting to ameliorate by the performance of the stereotypy. In such cases, attempts to prevent the behaviour could do more harm than good. This dilemma for the veterinarian emphasizes the need to understand more about the causes and functions of equine stereotypies.

Description

Crib-biting - the horse seizes a fixed object with its incisors and pulls back, drawing air into its cranial oesophagus, and usually emitting a characteristic grunt. As the behaviour develops it may become more complex in form, sometimes involving licking before or after each bite. The behaviour is strikingly invariant for any given horse, and may occur in just one or two locations. Although probably observed most frequently within a stable, it is also quite common for horses to crib-bite on the fence while out at pasture. Crib-biting frequently occurs during or just after the provision of a concentrate meal and may, in some horses, be intimately patterned within bouts of forage ingestion. Contrary to a widely held belief, crib-biting does not involve aerophagia, as inhaled air is expelled again via the mouth [6].

Wind-sucking - the physical form of the behaviour is almost identical to Crib-biting but the horse achieves the same posture and tension of the neck muscles without grasping a fixed object.

Weaving - the horse sways its head laterally, sometimes involving the neck, forequarters and sometimes hindquarters. Weaving usually occurs while the horse is standing with the head over the stable door, although it can be performed in any part of the stable, or by a field gate.

Distribution of Equine Stereotypies

Six surveys have been conducted in recent years to discover the prevalence of stereotypic behaviour in a variety of equine populations around the world [7,12]. These studies were cross-sectional in nature i.e. they asked about stereotypy prevalence and management practices at the time of the survey only. Overall prevalence rates between populations were surprisingly similar. Approximately 12% of adult horses wood-chew, 4% crib-bite, 3% weave and 2% box-walk. Despite the overall similarities, some studies reported significantly higher stereotypy prevalences in Thoroughbred populations compared to other breeds, in dressage and event horses compared to endurance horses, and in stallions compared to mares. Genetic factors may play a part. Selection experiments in rodents have shown that the propensity of the F2 generation to develop stereotypies is markedly related to the occurrence of stereotypies in their parents [13]. In horses, certain Thoroughbred bloodlines appear more likely to produce stereotypic individuals than others [14] although it is difficult to exclude environmental or management differences. Management factors certainly vary between populations. Thus, Thoroughbreds received more concentrate feed and had fewer opportunities for social contact than Swedish Trotters [11] whilst dressage and event horses spent more time in their stables than endurance horses [8]. It is therefore possible to assess the effect of the management factors only by looking within a relatively uniform genetic population. This has been done for Thoroughbred horses.

Management Factors

In the UK Thoroughbred horse population, positive associations have been reported between overall stereotypy prevalence and stable designs that limited the degree of social contact between horses, the use of non-straw bedding, and a forage ration of less than 6.8kg per day [9]. In Swedish Thoroughbreds, a similar correlation was noted between stereotypy prevalence and low forage ration. In addition, high concentrate feed rations were positively associated with stereotypy prevalence [11]. Stereotypy prevalences were lower in Australian Thoroughbred horses kept at pasture compared with stabled horses [12]. This statistical information is important as it suggests that some management practices may cause stereotypic behaviour to occur. However, cross-sectional survey data cannot reveal whether management practices precede or follow the onset of stereotypic behaviour for any particular horse, or even whether stereotypic horses are bought in from other yards with different management practices. In addition, very large datasets are required to draw valid statistical conclusions, and few of the surveys conducted have been able to examine the separate risk factors associated with the different forms of equine stereotypy. For these reasons prospective studies, where horses are monitored over time are a more powerful source of information. One study in the UK followed 218 foals over a 4 year period [15]. In this study the prevalences of box-walking and weaving were similar to other surveys but Crib-biting was observed in 10.5% of the horses and occurred at a strikingly early age. The median age of onset of crib-biting was only 20 weeks, in contrast to a median age of onset of weaving at 60 weeks. Thus, in many cases foals started Crib-biting before they were weaned whilst still out on pasture with their dams. The only management intervention that these young animals had received was the introduction of concentrate feeds. Some foals had been allowed to nibble their mothers' rations from a few days of age. Others were given concentrate feeds shortly before weaning to familiarise them with a new diet and decrease the risk of a slowing of growth at weaning. Even after weaning, foals that received concentrate feeds were at four times the risk of developing Crib-biting than foals that did not receive concentrate feeds [15].

