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The effect of a compressed air stimulus on blocking times in a concentrate feeding station for horses in group housing

Aline Gülden*, Wolfgang Büscher

Institute of Agricultural Engineering, Livestock Technology Section, University of Bonn, Nußallee 5, 53115 Bonn, Germany

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ABSTRACT

Concentrate feeding stations are used to meet the different feeding requirements of group-housed horses. In practice, blocking times caused by horses remaining in the feeding station without concentrate allowance constrain the feeding process considerably. To date, the application of an electric shock seems to be the most effective stimulus to prevent these blocking times.

The aim of the present study was to examine the effectiveness of an innovative stimulation device in preventing the occurrence of blocking times. The study was carried out in a so called active barn, a group housing system with a generous space offer which is subdivided into different functional areas (resting, water intake, concentrate intake, roughage intake, paddock, pasture). Each of the 16 horses observed was fed with the help of a concentrate feeding station. As standard, the concentrate feeding station was equipped with a stimulation device that is intended to encourage the horses to leave the station after feed intake. The stimulation device consisted of an acoustic signal (beeper) and a touch trigger (thin stick) that should drive the horses from the feeding station. In the course of the present study, an additional stimulus was implemented, namely the application of compressed air between the horses' hind legs. The behaviour of the horses was recorded with video observation and analysed over a period of 3 × 24 h in each of the trial periods (1. Status quo = no application of compressed air; 2. Compressed air; 3. Compressed air after two weeks of application; 4. Compressed air after six weeks of application).

It was observed that the average daily blocking durations, as well as the average daily blocking frequencies of the horses, could be reduced significantly by the application of compressed air. However, an increase of the observed blocking durations and blocking frequencies during the six weeks of the trial period indicates the occurrence of a habituation effect over time. In the course of the present study it became obvious that there are great individual differences concerning the reaction of the horses to the applied stimulation devices. As the emergence of blocking times is a very complex issue, the authors strongly recommend further scientific research on this topic. Possible future research focuses are discussed in the course of the present study.

1. Introduction

In practice, different housing systems are available for keeping horses in groups (Gieling et al., 2007). In recent developments, the management of horses in so called active barns has become popular because increasingly more horse owners want to keep their horses under species-appropriate conditions (Hoffmann et al., 2012). The main characteristics of active barns are the spatial separation of the different functional areas for resting, water intake, concentrate and roughage intake as well as a generous space offer (Rose-Meierhöfer et al., 2010). According to the current state of knowledge, this stable design best satisfies the horses' basic needs for locomotion and social contact (Vervuert and Coenen, 2002).

The German Federal Ministry of Food, Agriculture and Consumer Protection recommends the use of feeding stalls to guarantee individual feeding in group housing (BMELV, 2009). In practice, automatic feeding systems are increasingly used to meet the different feeding requirements of group-housed horses (Streit et al., 2008). Responsiveness to a horse's individual needs, as well as the time-controlled feeding process throughout the day, are described as the main advantages of computer-controlled concentrate feeding stations (Pirkelmann, 1990; Kreimeier, 2004). Due to the feeding computer the farm manager can easily check the concentrate intake of each horse. Feed remains might indicate illnesses and

* Corresponding author.
E-mail address: guelden@uni-bonn.de (A. Gülden).

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technical problems like a defective or lost transponder (Pirkelmann, 1998; Kreimeier, 2004). A reduction of working hours, as well as more flexibility in working practices, can be described as the main advantages of concentrate feeding stations for farm managers (König von Borstel et al., 2010; Zeitler-Feicht et al., 2010).

The main disadvantage of computer-controlled concentrate feeding stations, which could deter uptake, are relatively high investment costs that lead to an increased animal/feeding-place ratio of usually 30:1 (Kreimeier, 2004; Zeitler-Feicht et al., 2010). In contrast to feeding stalls, and as a result of the saving of feeding places, concentrate feeding stations do not allow simultaneous feed intake (Streit et al., 2008). The specific importance of synchronization and social facilitation regarding feed intake has already been pointed out by Rifá (1990) and Sweeting et al. (1985). Due to the natural feeding behaviour of the horses, as well as the increased animal/feeding-place ratio, waiting times in front of concentrate feeding stations are almost inevitable. Blocking times caused by horses remaining in the feeding station without concentrate allowance, constrain the feeding process considerably and increase waiting times additionally (Gülden et al., 2011). According to Zeitler-Feicht et al. (2011) the accumulation of horses in the waiting area (in front of the feeding station) leads to an increased risk of aggressive interactions. Although Gülden et al. (2011) observed that the two lowest ranking horses had to wait for more than two hours throughout several observation days to obtain their feeding claims, a statistically significant difference concerning waiting times between low-ranking and high-ranking horses has not yet been verified (Gieling et al., 2007; Streit, 2009; Gülden et al., 2011).

