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THE EFFECT OF THE PASSAGE FLOORING IN CUBICLE HOUSES ON THE BEHAVIOURAL TIME-BUDGET OF DAIRY COWS

Jessica Olsson[1], Madeleine Magnusson[2] & Michael Ventorp[2]

[1]The Royal Veterinary and Agricultural University, Department of Large Animal Science, Fredriksberg C, Denmark
[2] Swedish University of Agricultural Sciences. Department of Agricultural Biosystems and Technology, Alnarp, Sweden.

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Introduction

The physical properties of flooring, besides other factors, significantly influence the behaviour and time-budget of dairy cows. The animals have close and continual body contact with the flooring, both when lying and when standing or walking. The lying behaviour and lying pattern of the cow are dependent on the floor properties. On pasture, the cows spend a total of 8 to 12 hours lying down out of the 24-hours (Hafez, 1962; Albright & Arave, 1997). In addition, it has been shown that the locomotion and other activities of the dairy cows are affected by different floor types (Zeeb, 1987; Phillips & Morris, 2001; Benz, 2002; Telezhenko & Bergsten, 2005). Cows maintained indoors often spend more time lying down per 24-hours period than do grazing cows (Wierenga & Hopster, 1990; Haley et al., 2001).

The natural flooring for cattle, the out-of-doors ground surfaces, to which the cattle have adapted evolutionarily, is normally soft and slip resistant. The floors in cubicle housing systems for dairy cows are usually made of concrete and have properties opposite to that of the natural flooring. Concrete floors are hard and often slippery, especially after some years of use (Reimann & Freiberger, 1999). Occasionally, mastic asphalt is used as a passage floor surfacing due to its lasting friction coefficient (Reimann & Freiberger, 1999). The use of soft rubber mats on concrete floor is passage floorings of interest, since they have in some aspects the same properties as the natural flooring. It has been found that using a soft rubber floor with a good grip in comparison to the hard and slippery concrete floor in walking areas in cubicle houses for dairy cows increased the proportion of activities such as walking and self grooming (self licking caudally) (Benz, 2002). The aim of the present study has been to investigate the effect of three passage floor types on the time-budget of dairy cows in a cubicle housing system.

Material and methods

Sixty-three dairy cows of Swedish Holstein breed were divided into three equal groups (3 x 21 cows, although the cows in two groups were reduced to 20 head each) according to calving time and lactation number. The number of first lactation cows was 10 per group. There were no significant milk yield differences between the groups, and the feeding was identical between groups. The groups were placed simultaneously in the same dairy cow-shed but in three different units, which were identical with the exception of the floor material in the passages. Each unit had 1.0 - 1.1 cubicles and 1.0 - 1.05 eating places per head, respectively. The cubicles had dimensions of 1200 x 2350 mm, and were equipped with cubicle partitions (DeLaval, Solid™), cubicle mats (DeLaval, CM 30™), and wood shavings. Concentrates were fed by computer-transponder managed concentrate feed station and the cows had ad lib access to a mixed feed ration given at the feeding table two times daily. Additionally, hay was fed once a day. The feed barrier was self locking, and the self locking option was used during ca 30 minutes after each milking time. The cows were milked twice a day in a milking centre.

The floors to be tested were slatted concrete flooring, solid mastic asphalt flooring and solid rubber flooring (Kreiburg rubber mats KURA-P™), respectively. The concrete floor was characterised as being hard and slippery (kinetic coefficient of friction, μ_k, 0.30 measured at clean and dry conditions), the mastic asphalt floor as being hard and relatively slip resistant ($\mu_k = 0.40$), and the rubber floor as being soft and slip resistant ($\mu_k = 0.56$). The passages with the solid floors were scraped between the cubicle rows and along the feeding table 11 and 9 times a day, respectively.