Why do Horses Start to Crib-Bite?

The epidemiological data suggest that low forage and high concentrate rations are risk factors for Crib-biting. It has been suggested that a high forage ration may reduce the time available to perform stereotypy or that the motivation to forage is reduced through increased gut - fill or other feedback mechanisms [15,16]. However, recent data suggest another mechanism. It has been known for some time that the feeding of concentrate diets [17] and periods of food deprivation increase gastric acidity to harmful levels that can result in rapid ulceration [18]. High concentrate diets also alter caecal fermentation and increase caecal acidity [19]. In one study, early signs of abnormal wood - chewing and stable biting were higher in horses fed a predominantly concentrate diet than horses fed 8 Kg of hay per day but not if the horses fed concentrates were given an additional supplement, virginiamycin, that suppressed lactic acid production in the hindgut and increased hindgut pH [20]. This suggests that Crib-biting may function to reduce acidity of the digestive tract. The exact mechanism by which Crib-biting could ameliorate excessive acidity of digestive tract is not known but it has been suggested that Crib-biting may result in increased salivary flow [21]. Equine saliva is a natural buffer but

it is produced only during mastication and not in response to the sight or smell of food [22]. Horses fed low fibre rations, or placed in situations where calm, continuous forage intake is unlikely (e.g. individually weaned foals are at a greater risk of developing stereotypies than group - weaned foals [15]) may simply not produce sufficient saliva to buffer their stomach contents. The tension exerted during the Crib-biting action may be an alternative method of stimulating saliva production, although this hypothesis remains to be rigorously tested.

Why do Horses Start to Weave?

In the UK many horses start to weave when they are about one year old, after they have been sold from their birthplace stud and re-stabled in new surroundings [15]. Casual observations that horses perform weaving over the stable door, particularly when companions from neighbouring stables are removed suggest that horses may start to weave when their inclination to leave the stable (particularly to regain contact with other horses) is thwarted. Weaving develops as a form of frustrated escape response. The epidemiological data partly supports this interpretation as stable designs that reduce social isolation also reduce the risk of stereotypic behaviour (including weaving) [8,10]. However, a recent experiment provides further support [23]. Weaving horses were housed in stables where they could see out only at the front, or additionally at the back or the sides, allowing a greater degree of contact with neighbouring horses. The incidence of weaving was significantly reduced when the horses had more opportunities for social interaction with their neighbours, and dropped to zero when all four windows were open [23]. A pilot study showed that placing mirrors in the stable may also reduce the frequency of weaving behaviour [21] although this requires verification.

Stereotypies and Stress

An influential general hypothesis proposes that stereotypy functions to reduce stress experienced in captive environments. There have been a number of attempts to determine whether stereotypy assists horses to "cope" in this way, but it is difficult to obtain proof. A key prediction is that stereotypic animals should have lower levels of stress either all the time, or at least during bouts of stereotypy, than non - stereotypic horses exposed to the same environment. Researchers have investigated heart rate, plasma cortisol and plasma beta - endorphin but have obtained sharply conflicting results. Some studies have found no difference in baseline levels between stereotypic and normal horses [24-26], while others have found either higher [27] or lower [28] plasma cortisol or endorphin concentrations in stereotypic horses. One difficulty is that stereotypic horses may have been more reactive than other horses before they developed a stereotypy. The onset of stereotypy may serve only to reduce their stress levels to a "normal" level, but this could be determined only if long - term prospective studies were initiated prior to stereotypy development.

There is some evidence that heart rate is lowered in horses during bouts of cribbing behaviour compared with other behaviours [25,29] but, in general, evidence for the coping hypothesis in horses is weak.