The setup of the feeding stall is of vital importance to guarantee an undisturbed feed intake at automatic feeding stations for all horses. Already Pirkelmann (1990) pointed out that the feeding stall should cover the whole body length to ensure a stress-free environment and complete feed intake also for low-ranking horses. Nevertheless, the partitions should allow visual contact to the other horses. Concerning ethological aspects, one-way stations with a separate entry and exit are more suitable than stations that have to be left backwards (Pirkelmann, 1990; Zeitler-Feicht et al., 2011). Based on the current state of knowledge, feeding stations that are equipped with an entry barrier are classified as animal-friendly because they guarantee an undisturbed feed intake for all horses (Pirkelmann, 1990; Zeitler-Feicht et al., 2011). Although there are great differences concerning the design of the entry barriers in practice, their common characteristic is that they increase the occurrence of blocking times caused by horses standing inside the station without concentrate allowance (Pirkelmann, 1990; Streit, 2009). The average daily blocking durations of the horses observed in different scientific investigations range from 14.9 ± 15.9 min (Gülden et al., 2011) to 36.7 ± 128.4 min (Zeitler-Feicht et al., 2011). Zeitler-Feicht et al. (2011) could identify great individual differences – some horses did not block the feeding station at all, however, others did so for more than two hours. In contrast to Pirkelmann (1990), recent studies could not identify a statistically significant influence of the horses' social rank on the occurrence of blocking times (Streit, 2009; Gülden et al., 2011).

According to Pirkelmann (1990) blocking times can be reduced by a computer-controlled stimulation device that is activated if necessary. In general, these stimulation devices are used as negative reinforcers. Zimbardo and Hoppe-Graff (1995) describe a negative reinforcer as a stimulus that increases the occurrence of a specific reaction to the presented stimulus in case the stimulus is taken from the situation. Pirkelmann et al. (1993) investigated a stimulation device that drove through the feeding station. An acoustic signal indicated the activation of a live wire rope being connected with a fence energiser. After appropriate modifications the horses left the feeding station with the activation of the acoustic signal and without getting in contact with the electric shock. Gülden et al. (2011) observed that the application of a stimulation device was able to reduce the average daily blocking durations of the horses significantly from 14.9 ± 15.9 min to 0.6 ± 1.3 min. The stimulation device consisted of an acoustic signal (beeper) and the touch of a crop. The crop was lowered onto the horses standing in the feeding station and operated without the use of an electric shock. The stimulation device complied with the principles of classical conditioning. The acoustic signal sounded for five seconds while the feeding trough was closed. Then the crop was activated and the acoustic signal sounded for a further five seconds. Gülden et al. (2011) observed a habituation effect already after two weeks of application. The heart rate measurements conducted verified their observations. Zeitler-Feicht et al. (2011) pointed out that blocking durations were eleven minutes shorter in the case of feeding stations equipped with a stimulation device that applied an electric shock. In recent developments, the stimulation device comprises an acoustic signal as well as a touch trigger (thin stick) that passes through the feeding station and can be activated, including an electric shock, if necessary. However, the use of an electric shock as a stimulation device is controversial and cannot be applied without restrictions (Streit, 2009; Gülden et al., 2011). Zeitler-Feicht (2005) found out that some horses panic after the application of the electric shock and are not motivated to enter the feeding station again. According to Zeitler-Feicht (2005), the use of an electric shock is incompatible with the feeding of horses and cannot be described as compliant to appropriate animal welfare standards (Zeitler-Feicht et al., 2011). The fact that the use of an electric shock is the only means to efficiently prevent the occurrence of blocking times points out the high discrepancy between scientific theory and what is done in practice (Gülden et al., 2011). This fact confirms the conclusion of Hartmann et al. (2012) who stated that "innovative housing designs" for group-housed horses and especially the implemented feeding regimes should be further investigated because only a few scientific studies have been conducted to date.

The current study emerged from the authors' opinion that a feeding system will only be completely accepted in practice if it accords with appropriate animal welfare standards. The aim of the present study was to evaluate the effectiveness of a compressed air stimulus in preventing the occurrence of blocking times. Due to the encouraging results of different preliminary studies on the manual application of compressed air, we conducted the present test series. We expected that the compressed air stimulus would be appropriate to prevent the occurrence of blocking times in concentrate feeding stations. As the horses responded reliably to the compressed air stimulus in the preliminary studies, we expected that a habituation effect would not occur over time.

2. Materials and methods

2.1. Housing system

The study was conducted at a horse farm in the west of Germany between July and September 2014. The group housing system investigated was designed for 30 horses and covered a total area of 3500 m^2 (Fig. 1). The housing system was divided into different functional areas (resting area, concentrate feeding station, roughage area, water intake, paddock, pasture). The central stable (300 m^2) comprised an engineering room, two resting areas (262.5 m^2) and three boxes to enable the gradual integration of new horses. The resting areas were bedded with forest soil and had two different entries and exits. A concentrate feeding station (Schauer Agrotronic GmbH) was placed at the gable end of the central stable to supply the horses with concentrate and mineral supplements throughout the day. A rack offering straw ad libitum was placed in the paddock. Additionally, three hay racks were placed in a sepa-

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