The cows were accustomed to each other and the floor for two month. Thereafter, each group in the three different units was video filmed for a five day period. Every 15th minute, excluding the time spent milking (50 minutes per day), the dairy cows' activity were recorded as follows: lying in the cubicles, eating from the feeding table, standing or walking on the passage without eating, and standing with one or more legs inside the cubicle. The data was statistically analysed on the group level in order to avoid random variables statistically dependent within the group, and was determined to be normally distributed (Minitab Inc., 2003). A model with floor type and observation day as the independent variables was used for the analyses of variance (Minitab Inc., 2003).

Results

The type of floor had a significant influence upon all behaviour parameters studied. The influence of floor type on the behaviours "lying in cubicle" and "eating at feeding table" had P-values of 0.000 and 0.008, respectively. However, there were no significant differences ($p>0.05$) between the dairy cows' behavioural time-budget for those on the slatted concrete floor and those on the mastic asphalt floor. The dairy cows in the unit with the rubber mat floor lay in the cubicles for a shorter part of the day than other animals did (- ca 2 h), they ate from the feeding table and also stood or walked on the floor without eating, longer than others (+ ca 1 h and + ca 0.5 h, respectively), and they stood up in the cubicles more than others (+ ca 0.5 h) (Figure 1). All the differences between the group on the rubber floor and those on the other types of flooring were significant ($p<0.05$), with the exception of the differences in the amount of time spent standing and walking on the floor without eating for the group on the rubber floor and the one on the mastic asphalt floor.

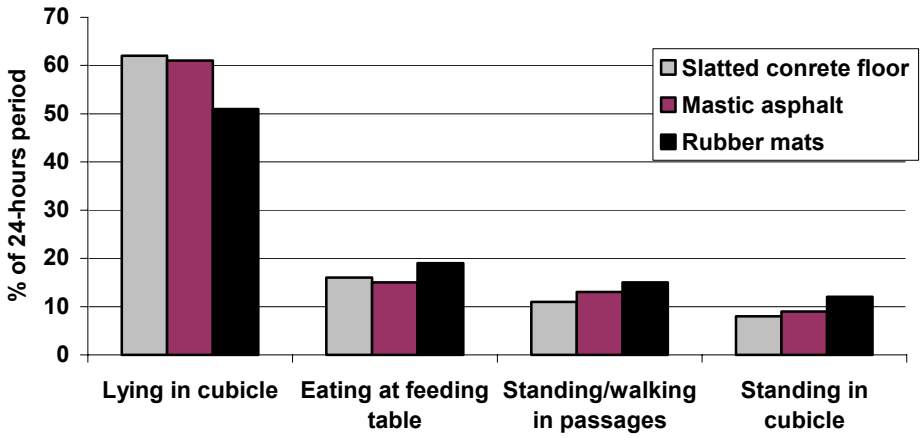

Figure 1. The behavioural time-budget of the three groups of dairy cows, according the type of flooring in the passages of their housing unit. Time spent milking (ca. 1hour) is not shown.

Discussion

The cows in the unit with rubber floor in the passage area lay down less than the other cows. An increase in the amount of time spent standing and walking has been shown to increase the incidence of lameness and digital disorders (Manninen et al., 2002; Fisher et al., 2003). On the other hand, it has also been shown that fewer digital disorders arise when dairy cows walk on rubber flooring (Benz, 2002; Fregonesi et al., 2004). It would be probable that

the presence of lameness and foot and leg problems would affect the amount of time spent lying. Clinical examinations and locomotion scoring of all cows studied here were been carried out, and no significant differences in the presence of digital disorders between the groups could be found. It appeared as if the cows in the unit with rubber floor did not have the same need to be lying down; instead, they seemed to use the opportunity to stand on soft footing while resting, or to spend more time at the feeding table. The total 12 hours per 24 hour period spent lying when the rubber flooring in the passages was used was more equivalent to the lying behaviour observed in grazing dairy cattle, than that of cattle housed on hard flooring.

Conclusion

The results indicated that the dairy cows experienced the passage rubber floor as being comfortable to stand and walk on, and that the presence of soft (and slip resistant) floors improves their welfare, in comparison to the usage of hard (and slippery or slip resistant) floors. The increased time spent eating by the cows on the rubber floor also gives the prospect of enhancing the feed consumption and milk yield.

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