Mature Horses and Established Stereotypies

Instead of reflecting current problems, adult stereotypy may be like a "scar" representing a severe problem experienced at the time of onset [30]. Although this has not been investigated in horses, it is known that wild - caught rodents (that presumably did not experience frustrating or stressful conditions when young) rarely show stereotypic behaviour in barren cages, whereas their laboratory reared offspring do [31]. Improving the environment can reduce stereotypic behaviour in young rodents but not to any great extent in older animals [28]. This suggests that young animals are particularly sensitive to conditions that elicit stereotypic behaviour. It is generally thought that, with age, stereotypies are elicited by a wider set of stimuli than in early development (emancipation) and become relatively immune to normal control mechanisms. It should therefore come as no surprise to see older horses performing stereotypies in environments that appear to support high welfare. In older horses stereotypies may also become conditioned responses, activated in anticipation of a particular eliciting event (a concentrate meal, removal of a companion) as a protective response. It may not be possible to reverse the process of stereotypy development in mature animals but the proportion of time they spend performing the stereotypy can clearly be manipulated by increasing opportunities for social contact [23] and foraging behaviour [32].

Conclusion

Prevention of stereotypic behaviour is a better strategy than control. Young foals and horses are at particular risk but this risk can be reduced by maintaining opportunities for social contact particularly during and immediately after weaning, feeding high forage rations and providing the minimum amount of concentrate

feed to sustain health. Environmental improvement should be the first step in managing horses with established stereotypies and caution should be exercised if other preventive methods are considered so as not to compromise the horses' welfare [1]

References

1. McGreevy PD, Nicol CJ. Prevention of crib-biting: a review. *Eq Vet J Suppl* 1998; 27:35-38. - PubMed -
2. Schofield WL, Mulville JP. Assessment of the modified Forsell's procedure for the treatment of oral stereotypies in 10 horses. *Vet Rec* 1998; 142:572-575. - PubMed -
3. Cabib S, Puglisi-Allegra S, Oliveria A. Chronic stress enhances apomorphine-induced stereotyped behavior in mice: involvement of endogenous opioids. *Brain Res* 1984; 298:138-140. - PubMed -
4. Dodman NH, Shuster L, Court MH, et al. Investigation into the use of narcotic antagonists for the treatment of a stereotypic behavior pattern (crib-biting) in the horse. *Am J Vet Res* 1987; 48:311-319. - PubMed -
5. Nurnberg HG, Keith SJ, Paxton DM. Consideration of the relevance of ethological animal models for human repetitive behavioral spectrum disorders. *Biol Psychiat* 1997; 41:226-229. - PubMed -
6. McGreevy PD, Richardson JD, Nicol CJ et al. Radiographic and endoscopic study of horses performing an oral based stereotypy. *Eq Vet J* 1995; 27:92-95. - PubMed -
7. Borroni A, Canali E. Behavioural problems in Thoroughbred horses reared in Italy, in Proceedings. 26th Int Cong Appl Ethol 1993; 43-46.
8. McGreevy PD, Cripps PJ, French NP, et al. Management factors associated with stereotypic and redirected behaviour in the Thoroughbred horse. *Eq Vet J* 1995; 27:86-91. - PubMed -
9. McGreevy PD, French NP, Nicol CJ. The prevalence of abnormal behaviours in dressage, eventing and endurance horses in relation to stabling. *Vet Rec* 1995; 137:36-37. - PubMed -
10. Luescher UA, McKeown DB and Dean H. A cross-sectional study on compulsive behaviour (stable vices) in horses. *Eq Vet J Suppl* 1998; 27:14-18. - PubMed -
11. Redbo I, Redbo-Tortensson P, Odberg FO, et al. Factors affecting behavioural disturbances in race-horses. *Anim Sci* 1998; 66:475-481.
12. Pell SM, McGreevy PD. Prevalence of stereotypic and other problem behaviours in Thoroughbred horses. *Aust Vet J* 1999; 77:678-679.
13. Schoenecker B, Heller KE. Indication of a genetic basis of stereotypies in laboratory-bred bank voles (*Clethrionomys glareolus*). *Appl Anim Behav Sci* 2000; 339-347.
14. Vecchioti G, Galanti R. Evidence of heredity of cribbing, weaving and stall-walking in Thoroughbred horses. *Livestock Prod Sci* 1986; 14:91-95.
15. Waters AJ, Nicol CJ, French NP. The development of stereotypic and redirected behaviours in young horses: the findings of a four year prospective epidemiological study. *Eq Vet J* (submitted).
16. Cooper JJ, Mason G. The identification of abnormal behaviour and behavioural problems in stabled horses and their relationship to horse welfare: a comparative review. *Eq Vet J Suppl* 1998; 27:5-9. - PubMed -
17. Rowe JB, Pethick DW, Lees MJ. Prevention of acidosis and laminitis associated with grain feeding in

