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Head partitions at the feed barrier affect behaviour of goats

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ABSTRACT

Space allowance at the feeding places often forces goats to feed in close proximity, that is, less than their individual distances. In consequence, agonistic behaviour may increase as well as stress and injuries, while access to feed may decrease, especially in low-ranking goats. Partitions between single feeding places may reduce individual distances and may enhance the acceptance of goats feeding close by. The aim of this study was to investigate the influence of non-transparent head partitions at the feed barrier on agonistic behaviour, activity budget, feeding place occupancy, adrenocortical activity, nutritional status (body weight and body condition), and injuries in loose-housed dairy goats.

The study involved 72 pregnant dairy goats of the German Improved Fawn breed. Two groups of 36 animals each were tested in a cross-over design. At the beginning, one group was provided with head partitions at a wooden palisade feed barrier, whereas the other group stayed without head partitions. After 11 experimental days, the head partitions were switched to the other group. Social interactions were recorded for 13 h and 20 min per treatment (2 h and 40 min on 5 days each group). Activity budget and feeding place occupancy were observed via scan sampling for 48 h per treatment. Body weight, body condition score, and occurrence of injuries were assessed, and faeces were sampled for analysis of cortisol metabolites. Data were analysed by Wilcoxon-tests for dependent data, except for feeding place occupancy, where *t*-tests were used. Goats displayed less agonistic behaviour in the feeding area with head partitions at the feed barrier ($p = 0.003$). In addition, with head partitions a lower number of displacements from feeding place by an actor standing inside the feed barrier was found ($p = 0.002$). The impact was most pronounced in low-ranking animals ($p = 0.009$), but effects were also found in middle-ranking goats ($p = 0.030$). Low-ranking goats were observed less often feeding ($p = 0.009$) and more often lying ($p = 0.026$) during the first hour after feed supply with head partitions. With head partitions more goats were feeding directly next to each other, i.e. without an empty feeding place in between ($p = 0.017$). Regarding the nutritional status of the goats, the lumbar body condition scores were higher in high-ranking animals with head partitions ($p = 0.007$). Presence of head partitions had no effect on sternal body condition scores, body weight, concentrations of faecal cortisol metabolites, and occurrence of injuries. In summary, non-transparent head partitions seemed to reduce the accepted distance between goats and therefore showed beneficial effects in terms of lower levels of social disturbances during feeding. Thus, head partitions can be recommended for feed barriers in goat loose-housing systems.

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1. Introduction

Animals strive to keep a minimum distance, termed "individual distance", to conspecifics (Hediger, 1940; Wilson, 2000; Aschwanden et al., 2008). If possible, subordinate animals avoid intruding the individual distance of dominant animals and withdraw from approaching dominant individuals (Bouissou et al., 2001). However, in housed animals limited space and clumped resources make such avoidance behaviour difficult. Indeed, the number of agonistic social interactions and injuries increases with reduced space allowance (Weng et al., 1998; Menke et al., 1999; Boe et al., 2006). The space per goat at the feeding place is often 40 cm and less (Jørgensen et al., 2007; Waiblinger et al., 2010). In contrast, the individual distance, being defined as the critical distance at which further proximity would trigger agonistic behaviour by one of the animals (Hediger, 1940), was shown to range from 0.1 m to 4 m in goats during feeding, but only for 14% of the pairs it was below 0.5 m, while the freely chosen distance was even higher (Aschwanden et al., 2008). Therefore adjacently feeding goats are often forced to intrude another goat's individual distance, which increases social tension in the feeding area. Consequently, agonistic interactions, displacements, and avoidance behaviour will be displayed, which could impact on feeding behaviour, feed intake and thus nutritional status (Andersen et al., 1999; Olofsson, 1999), the risk of injuries, as well as stress level.

