Effects of Bedding Material on the Lying Behavior in Stabled Horses

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The objective of this study was to investigate the effect of straw, sawdust, coconut husk (husk), and coconut fiber (fiber) on the welfare of stable horses by observing their resting behavior. Twenty horses with ages ranging from 3 to 21 years were used at the Equine Research Institute of the Japan Racing Association, Utsunomiya, Japan. Five horses were allocated to each bedding condition. The behavior of each horse was recorded by video camera for 3 days and was continuously sampled from 17:00 to 05:00. The total duration, the number of bouts, and the mean and the maximum duration of bouts in standing rest, sternal lying, and lateral lying were calculated and analysed by the Kruskal-Wallis test and post hoc Steel-Dwass test. There was no difference in the standing rest and the sternal lying among beddings. Significant differences were observed in these values in the lateral lying among the different beddings (P<0.05). The values of the means of the total duration, the number of bouts, and the mean and the maximum duration of bout in the lateral lying were greater when husk was used as the bedding material than when sawdust were used (P<0.05). The results of the observations show that the new bedding materials would be as usable as straw. However, lateral lying was observed less frequently when sawdust were used as bedding; this indicates that use of sawdust as bedding material will decrease the welfare of stabled horses.

Key words: bedding, lying, stabled horse, welfare

Introduction

Bedding is an essential component in the housing of stabled horses. Bedding can be effectively used as a floor covering to absorb moisture and provide a soft surface [9]. Some studies have used the preference test to investigate the bedding preference in horses and ponies [3, 4, 6]. These studies have reported that the animals preferred straw over shavings and paper as the material for bedding. In Japan, rice straw has frequently been used as bedding, and in some cases, used straw bedding is often reused after drying in the sunshine. Aoyama et al. (2004) reported that drying the bedding in sunshine was not sufficient to completely clean it from urine ammonia. Moreover, rice straw has been unobtainable in Japan and imported from foreign countries, and the law relating to excreta of livestock was proclaimed. Therefore, it is required to use a new reusable material for bedding.

In this study, the husk and fiber of coconuts, which are wasted during the production of coconut milk, oil, etc. from coconut, were used as bedding materials. We
investigated the effect of these bedding materials and that of the commonly used bedding materials, namely, straw and sawdust, on the welfare of stable horses by observing their resting behavior.

**Materials and Methods**

**Animals and management**

Twenty horses ranging from 3 to 21 years of age were used at the Equine Research Institute of the Japan Racing Association, Utsunomiya, Japan. The breeds of horses were Thoroughbred (n=8), Anglo-Arab (n=3), Selle Français (n=3), Thoroughbred mixed breed (n=2), and Dutch Warmblood, Haflinger, Hannover, and Westfalen (n=1 each). The horses were kept individually in box stalls which floor was concrete (2.6 m × 3.6 m). They were ridden from 7:00 to 9:00 or were turned out into a pasture or a paddock from 09:00 to 13:00. Each horse received a pelleted concentrate and oat mixture and cut alfalfa hay at 05:30 and 15:30, and long timothy hay at 12:00 as a maintenance ration.

**Bedding materials**

The following 4 types of bedding materials were used: straw, sawdust, coconut husk (husk), and coconut fiber (fiber). The husk was made of crushed coconut husk and the fiber bedding was prepared with husk bedding covered with fiber from coconut husk. All the horses were housed with straw bedding before the experiments. Three weeks before the behavioral observation, the bedding was changed to the experimental bedding. Five horses were allocated to each bedding condition. In every bedding condition, the box stalls were cleaned and their faeces were removed once daily. Dirty straw was replaced with new straw daily, and the other beddings were replaced with new bedding once a week.

**Behavioral observation and data analysis**

The behavior of each horse was recorded by video camera for 3 days and was continuously sampled from 17:00 to 05:00. The box stalls were illuminated during the observation period. The total duration (minutes per a day), the number of bouts (times per a day), the mean and the maximum duration of bouts (minutes) in standing rest, sternal lying, and lateral lying [8] were calculated. The data in each behavioral category were analysed with the Kruskal-Wallis test, and a post hoc Steel-Dwass test was used to investigate the differences among beddings.

