Voeding

Het belang van gras/ruwvoer
Davidson & Harris, 2002: Whether free-living or domesticated, horses tend to spend around 16–18 hours out of every 24 hours foraging, depending on the type of grazing available (Gallagher & Hughes, 1993; Keiper, 1986; Avery, 1996).

Elia et al., 2010: A reduction in fiber in the diet has a major impact on the behavior and physiology of horse. Using operant conditioning, we were able to show that horses are motivated to work for hay (higher fiber), only when fed a low fiber diet, indicating a behavioral need for chewable fiber.

Mills & Clarke, 2002: Meal feeding (concentrate diet, as experienced by intensively managed horses) is not the evolved method of ingestive behaviour and so its imposition may pose problems for the domestic horse (Mills, 2001). It seems likely therefore that the evolved mechanisms designed to regulate intake, may not be appropriate to restrictive feeding practices. The presentation of food, especially concentrate, represents a rewarding event and many horses appear to exhibit bizarre feed time rituals which have probably been conditioned through the presentation of feed. This is also a time of high arousal as food is anticipated and so frequent meal feeding or staggered feed-times across a yard may be expected to increase the stress load on a horse. The provision of an ad libitum forage based diet is therefore to be preferred when possible. Foraging devices which require the horse to work for a small amount of concentrate at any given time have been proposed for the prevention of some of these problems, but have a variable effect (Henderson & Waran, 2001). They may moderate the period of high arousal associated with the delivery of food and so be efficacious for the control of pre-feeding problems, but the substantially extended time spent involved in ingesting concentrate (Winskill *et al.*, 1996) may exacerbate problems related to this component of the diet.

McGreevy et al., 1995: Offering forage 3 times per day was associated with an increased risk (Adjusted Odds Ratio [AOR] 1.067) of abnormal behaviours in general when compared with individuals offered forage once or twice per day. However, feeding forage more than 3 times per day was related to a reduced risk of abnormal behaviours in general (AOR 0.454). This variable had no significant relationships with individual behaviours after adjustment for confounding.
Offering relatively large amounts of forage per day and offering forage frequently were both associated with a reduction in the prevalence of abnormal behaviours. Horses offered forage types other than hay were less likely to perform abnormal behaviours.

Bachmann et al., 2003: Feeding 4 times per day increased the likelihood of stereotypic activity compared with horses fed less or more often. The final logistic regression model of risk factors leads to the hypotheses that causal prevention of stereotypic behaviours should be based upon housing and management conditions which allow tactile contact with other horses (e.g. mutual grooming), daily free movement (paddock or pasture), as well as the provision of high amounts of roughage but of little or no concentrates.
Feeding grain was found to cause a significant increase in the crib-biting frequency of crib-biting horses, whereas pelleted alfalfa hay was without effect (Gillham *et al.* 1994).

(for additional information on stereotypic behaviour and feeding schedules, see 'Gezondheid en gedrag – afwijkend gedrag').

Bulens et al., 2013: The effect of the provision of simple objects to stabled horses on their behaviour was investigated to determine whether these objects can affect horses' behaviour in a positive way and thus enrich their environment. For an average of 3.85% (±0.420) of our observations, the horses exhibited behaviour involving the items. This frequency does not significantly reduce after a week. The frequency of item related behaviour was also associated with the quantity of hay, with the highest frequency when no hay was available. It is possible that horses are expressing either frustration of having no roughage towards the item or a need for fibres by chewing on the objects. It is suggested that oral activities show the motivation to eat, to attempt to supplement the concentrate feed or the absence of roughage with additional sources of fibres. The use of the items had the tendency to reduce one specific type of abnormal behaviour, i.e. the occurrence of licking walls and other objects (P = 0.0586). However, it is possible that horses redirect their abnormal behaviour towards the items. Biting behaviour towards enrichment objects (not food containing) was associated with the quantity of hay, with a higher frequency when no hay was available. This possibly also suggests a search for other sources of fibres when roughage is absent. Although horses exhibited item related behaviour, the used objects do not offer a food reward and arouse the interest only to a very limited extent, showing a limited enriching effect.

