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Investigating duration of nocturnal ingestive and sleep behaviors of horses bedded on straw versus shavings

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Abstract Horses are stabled overnight for a number of practical reasons; however, there is little research quantifying nocturnal equine behavioral patterns or the extent to which different environments influence nocturnal behavior. The aim of this study was to establish whether differences in duration of sleep and ingestive behaviors were apparent for horses bedded on straw (group 1) or shavings (group 2). Ten geldings of mixed breed (mean age: 7.3 ± 3.53 years) bedded on either shavings (n = 5) or straw (n = 5) were observed between 7 PM and 7 AM. Duration of behaviors according to a predefined ethogram was recorded in minutes using a video recorder and continuous focal sampling. Mann–Whitney *U* tests were used to identify whether any significant differences in duration of ingestion and sleep behaviors occurred for horses bedded on straw compared with shavings. Of the total observation period, group 1 spent, on average, 29.3% of their time budget engaged in recumbent behaviors, compared with 12.2% for group 2. However, no significant differences in duration were established between horses bedded on straw or shavings for standing sleep, sternal recumbency, and lateral recumbency behaviors ($P > 0.05$). Ingestive behaviors occupied approximately one-third of the time budget, with no significant difference ($P > 0.05$) observed between groups. On average, group 1 spent a longer proportion of the observation period ingesting bedding (8.1%) compared with group 2 (1%). Duration of bedding ingestion appeared to peak between 1 AM and 7 AM for both groups. Although not quantified, general observations revealed horses were motivated to alternate between eating hay and bedding in both groups, owing to the prevalence of bedding ingestion. The results indicate that 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.

Introduction

The domestic environment within which the horse is kept and managed can present challenges to instinctive and innate behavioral patterns. Research indicates that within this environment, stabling and associated practices are often the most challenging aspects that the horse is expected to cope with (e.g., McGreevy et al., 1995; Henderson & Waran, 2001; Piccione et al., 2008). Intense stabling practices, involving long periods of confinement with little access to (free) exercise, have been associated with increased restlessness and aggression (Werhahn et al., 2011). Extended periods of confinement can also be associated with increased risk of abnormal behavior development (McGreevy et al., 1995).

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Barriers within traditional and conventional stabling systems therefore appear to reduce the opportunity for the horse to display normal behavior and increase the likelihood of abnormal behavior display (Cooper and Albentosa, 2005; Rose-Meirhöfer et al., 2010). However, the role of the horse in modern society seems to necessitate stabling (Henderson, 2007), and as a result, research exists to investigate methods to enrich the stable environment using feed-balls (Henderson and Waran, 2001), increased opportunities to forage (Thorne et al., 2005), and increased visual horizons, such as mirrors (Cooper et al., 2000; Mills and Davenport, 2002). The use of bedding in the stable is a traditional practice that is receiving increased attention as a stimulus that is reported to exert variable positive and negative influences (Werhahn et al., 2010). However, previous studies investigating bedding report contradictory evidence, possibly owing to noncomparable sample populations or aspects of the study design. For example, some studies included female populations exclusively (Houpt et al., 1986; Werhahn et al., 2010), used relatively small stalls (Pedersen et al., 2004), and used crossover designs using different bedding materials (Werhahn et al., 2010). During preference tests, horses have been observed to choose straw bedding when given the choice (Mills et al., 2000), but some have also demonstrated no significant preference (Hunter and Houpt, 1989). Some of the negative conclusions from bedding research suggest that bedding material has little significant influence on behavior (Thompson, 1995) and is linked with colic (Greet and Rossdale, 1987). More recently, research has shown that straw bedding encourages more bedding-directed behaviors, less standing behavior, and longer-duration recumbent behavior (Pedersen et al., 2004; Werhahn et al., 2010). The current study therefore aimed to establish whether significant differences existed for a sample population of mixed-breed/age geldings, bedded on either straw or shavings, looking at the duration of nocturnal ingestive and sleep behaviors.

Methods and materials

Materials

Ten geldings of mixed breed and age (average age: 7.3 ± 3.53 years; range: 4-13 years) were allocated to either group 1 (straw; n = 5) or group 2 (shavings; n = 5) based on the bedding material that appeared in their stable. Each horse had been bedded on the material for at least 5 months previously. Each stable measured 12 feet by 12 feet, the design of which prevented physical contact between neighboring horses owing to solid walls separating each horse; they were able to see each other from the stable door. No deep litter systems or rubber matting was present in any of the stables. The bedding that appeared in the stable was either wheat straw or pinewood shavings that were not entirely new and varied in depth according to owner preference (minimum: 10 cm). Each horse was provided with access to pasture for between 6 and 10 hours during the day and given its normal feed and/or individual ration of hay at 6.30 PM. All horses were individually stabled on the same yard and underwent light-to-medium work but were privately owned and therefore subject to different daily regimens.

Experimental design

Each horse was filmed once for a period of 12 hours between 7 PM and 7 AM. The light was left on during the study, and horses were habituated to this for a period of 2 nights before data collection. A Sony Handycam DCR-SX15E (Sony, Tokyo, Japan) with a NP-FV100 battery was secured in the stable rafters in the top corner above the stable door and set on a wide-angle lens so that the entire stable was visible to facilitate data collection. Duration of ingestion and recumbent behaviors according to a predetermined ethogram (Table 1) were recorded using continuous focal sampling. Sleep was recorded where the behavior lasted for longer than 1 minute. Ethical approval was granted by Hartpury College.

Statistical analysis

To establish whether differences in frequency or duration of ingestive and recumbent behaviors existed for horses bedded on straw or shavings, Mann–Whitney U tests were used ($n_1 = n_2 = 5$). Significance levels were set at $P < 0.05$. Total mean duration of individual behaviors was calculated from the sum of the total time spent engaging in that behavior by each horse, divided by the size of the sample population in each group. Mean duration data were also used to calculate the proportion of the total observation period (720 minutes) that each behavior was displayed for.

Results

Sleep behavior

No significant differences between group 1 or 2 were observed for average total duration sleep standing ($z = -0.104$; $P > 0.05$), sternal recumbency ($z = 0.301$; $P > 0.05$), and lateral recumbency ($z = 1.985$; $P > 0.05$) (Table 2). During the total observation period, horses bedded on straw spent, on average, 29.3% of their time budget engaged in recumbent behaviors, compared with 12.2% for those bedded on shavings. Overall, horses bedded on straw spent, on average, 56.9% engaged in sleep behaviors compared with 49.2% for horses bedded on shavings.

Ingestion behaviors

Only 1 horse bedded on shavings was observed not to display any type of bedding ingestion behavior. No