**Results**

There was no significant difference among beddings in the standing rest and the sternal lying (Tables 1 and 2).

| Table 1. Effects of bedding materials on the standing rest in stabled horse |
| Bedding materials | straw | sawdust | husk | fiber |
|-------------------|-------|---------|------|-------|
| Total duration (minutes) | 381.6 ± 88.7 | 437.8 ± 75.7 | 409.8 ± 75.7 | 443.8 ± 151.2 |
| Number of bout | 20.7 ± 4.8 | 24.1 ± 4.9 | 26.8 ± 9.8 | 16.7 ± 5.8 |
| Mean duration of bout (minutes) | 18.4 ± 11.8 | 18.2 ± 3.7 | 15.3 ± 7.5 | 26.6 ± 8.5 |
| Maximum duration (minutes) | 93.0 ± 59.0 | 116.4 ± 78.5 | 102.8 ± 43.3 | 93.9 ± 34.4 |

Numbers are mean value ± S.D. Husk was made of crushed coconut husk and fiber was prepared with husk bedding covered with fiber from coconut husk.

| Table 2. Effects of bedding materials on the sternal lying in stabled horse |
| Bedding materials | straw | sawdust | husk | fiber |
|-------------------|-------|---------|------|-------|
| Total duration (minutes) | 38.6 ± 33.1 | 19.4 ± 20.1 | 69.6 ± 39.4 | 19.1 ± 28.4 |
| Number of bout | 2.8 ± 2.6 | 1.7 ± 1.5 | 6.1 ± 3.6 | 1.7 ± 1.4 |
| Mean duration of bout (minutes) | 13.8 ± 7.9 | 11.6 ± 5.8 | 11.3 ± 4.8 | 11.0 ± 8.3 |
| Maximum duration (minutes) | 31.5 ± 27.9 | 13.6 ± 9.8 | 28.7 ± 10.2 | 13.4 ± 16.1 |

Numbers are mean value ± S.D. Husk was made of crushed coconut husk and fiber was prepared with husk bedding covered with fiber from coconut husk.
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Table 3. Effects of bedding materials on the lateral lying in stabled horse

| Bedding materials | straw   | sawdust  | husk     | fiber    |
|-------------------|---------|----------|----------|----------|
| Total duration (minutes) | 4.0 ± 5.6<sup>ab</sup> | 0.02 ± 0.05<sup>b</sup> | 10.1 ± 10.9<sup>a</sup> | 1.5 ± 2.5<sup>b</sup> |
| Number of bouts    | 1.6 ± 1.8<sup>b</sup> | 0.1 ± 0.15<sup>b</sup> | 3.4 ± 0.9<sup>a</sup> | 0.3 ± 0.5<sup>b</sup> |
| Mean duration of bout (minutes) | 2.5 ± 1.1<sup>b</sup> | 0.3 ± 0.01<sup>b</sup> | 3.0 ± 0.9<sup>a</sup> | 4.4 ± 2.5<sup>b</sup> |
| Maximum duration (minutes) | 4.4 ± 3.9<sup>b</sup> | 0.07 ± 0.15<sup>b</sup> | 5.1 ± 2.2<sup>a</sup> | 3.8 ± 6.8<sup>b</sup> |

Numbers are mean value ± S.D. Husk was made of crushed coconut husk and fiber was prepared with husk bedding covered with fiber from coconut husk. Numbers with different letters are statistically different (a, b: P<0.05).

2). Significant differences in the total duration, the number of bouts, and the mean and the maximum duration of bouts in the lateral lying were observed among beddings (P<0.05). The values of the means of the total duration, the number of bouts, and the mean and the maximum duration of bouts in the lateral lying when husk was used as bedding were greater than those when sawdust were used as bedding (P<0.05, Table 3).

Discussion

Resting behavior when husk and fiber bedding were used was not different from that in straw treatment. The resting behavior indicates that these new bedding materials would be as usable as straw. However, lateral lying was observed less frequently with sawdust, which is a commonly used bedding material, than when husk was used as bedding. The lateral lying is said to be related to sleeping [9], which is a positive indicator of welfare in stabled horses [7]. It is also reported that horses preferred straw bedding over shavings in the preference tests [6]. The less frequent observation of the lateral lying with sawdust indicates that sawdust used as bedding material decrease the welfare of stabled horses. In this study, replacing dirty bedding with new bedding of sawdust was performed once a week although faeces in stalls were removed once a day. This management would influence the less frequency of the lateral lying. Moreover, it is said that the sleeping behavior was related to learning and memory (review, [5]). Therefore, further investigations on the effect of bedding material and the method of cleaning the bedding on the horses’ welfare and learning are required.

However, in animal welfare, we focus on the physical and mental health of the animals with reference to the ‘5 freedoms’. The concept of 5 freedoms are (1) freedom from hunger and thirst; (2) freedom from discomfort; (3) freedom from pain, injury, or disease; (4) freedom to express normal behavior; and (5) freedom from fear and distress. Bedding material is related to the ‘freedom from discomfort’ in terms of moisture, soft surface, and air ammonia; ‘freedom from pain, injury, or disease’ in terms of hoof disease and skin conditions, and ‘freedom to express normal behavior’ in terms of resting and sleeping behavior. The effect of bedding materials on the welfare of stabled horses should be evaluated not only based on the resting behavior but also based on the water content in bedding, airborne ammonia (e.g. [1]), and hoof condition. Moreover, the use of beddings should be evaluated in terms of management and costs for the applied purpose.

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