Henderson, 2007: Performance horse manager pride themselves on finding the richest, finest quality hay available, but this may not necessarily be in the horse's best interests (Cooper & Albentosa, 2005; Houpt & McDonnell, 1993; McGreevy et al., 1995).

Maagzweren versus 'tijd niet voeren'

Cooper & McGreevy, 2002: 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 & Eichorn 1996).

Andrews et al., 2005: Equine gastric ulcer syndrome is caused by exposure of the stomach to inorganic and organic acids. Many factors including feeding, management, and stress allow increased production of these stomach acids that act synergistically to produce gastric ulcers.

Luthersson et al., 2009: Contributing factors to the reported high prevalence in racehorses, in particular, have been suggested to be high concentrate diets, low hay diets, meal feeding, fasting, training and the administration of certain drugs (Vatistas *et al.,* 1999b; Merritt, 2003; Lester, 2004; Jonsson & Egenvall, 2006). This study therefore aimed to investigate the prevalence of EGUS in a subpopulation of Danish horses not in active race training and to evaluate the influence of feed, work level and environment on the risk of EGUS ≥ *grade 2* severity (MacAllister *et al.* 1997). In the current study, 53% of horses were defined as having clinically significant EGUS. The current study identified a number of management practices that might affect this balance. The amount of grain (starch) fed per day and per meal in particular may, for example, be very important factors in the development of EGUS. Whether measured in g/kg bwt/day or per meal, starch intake over a certain amount increased the likelihood of EGUS ≥2 or NG ≥2. In the present study, time between forage meals of >6 h, compared with frequent forage feeding with intervals of <6 h, increased the likelihood of NG≥2. Deprivation of feed for repeated periods has been shown to cause gastric ulcers in the squamous non glandular region but not the glandular region or antrum/pylorus (Murray and Grady, 2002). Feed deprivation is associated with highly acidic conditions within the stomach (see Murray and Grady, 2002) and the more liquid, less saliva buffered contents may be more easily displaced or 'splashed'.

In equine populations where gastric ulceration is common, provision of *ad libitum* forage may significantly reduce the prevalence of EGUS. Where this is not possible or desirable, ensuring frequent access to forage, as well as providing more frequent fibre based, smaller concentrate meals (with reduced starch content) may be advantageous. Finally, using vegetable oil as a low starch, low bulk, high energy supplemental source, where appropriate, may enable more forage to be fed daily whilst maintaining the energy intake.
In conclusion, this study highlights the importance of management practices with respect to EGUS. In particular, it suggests that reducing total amount of starch given each day as well as the amount provided in each meal may significantly reduce EGUS prevalence. Ensuring that water is available in any turnout paddock and that straw is not the only provided forage is also advisable. Finally, avoiding leaving horses without forage provision for more than 6 h should also be avoided.

Maximum interval tussen maaltijden (in ad libitum situatie)
Ralston et al. (1979): The feeding patterns of five pony geldings fed pelleted diets *ad libitum* were quantified for five 24-hr periods. Eighty percent of a given pony's total daily intake (6.3 +- .81 kg or 2.9 +- .41% BW) was eaten in 10 +- .9 separate meals. Each meal averaged .49 +- .13 kg of pellets and lasted 44 +- 10 minutes. The mean intermeal interval was 84 +- 10 min, with a maximum of 3 hour. The animals spent 38 -+ 7.2% of a 24-hr period engaged in eating activities, 84 +- 3.7% of which was devoted to meals, the other 16% spent in nibbling activities. Forty-nine percent of the total daily intake was consumed between 0800 and 1700 hours. Fewer (P<.01), smaller (P<.05) and less frequent (P<.01) meals were observed between 1700 and 0800 hour. Wood chewing was observed only in the course of aggressive interactions between ponies.

Gebruik stro als ruwvoer
Greening et al., 2012: The results indicate that in horses stabled during the night, straw bedding facilitates the display of ingestive and sleep behaviors, whereas horses bedded on shavings spent a greater proportion of their nocturnal time budget engaged in “other” behaviors. Further research is required to investigate the extent to which different types of bedding material enrich the environment of horses that are stabled overnight.

