

Rank correlated use of soft flooring by dairy cattle

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Abstract

The present study covers rank correlated use of soft flooring during partial replacement (45% of the total floor space) of concrete slatted floor by rubber covering. For this purpose, the rank position of 19 cows within a 50 Brown Swiss dairy cattle herd was evaluated by calculating the individual dominance index. A clear rank affiliation could be found for 16 cows (eight cows with a rank index 0.67 – 1.0 (ie high ranking) and eight cows with a rank index 0.0 – 0.25 (ie low ranking). Using focal sampling, the 16 cows were observed with time-lapse video recording before and after floor replacement (8.5 hours per day for 10 days with each floor kind). After replacing 45% of the concrete floor surface with soft flooring in a test area far from the milking parlour, high ranking cows used this area significantly longer ie 105.5 ± 36.2 min more than before compared with lower ranking herd members, who did so 17.6 ± 24.6 min less. Before replacement, low ranking cows spent significantly more time on the concrete slatted floor of the test area (147.6 ± 13.2 min) than high ranking cows (80.9 ± 17.3 min). The results of the observation demonstrate that the extent of use of soft rubber flooring correlates to rank-order and illustrates the importance of barn designs in terms of meeting their specific needs in spite of an existing rank order.

Keywords: animal welfare, concrete floor, cow comfort, dairy cattle, social rank, soft flooring

Introduction

Cow comfort can increase overall health, milk yield and productive life span due to an enhanced animal welfare status (Wagner-Storch *et al* 2003). The commonly-used concrete slatted floor in loose housing systems conflicts with cattles' specific demands for a 'pasture-like' sub-surface (Benz & Wandel 2004) and is identified as one of the most important causes of cattle lameness (Somers *et al* 2003; van der Tol *et al* 2003; Cook *et al* 2004). The high incidence of lameness and the consumers' growing demand for welfare-friendly livestock systems (Bennett 1996) has led to a search for alternatives, especially regarding floor quality. One possibility is to cover the concrete slatted floor with slatted rubber mats. This combines a labour saving, self-cleaning management system with the demands of cattle-friendly flooring. These rubber mat layers cushion the cow's claw, allowing it to sink into the rubber up to four millimetres, so that the impact load is reduced, lateral slipping is avoided (Hultgren 2001), and claw health is improved (Hultgren & Bergsten 2001). The intensity of use of comfortable areas within the barn by the cow has been correlated with its social status and has also been defined as a clear indicator of an animal's acceptance of its housing environment (Broom 1991; Lowe *et al* 2001).

The present study investigated how the time spent on soft flooring is influenced by the rank order of dairy cows. For this purpose, an area of concrete slatted floor was gradually replaced by slatted rubber covering.

Materials and methods

Animals and housing environment

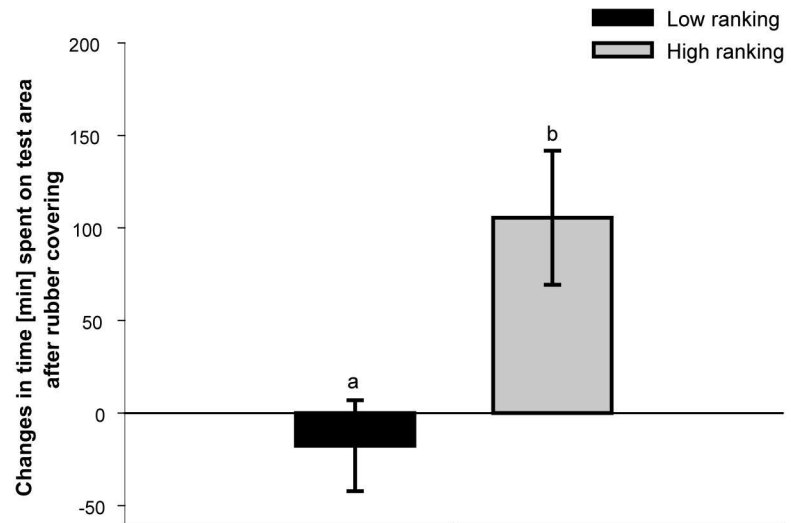
The research was conducted in a naturally ventilated cubicle house with 50 Brown Swiss dairy cows. The rubber mats used (Type Kura S, Gummiwerke, Kraiburg, Germany) are 3.1 cm thick, with a hammer-blown profiled surface to enhance grip and the sub-surface is made up of knobs which promote elasticity and the borders are profiled to provide a smooth laying surface.

