

# The effect of presenting forage in multi-layered haynets and at multiple sites on night time budgets of stabled horses



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## ABSTRACT

The aim of this study was to explore the efficacy of multi-layered haynets and multiple presentation of haynets to increase time spent on feed intake behaviour at night (13 h observation). For preliminary assessment two horses performing the oral stereotypy of crib-biting were included. Six horses received the same amount of forage during a 22-day, cross-over study where treatment consisted of either forage presentation in a single small-holed haynet (SH) or the forage was divided between 3 haynet combinations hung up simultaneously = multiple haynets (MH). The three haynets presented simultaneously consisted of (a) MH single haynet (same as SH), (b) MH double layered haynet and (c) MH triple layered haynet. Multiple haynets were presented, in random order, on three sides of the stable. Horses were filmed using a video surveillance camera with infrared light source. Behaviour was observed for at least 4 nights per treatment (one night during the acclimatisation period [nights 2–4] and three nights during the end period [nights 7–11]). The observation period commenced at 16.30–17.00 h (point of haynets being presented) until 06.00 h (all horses) or 9.00 h (2 crib-biting horses) the next morning. Data were analysed for normal distribution and ANOVA between haynets, paired *t*-tests between treatments and Pearson correlation were used (SPSS, 17.00; 2012). There was a significant effect of type of haynet ( $p < 0.001$ ) on intake time per kg forage (min/kg for SH: 39; MH all (data combined): 51; MH Single: 27; MH Double: 67; MH Triple: 78; overall sem. 8.9). The overall time budget (minutes per observation hour) showed a significant difference between treatments for eating from haynet, standing still, locomotion and drinking. Horses finished eating from SH haynets at around 01.38 am ( $\pm 1.05$  h s.d.), were last observed at the double net at 03.00 am and at the triple net at 05.12 am ( $\pm 1.25$  h s.d.). Based on these results, providing 6 kg of forage in 3 double-layered, 2.5 cm haynets spread around the stable could potentially lead to an increased feeding time of 2 h per night compared to a single 2.5 cm holed haynet containing 6 kg. From the continuous observation data a clear visual difference in crib-biting pattern and therefore motivation to perform crib-biting emerged between the two stereotypic horses.

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## 1. Introduction

The foundation of any equine diet should be forage, fed either fresh or preserved, as naturally horses would spend  $12 \pm 2.5$  h a day foraging and their digestive tract is designed for a continuous intake of fibrous low energy herbage (Ellis, 2010). Feral, semi-feral or pasture kept horses spend rarely more than 3 h on non-foraging behaviours within 24 h and limited studies of stabled horses

confirm similar night time activity patterns (Ellis, 2010; Hallam et al., 2012; Ellis et al., 2015). Greening et al. (2013) observed in stabled horses that during the period between 01.00 and 07.00 h the greatest amount of bedding eating took place, possibly due to lack of forage provision. Feeding hay from the ground in stables would be most natural and a position favoured by horses (Webster and Ellis, 2010) but horses do have an intake rate (min/kg) for loose hay which is 25% faster compared to hay presented in a medium sized haynet (Glunk et al., 2013). This may not be a problem in horses which can be fed *ad libitum* forage, as voluntary intake rate studies have shown (Ellis, 2010). Potential issues arise in stabled horses fed limited amounts of forage especially when

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energy dense complimentary feed is given or when energy intake has to be significantly restricted, most commonly for weight management (Argo et al., 2012). Haynets are, therefore, commonly recommended as part of a weight management programme to help extend the time spent foraging when on such restricted calorie diets, thereby helping to preserve more natural intake behaviour.

Loss of natural feed intake time and chewing opportunity has been cited in the past as an important trigger for pre-disposing animals to develop stereotypic behaviours (McGreevy et al., 1995; Mills et al., 2002; Christie et al., 2006; Ellis, 2010; Wickens and Heleski, 2010; Sarrafchi and Blokhuis, 2013). Crib-biting and weaving behaviour, generally increases considerably during the periods of day when concentrates are given (Mills et al., 2002) and this may be linked to stressful feeding times (Hallam et al., 2012). On the other hand, Whisher et al. (2011) found a significantly higher amount of crib-biting occurred during the night compared to day time observations in 8 stereotypic horses. These authors concluded that this was possibly due to a lack of forage available overnight (Whisher et al., 2011). Therefore, increasing the horse's time spent on feed intake behaviour is an important strategy in management of stabled horses.

Various methods have been used to try and extend the time spent foraging, such as the use of small holed haynets, meshes/bars over feeding bins and multiple feeding stations (Ellis et al., 2015; Glunk et al., 2013; Hallam et al., 2012; Goodwin et al., 2002). Ellis et al. (2015) showed that even when presented with small meshed haynets containing 7 kg of forage at 17.00 h, horses had completely finished eating their ration by approximately 23.30 h. This left a period of 7–8 h before morning feeding commenced at 07.00 h thereby increasing the risk of gastric ulcer development (Luthersson et al., 2009). Presenting forage at multiple points within the stable environment increased feed intake time and reduced foraging in bedding in stabled horses (Goodwin et al., 2002, 2007; Thorne et al., 2005).