Mills & Clarke, 2002: Mills *et al.* (2000) found that straw bedding was preferred over wood shavings and both of these were preferred to shredded paper. More bedding-related activities occurred in choices where straw was available (P<0.001) and in these choices the activities were preferentially expressed in the straw alternative (P<0.001). It is suggested that straw may be preferred as it allows the expression of a wider number of motivationally significant activities. Whilst straw bedding is associated with fewer behaviours of welfare concern (McGreevy *et al.*, 1995), it is also associated with an increased risk of respiratory disease (at the end of the day using alternatives to straw such as paper or wood shavings will improve the respiratory health of horses).

Henderson, 2007: Cooper and colleagues (2005) also found that horses bedded on straw—as opposed to wood or paper shavings—were less likely to engage in stereotypic behaviors (McGreevy et al., 1995), presumably because they could pick through the straw and forage for small traces of oat or wheat grains.

Luthersson et al., 2009: An increased likelihood of EGUS ≥2 and NG ≥2 was demonstrated when straw was the only forage provided. These horses had access to straw from their bedding (without any other forage) or were being specifically provided with straw as forage and received none or only very

small amounts of hay or haylage (<0.25 kg dry mass/100 kg bwt) in their daily ration. The authors are not aware of this being reported as a risk factor in previous studies. However, this may reflect differences in feeding practices as racehorses and other performance horses are not typically fed high amounts of such low energy forage. Straw is also low in protein and calcium and, therefore, may not provide additional buffering support. It can also be highly lignified and there is the potential that, especially if not chewed thoroughly, some irritation of the gastric mucosa could result from high levels of intake. It is also possible that the high lignin and silica nature of straw alters the fibrous mat in some way to increase the risk of the squamous epithelium being exposed to acidogenic factors.

Werhahn et al., 2010: When kept on straw bedding, the horses spent the maximum time with the behavior "occupation with bedding" and the shortest with the behavior "standing." It is known that horses in the wild are occupied with finding feed for about 60% of the day (Zeitler-Feicht, 2004; Duncan, 1980).
Kiley-Worthington, 1990: In contrast, horses housed in stables usually spend a lot more time standing without occupation (up to 65%) and only about 15% of the day eating when fed restricted fibre (about 3 kg/day, horses of 15.2-16hh).
Werhahn et al., 2010: This situation can lead to the development of stereotypic behavior (McGreevy et al., 1995). Providing horses with a possibility to occupy themselves with bedding material should have an important influence on how animal-friendly the housing system is (Zeitler-Feicht, 2005). On the basis of this, compared with wood shavings and straw pellets, straw as a bedding material seems to meet the requirements of the horses in terms of occupation most suitably and in turn improves their welfare. These findings concur with the results from a study by Mills et al. (2000) regarding preferences between bedding materials in Thoroughbred horses. On the basis of the fact that horses also eat some bedding material while they are occupied with it, the present study proves the hypothesis that time spent standing is reduced when horses in single stalls spend more time eating (Houpt, 2005).
In conclusion, the results of this study show that bedding material does influence horse behavior in occupation with bedding, standing, and lying. On the basis of the longest time spent occupied, straw seems to support the welfare of the horse better than wood shavings or straw pellets. Because of the highly significant influence of each horse, further investigations with a larger and more heterogeneous horse group are necessary to verify the observed reactions. Because providing roughage ad libitum to horses housed in single stalls is not always possible, it is advised -with regard to the behavior of the horse- to place the rationed diet inside the stall, thereby enabling an extension of their time spent occupied.

Duncan, 1980: Time-budgets of adult and weaned sub-adult horses were studied in a small population of Camargue horses living in semi-liberty. The categories of activities used were: Standing resting, Lying flat, Lying up, Standing alert, Walking, Trotting, Galloping, Rolling and Foraging. The main differences in time-budgets were related to age and to sex : young horses spent more time lying (sleeping), males spent more time standing alert and in rapid movements (trot, gallop), while usually foraging less than did the adult females. During the three years of the study the population increased from 20 to 54 horses and there were considerable changes in social structure as the number of adult males increased. Associated with these developments there were some changes between years in the time-budgets: the most striking of which was a general trend for all horses to spend less time lying. Nonetheless the time-budgets showed a considerable constancy across years and age/sex-classes, especially with regard to time spent foraging. This conclusion may provide a clue

as to why horses have an unusual social system based on long term relationships between a male and the females of his harem.