horses. *J Nutr* 1994; 124:2742-2744.

18. Murray MJ, Eichorn ES. Effects of intermittent feed deprivation, intermittent feed deprivation with ranitidine administration, and stall confinement with ad libitum access to hay on gastric ulceration in horses. *Am J Vet Res* 1996; 11:1599-1603. - PubMed -

19. Willard JC, Wolfram SA et al. Effect of diet on cecal pH and feeding behavior of horses. *J Anim Sci* 1997; 45:87-93.

20. Johnson KG, Tyrell J, Rowe JB et al. Behavioural changes in stabled horses given non-therapeutic levels of virginiamycin as Founderguard. *Eq Vet J* 1998; 30:139-143. - PubMed -

21. Nicol CJ. Understanding equine stereotypies. *Eq Vet J Suppl* 1999; 28:20-25.

22. Alexander F, Hickson JCD. The salivary and pancreatic secretions of the horse. In: Phillipson AT, ed. *Physiology of digestion and metabolism in the ruminant*. Newcastle upon Tyne: Oriel Press, 1970; 375-389.

24. Cooper JJ, McDonald L, Mills DS. Increasing visual horizons reduces stereotypic patterns of weaving in the stabled horse. *Proceedings BEVA Specialist Days on Behaviour and Nutrition, 1999; 22-24.*

24. McBride S. A comparison of physical and pharmacological treatments for stereotyped behaviour in the horse, in *Proceedings. 30th Int Congr Appl Ethol* 1996; 26.

25. Lebelt D, Zanella AJ, Unshelm J. Physiological correlates associated with cribbing behaviour in horses: changes in thermal threshold, heart rate, plasma beta-endorphin and serotonin. *Eq Vet J Suppl* 1998; 27:21-27. - PubMed -

26. Pell SM, McGreevy PD. A study of cortisol and beta-endorphin levels in stereotypic and normal Thoroughbreds. *Appl Anim Behav Sci* 1999; 64:81-90.

27. McGreevy PD, Nicol CJ. Physiological and behavioural consequences associated with short-term prevention of crib-biting in horses. *Physiol Behav* 1998; 65:15-23. - PubMed -

28. Gillham SR, Dodman NH, Shuster L, et al. The effect of diet on cribbing behaviour and plasma beta-endorphin in horses. *Appl Anim Behav Sci* 1994; 41:147-153.

29. Minero M, Canali E, Ferrante V, et al. Heart rate and behavioural responses of crib-biting horses to two acute stressors. *Vet Rec* 1999; 145:430-433. - PubMed -

30. Mason GJ. Stereotypies and suffering. *Behav Proc* 1991; 25: 103-11.

31. Cooper JJ, Nicol CJ. Stereotypic behaviour in wild caught and laboratory bred bank voles, *Clethrionomys glareolus*. *Anim Welfare* 1996; 5:245-257.

32. Houpt KA, McDonnell SM. Equine stereotypies. *Comp Cont Educ Pract Vet* 1993; 15:1265-1271

All rights reserved. This document is available on-line at www.ivis.org. Document No. A0803.0800 .