Glunk et al. (2013) reported a strong effect when comparing a very large holed haynet (15 cm) to a small holed haynet (3.2 cm) with an additional 20 min spent on feed intake per kg forage (horses  $n=8$ ). However, the study by Ellis et al. (2015) which used much longer adaptation periods, showed that haynets with smaller holes (2.5 cm) were only able to slightly slow down feed intake in horses (resulting in an increased chewing time of around 5 min/kg,  $n=12$ ) compared with 'large-holed' haynets (5.0–7.5 cm). Interestingly, night observations in that study ( $n=6$ ) showed no difference in the overall total time spent on forage intake between the haynets even though according to short term intake rates horses would have been expected to spend an additional 35 min on food intake behaviour from the small-meshed haynets. Instead the

feeding time was spread slightly more across the night with the smaller-meshed nets (Ellis et al., 2015). Therefore, there is an indication that measuring just short term intake rates will not always highlight changes in long term time budgets. Further studies are required to help develop other methods to prolong feed intake time without increasing calorie intake for certain stabled horses.

### 1.1. Aim

The aim of this study was to explore the efficacy of multi-layered haynets and multiple presentation of haynets to increase time spent on feed intake behaviour in 6 horses over a full night-time period of 13 h. For preliminary assessment of crib-biting time budgets, two horses performing the oral stereotypy of crib-biting were included.

## 2. Materials and methods

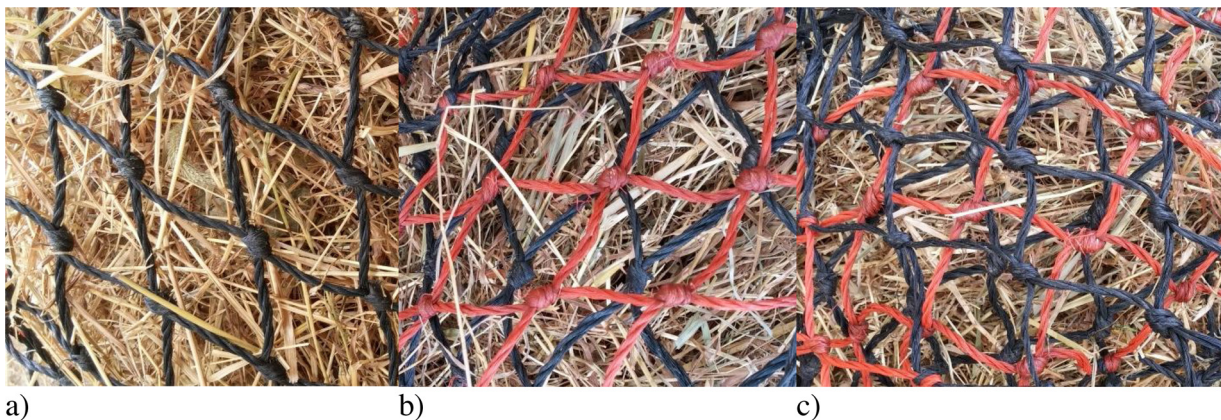
The study took place at Brackenhurst Equestrian Centre and ethical approval was granted by NTU, School of Animal, Rural and Environmental Sciences Ethics Committee.

### 2.1. Study design

The study was a cross over design with two phases lasting 11 days each with three horses on each treatment per phase and one day 'wash-out' period between. Within each phase two periods were measured, the acclimatisation period (beginning of phase) and the 'end of phase' period. Horses were randomly assigned to treatments, although two horses, which displayed the oral stereotypic behaviour of windsucking, were blocked between groups.

### 2.2. Horses and management

Six geldings (619 kg  $\pm$  42 s.d.) received the same type and amount of forage (hay or haylage) for both treatments. Average forage intake was 3 kg Wet Matter (WM, as fed) in the morning haynets (6.30–6.45 am) and 6  $\pm$  1 kg WM in the evening haynets (16.20–16.40). Horses also received a complementary feed (containing lucerne chaff, high fibre pellets and wet sugar-beet pulp; Wet matter weight 4  $\pm$  0.6 kg split into two equal meals per day: 07.00 h and 17.00 h) according to energy requirements assessed by body condition and weight (NRC, 2007). Horses were housed in individual boxes, kept on wood-shavings bedding and had regular anthelmintic treatment and dental evaluations. During the day, horses were involved in 2–3 h of riding activities which remained constant throughout the period (2.7  $\pm$  0.25 h/weekday).



**Plate 1.** Illustration of haynet combinations used (a) single haynet used in SH and MH single treatments, (b) double layered haynet used in MH double and (c) triple layered haynet used in MH triple.

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