Mills et al., 2000: The preferences shown by eight Thoroughbred horses (6-16 years of age) for three commonly used bedding materials (paper, straw and shavings) were investigated. For each preference test two choices were presented in separate boxes joined by an unbedded corridor. Time spent in each compartment and associated behaviours were recorded over 6 h during the day and over 11 h at night. Despite a positional bias, horses clearly showed a preference for straw bedding (42.9%) over shavings (35.2%, $P<0.05$), straw (42.0%) over paper (29.3%, $P<0.05$) and shavings (41.6%) over paper (27.7%, $P<0.001$) based on percentage of observed time spent on the substrate. More bedding-related activities occurred in choices where straw was available ($P<0.001$) and in these choices the activities were preferentially expressed in the straw alternative ($P<0.001$). It is suggested that straw may be preferred as it allows the expression of a wider number of motivationally significant activities.

Henderson & Waran, 2001: 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.

Hoogte aanbieden kracht/ruwvoer

Mills & Clarke, 2002: The raised feeding posture is abnormal (not natural), and the additional time spent with the head raised may compromise the function of the mucociliary escalator of the upper respiratory tract (Racklyeft & Love, 1990). The disadvantages of hay racks or nets high from the ground have been suggested as including an increased risk of particles getting into the eyes and nose, as well as, feet getting caught in the bars/hay net. As this high feeding posture is not the natural feeding position it has been suggested to adversely affect drainage within the respiratory system, to increase the risk of developing caudal and cranial dental hooks and perhaps to adversely affect muscle and nerve function (Hintz, 1997). Hay racks at chest height are thought to have the potential to increase the risk of injuries, decrease the space available within the stable and are costly. However, despite hay feeding on the floor being a more natural feeding posture, it increases wastage by increasing the risk of contamination with faeces and urine, and there is an increased risk of parasite egg ingestion.

Volgorde aanbieden ruwvoer-krachtvoer

Davidson & Harris, 2002: Concentrate diets have always been implicated as causative factors for gastric ulcers in horses but ensuring these are fed in small amounts, possibly in combination with a forages such as alfalfa hay may help to increase the stomach pH and volatile fatty acid content in gastric contents (Nadeau et al., 2000).

Vervuert et al., 2008: The aim of this study was to investigate the effects of feeding oats alone before or after feeding chopped alfalfa or, in admixture with the alfalfa on the glycaemic and insulinaemic responses of horses as well as postprandial breath hydrogen and methane excretion. It seems that the influence of dietary fibre in the form of chopped alfalfa on pre-caecal digestibility is limited; but prefeeding alfalfa seems to enhance pre-caecal starch digestion. Hydrogen production was less following alfalfa addition, suggesting that starch fermentation in the intestine was reduced.

Luthersson et al., 2009: High starch diets tend to result in higher VFA production in the upper layers of the gastric mat (Nadeau *et al.* 2000) and possibly higher lactic acid production in the lower layers due to failure of the gastric acid to penetrate the less moist bolus and stop rapid fermentation from occurring (Harris *et al.* 2006). These factors have been implicated in the development of gastric ulceration.

Krachtvoer nodig voor sportpaarden

Davidson & Harris, 2002: Domestication, and our increasing demand for horses to perform repeatedly has resulted in energy requirements that, for some horses, are above those able to be provided by their 'natural' diet of fresh forage. Cereals provide more net energy than hay, which in turn provides more than twice the net energy of straw (Martin Rosset *et al.*, 1994; Harris, 1997a) which has resulted in their inclusion in the diets of many horses (Harris, 1997b, 2000). Confinement within a stable is therefore often coupled with the feeding of highly concentrated cereal-based meals a few times a day with limited forage (Harris, 1997b). Hay or roughage based diets may not provide sufficient net energy for many horses' needs (Harris 1997a).
Grain should only be fed when the horse's energy needs cannot be met by forage alone (sometimes small amounts of grain or other concentrates may also be needed to carry supplemental protein or minerals to balance the ration).