Assessment of rank order

To find out how much the rank position influences the choice of floor quality, social ranking patterns of 19 randomly sampled and individual marked cows were assessed by the method of Sambraus (1975). Using focal sampling, the social interactions among the 19 cows were videotaped for 8.5 hours a day for 10 days to evaluate the social index of each cow. The dominance index was then calculated for each cow using the quotient of the number

Figure 1

Mean difference of time the cows spent on the test area before and after rubber covering dependent on social rank position ($n = 8$ cows per group with the mean time of 10 days observation per phase [8.5 hours a day]). ^{ab} $P = 0.014$.



of (successful) dominations and the number of (checked) confrontations.

Dominance indicating behaviour was characterised by menacing behaviour, head pushing and fighting, while submissive behaviour was characterised by subordination (lowered head, mouth stretched forward, eyes opened wide) and avoidance.

A clear rank affiliation could be found for 16 cows (eight cows with rank index $0.67 - 1.0 =$ high ranking and eight cows with rank index $0.0 - 0.25 =$ low ranking). For the remaining three cows a clear rank affiliation could not be found, hence they were not considered for the further study.

Study design

The study was divided in two phases; each of six weeks duration.

1st phase: the duration of stay of the focal animals on the concrete slatted floor area which was intended for replacement by rubber covering; this was video recorded over a period of 10 days, 8.5 hours per day.

2nd phase: after 4 weeks of adaptation to the rubber covered flooring (45% of the total floor space, far from milking parlour, bordered at one side by the feeding alley) the duration of stay of the focus animals was video recorded again over a period of 10 days, 8.5 hours per day and compared with the durations of stay in the 1st phase before rubberising the area.

Statistical analyses

Statistical comparison of groups started with testing for normality (Kolmogorov-Smirnov's test with Lilliefors' correction) and equal variance (Levene's Median test). If data fulfilled both criteria, parametric tests were applied and values are presented in mean (\pm SEM). If normality failed, non-parametric tests were used (Mann Whitney Rank Sum test). All tests were performed using SigmaStat 3.01 (Systat,

Erkrath, Germany). A probability value (P) less than 0.05 was considered to be statistically significant.

Results

Low ranking cows stood significantly (Student's t -test, $P = 0.008$) longer during the period of observation on the concrete slatted floor areas than high ranking cows (147.6 ± 13.2 vs 80.9 ± 17.3 min).

By comparing the mean differences of time each cow spent on the test area before and after changing the floor quality, high ranking cows used the rubber area on average 105.5 ± 36.2 min longer than before rubberising. While low ranking cows could be observed on average 17.6 ± 24.6 min less than before rubberising (Student's t -test, $P = 0.014$; Figure 1). Recapitulating, high ranking cows spent on average 186.4 ± 45.4 min on the rubber covered test area vs 130.0 ± 22.8 min by the low ranking cows.

Discussion

The present study covered the rank correlated use of areas of the barn which had been improved with regard to floor quality. The design of the study, step-by-step replacement, was chosen consciously to simulate the practical farm realities of floor reconstruction. As a result, the possible influence of changes in feed quality and meteorological effects seemed to be negligible because of the relatively narrow time frame of three months in the present study. However, as the study was designed as a single herd study, the present results must be interpreted cautiously.

The rank correlated preference of areas with high cow comfort in the present study is the primary indicator that animals react to improvements in their husbandry environment. While high ranking cows spent significantly less time on the concrete slatted floor of the test area than low ranking cows, the opposite observation could be made after offering soft flooring. The reason why high ranking cows spent less time on the test area before rubber covering is due to the fact

that they were staying in other, perhaps more attractive, parts of the barn. It is clear evidence of high ranking animals' acceptance that they spent much more time on the test area after rubber covering. Due to the restricted area, a rubber covered floor was largely available only to animals with a high social rank position. In case of limited resources of cow comfort, cows low in the pen hierarchy will be evicted from the prime areas by high ranking cows or they fear an encounter with a high ranking cow in these areas (Cook *et al* 2004). Hence, it can be concluded that even more animals would have selected the rubber covered area if possible during the second step of the study. This rank-correlated degree of the use of presumably more comfortable locations within the barn could also be interpreted taking the findings of Galindo *et al* (2000) into account, who observed a higher incidence of lameness in low ranking cows. However, since only behaviour observations were carried out in the present study, assumptions can only be made with regard to potential effects on claw health, reproduction or milk yield. In earlier studies, claw health was significantly improved on elastic slatted floors compared with common slatted floors (Benz 2002). Furthermore, thick elastic rubber mats improved locomotion in both lame and non-lame cows (Telezhenko & Bergsten 2005). Lameness, in turn, complicates the access to feed and water which influences not only milk yield but also negatively affects the cow's hierarchical position.

In conclusion, to minimise problems due to social rank hierarchy in dairy cattle husbandry, it is of importance to create a building design that enables all herd members to meet their specific needs in spite of existing rank order.

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