One possibility of reducing the accepted social distance and thus agonistic behaviour is the use of physical separations (for review Waiblinger, 2009). Physical separation between feeding places can be classified into several levels. Firstly, offering fixed feeding places induces a definite distance between the necks of the animals and can reduce agonistic interactions (Endres et al., 2005; Huzzey et al., 2006; Nordmann et al., 2011). Secondly, partitions can be installed between the heads (head partitions) or between the bodies (body partitions, i.e. neck backwards only) of feeding animals. Head and body partitions as well as a combination of both were shown to reduce agonistic interactions and displacements and increase feeding time and access to feed, especially in low-ranking animals, in horses, pigs and cattle (Holmes et al., 1987; Andersen et al., 1999; DeVries and von Keyserlingk, 2006).

In goats, non-transparent body partitions (including protection of the head) were more effective in reducing agonistic interactions as well as in increasing the time spent feeding simultaneously and the latency to feeding place change than a transparent partition (Aschwanden et al., 2009). Further, the effects were more pronounced the longer the partitions (Aschwanden et al., 2009).

Non-transparent head partitions had no effect on feeding behaviour and little on agonistic interactions in unrestrained goats (Hillmann et al., 2014). When animals were restrained in the feed barrier, the number of agonistic interactions was lower and feeding scans higher, especially in low-ranking horned goats, with head partitions (Hillmann et al., 2014). In this study goats were kept in small groups of only 6–7 animals. There it might be even more difficult for some pairs of animals to keep the individual distance, because high-ranking animals occupy several feeding places and low-ranking animals have to share feeding places (Loretz et al., 2004). What is more, in larger groups there are more possibilities for individual goats to avoid specific others by choosing a distant feeding place.

Therefore, we investigated the effects of non-transparent head partitions at a feed barrier on behaviour, nutritional status, and stress of dairy goats in larger groups. We hypothesised that for the feed barrier with head partitions lower numbers of agonistic interactions and displacements, higher percentages in feeding, higher feeding place occupancy, and less stress, as measured by lower faecal cortisol metabolites, would be found. Furthermore, we expected, in accordance with a decrease in agonistic interactions due to head partitions, a reduction in the number of injuries.

2. Animals, materials, and methods

2.1. Animals, housing, and management

The experiment involved 72 pregnant dairy goats of the German Improved Fawn breed at the Thünen-Institute of Organic Farming in Germany, and was conducted from October to November 2008. Seven weeks before the start of the experiment, the goats were divided into two groups (group 1 and group 2) of 36 animals each. At the time of the study, the goats were 2–7 years old (mean ± s.d.: 4.2 ± 1.6). Both groups were similar in milk yield, numbers of lactation, and age. The average 240-day milk yield was 552 kg/animal, with an average of 3.30% fat and 2.98% protein. Almost all goats were horned, only two animals in group 1 and one in group 2 were hornless. As the animals had been mated shortly before the experiment and had kidded in spring (February/March) 2008, they were in their late lactation period. The goats were kept in two pens with straw litter. The two pens slightly differed in shape and size (group 1: 180.6 m^2 = 5.0 m^2/goat, group 2: 193.1 m^2 = 5.4 m^2/goat) due to constructional conditions of the stable. Both pens were equipped with a water bowl, a lick stone, and a brush for self-grooming. Before the experiment, goats were fed roughage in a hay rack. All goats were individually marked with numbers on their body sides by using hair dye.

Prior to the experiment, a feeding table and a wooden palisade feed barrier had been installed in the stable, which was accessible for the animals two weeks before data recording started. The wooden palisade provided 36 feeding places for each group (animal/feeding place-ratio 1:1). Each feeding place was 40 cm wide, consisting of 28 cm of solid wooden arcs and 12 cm space in between, where the goats could put their head trough and feed from the feeding table.

Since the palisades were 90.5 cm high from ground level of the pen (79 cm from feeding table), the feed barriers were stanchioned at the top, in a height of 106 cm from feeding table, to prevent the goats from jumping over it.

The head partitions had a dimension of 34.5 cm height and 25 cm depth from the feed barrier to the front (Fig. 1). They were installed at the feed barrier 26 cm over the ground level of the feeding table. The goats were fed hay ad libitum at the feeding table and got concentrates in the milking parlour. In the morning, the goats were provided with hay (08:30 h). At 13:00 h and 17:30 h, the remaining