Davidson & Harris, 2002: When large concentrate meals are fed, the swallowed bolus has a high dry matter (DM) content and the stomach contents therefore also have a higher DM content than if the horse was grazing. This results in slower and /or reduced mixing of the feed with the gastric juices and may allow the survival of, in particular, gas-producing bacteria (Meyer *et al.*, 1975). This increases the risk of disturbances due to fermentation and increased gas production. Whether this results in a clinical or sub-clinical problem will depend on the actual amount eaten and the rate of intake, the amount of available sugars and starches and the microbial population. The basic digestive processes of the small intestine (enzymatic degradation of proteins, fats, starches and sugars) are similar to those of other monogastric animals *but* the activity of some of the enzymes in the chyme, in particular amylase, is less than in other monogastric animals. The horse, therefore, has a limited capacity to digest starch but a comparatively high capacity to digest sugars in the small intestine (Cuddeford, 1999). Large starch or sugar based meals may overwhelm the digestive capacity of the stomach and small intestine, leading to the rapid fermentation of the grain carbohydrate in the hindgut and a decrease in pH. A significantly decreased caecal pH may initiate a chain of events, which include a change in the microbacterial flora (excessive growth of those bacteria that can live under such conditions), lysis of those bacteria which cannot live at such low pH, allowing the release of endotoxins and other molecules, as well as damage to the mucosa of the caecum and colon. This in turn may allow the absorption of endotoxins and various other materials with potential clinical consequences, including colic, diarrhoea and laminitis (Frape, 1988; Clarke *et al.*, 1990; Lewis, 1995; Harris, 1999a).

Harris, 1997a: When calculations similar to those used in Figure 3 were applied to a 100% Timothy hay (CP, 8.6% fat, 2.3% hydrolyzable carbohydrate, 12.8% fermentable carbohydrate, 59.8%) diet, however, they showed that in order to provide the same net energy (required for maintenance, other work, as well as the actual competition), an intake energy of 348 mega joule (MJ) was required from the hay. If all this energy was to be provided by the intake for that day, this would correspond to an intake of ~22 kg of hay or ~4.5% body weight. Horses would not be able to ingest as much hay

as this daily, which helps to explain why hay-only diets are unsuitable for intensively exercising animals.

Kleine hoeveelheden krachtvoer aanbieden

Vervuert et al., 2009: The aim of this study was to investigate the effect of increasing the intake of starch on the glycaemic and insulinaemic responses of horses. A cross-over study design was used in which four horses were fed increasing amounts of a compound feed (0.5–3.5 kg) to provide 0.3, 0.6, 0.8, 1.1, 1.4 and 2 g starch/kg bodyweight (BW)/meal. The glycaemic response increased with starch intake ($P < 0.05$), while feeding <1.1 g starch/kg BW resulted in a lowered response, compared to when 1.1–2 g starch/kg BW was fed ($P < 0.01$). The results suggested that insulin responses may be more appropriate to define the effect of feeding different starch levels than glycaemic responses. A starch intake of <1.1 g/kg BW/meal produced only moderate glucose and insulin responses, even though highly processed cereals were used. It is therefore recommended that a starch intake of <1.1 g/kg BW/meal or a meal size of 0.3 kg/100 kg BW (starch content of 30–40%) is used for horses. This study showed that a starch intake 61.1 g/kg BW/ meal produced only moderate glucose and insulin responses when highly digestible starch was fed in the form of a compounded feed. The results from the current study suggested that a meal size of 0.3 kg/100 kg BW/ meal or a starch intake <1.1 g starch/kg BW/ meal should be used in compounded feeds and cereals that contain 30–40% starch, while further limitations may be necessary for feeds that contain >40% starch.

Zeitler-Feicht, 2001-2004: Feeding trials of Sweeting et al (1985) in ponies and of Meyer (1995) showed that stalled horses with ad libitum access to feed showed a similar rhythm of feed intake as pastured horses, even when they were fed concentrated feed. If mixed feed was offered free choice, animals divided the entire amount into approximately 10 daily portions. The feed intake per meal was never above 0.25 kg/100 kg body weight (0.25 lb/100 lb).

Tinker et al., 1997: The horse-level variable 'feeding high levels of concentrate' (~2 .5 kg/day dry matter, OR=4.8, >5 kg/day dry matter, OR=63) relative to 'feeding no concentrate' was a significant risk factor for equine colic.

Slowfeeders

Winskill et al., 1996: The objective of this study was to determine whether horses will use a foraging device (modified version of the 'Edinburgh Foodball,' British Patent No. 9200499.3) and if so, whether it has an effect on their overall time budget. The horses used the Foodball for more than 0.14 of their overall time budget and except for Horse 1, in a manner resembling normal foraging behaviour. The use of the Foodball was associated with significant decreases in the following behaviours when compared with baseline conditions: ingesting concentrates *($P < 0.05$);* moving *($P <$* 0.01); standing *($P <$* 0.01); and nose bedding *($P < 0.05$).* All behaviours except eliminate, were found to be highly significantly affected by time of day and the effect of test period significantly altered the allocation of the proportion of time spent ingesting concentrates, moving and standing. The change in the overall time budget of horses enriched with an foraging device (modified version of the 'Edinburgh Foodball') is more comparable with that of their free ranging counterparts, which is indicative of good animal welfare.

Cooper & McGreevy, 2002: Changing the feeding time or changing the cues that pre-cede feeding dramatically reduces pre-feeding stereotypy (unpublished, Cooper *et al.*), but not post-feeding

stereotypy. This may explain the effect of trickle feeding devices such as the Equiball™ (Winskill *et al.*, 1996; Henderson & Waran 2001) *i.e.* they reduce pre-feeding stereotypy by removing pre-feeding cues rather than acting as an alternative means of expression for pre-feeding motivation. If this is true, then changing husbandry routine may be an effective treatment of stereotypy.

Henderson & Waran, 2001: 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. 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, grainbased 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.

Luthersson et al., 2009: Although the exact link between grain feeding and gastric ulceration is not known, this study has suggested that reducing the total amount of starch given each day as well as the amount provided in each meal may reduce the likelihood of EGUS.

Cooper et al., 2005: As the number of concentrate 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. Therefore this study 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.
The effect of operant foraging devices on stereotypic behaviour is 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).

Goodwin et al., 2002: In conclusion, these trials showed that supplying multiple forages significantly affected the behaviour of stabled horses, promoted natural foraging behaviour patterns, reduced foraging behaviour directed towards straw, and reduced the amount of nonforaging behaviour which could indicate motivation to search for alternative resources. Enrichment of the stable environment through provision of multiple forages may have welfare benefits for horses, in reducing straw consumption and facilitating the expression of highly motivated foraging behaviour.

Goodwin et al. (2007): Foraging devices are often presented on the ground, which risks ingestion of foreign material along with the dispensed feed. Husted et al. (2005) and Walesby et al. (2004) provide evidence of sand colic associated with feeding from the ground and Boles and Kohn (1977) provide evidence of impaction colic caused by ingestion of other foreign materials. The aim of this study was therefore to evaluate three devices presented within suitable, clean containers that would prolong food-handling times but avoid issues of contamination. While the devices presented in the mangers met the initial objectives of delivery into a clean receptacle, the unpredictability of reward suggests a source of frustration and warrants further investigation. These devices could represent a useful short-term distracter for stabled horses but, as for the Equiball (Henderson and Waran, 2001), we consider that they should be removed when empty.

Other

Thorne et al., 2005: The results indicate that the potentially beneficial behavioural effects of short-term multiple forage provision do persist when horses are managed on a multiple forage diet for a 7-day period. They suggest that a multiple forage diet provides a means of enriching the stabled horse's environment, by offering variety and enabling patch foraging behaviour.

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