The Old School, Brewhouse Hill, Wheathampstead,
Hertfordshire AL4 8AN, UK

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On-farm assessment of the lying behaviour of finishing bulls kept in housing systems with different floor qualities

L Gygax*†, C Mayer‡, H Schulze Westerath†, K Friedli† and B Wechsler†

† Centre for proper housing of ruminants and pigs, Federal Veterinary Office, Agroscope Reckenholz-Tänikon Research Station ART, Tänikon, 8356 Ettenhausen, Switzerland
‡ Institute for Animal Welfare and Animal Husbandry, Federal Agricultural Research Centre, Dörnbergstrasse 25-27, 29223 Celle, Germany
* Contact for correspondence and requests for reprints: lorenz.gygax@art.admin.ch

Abstract

Several studies have shown that finishing bulls kept in housing systems with fully slatted concrete floors are impaired in their lying behaviour and locomotion due to the hardness and slipperiness of the ground. The aim of this study was to investigate the effects of floor quality (straw-bedded lying area, rubber-coated slats, concrete slats) on the lying behaviour of finishing bulls. The floor type did not influence the total lying duration, but the number of lying bouts and the number of short standing periods decreased with increasing hardness of the floor in the lying area. In addition, bulls showed more interrupted lying-down and standing-up movements on concrete and rubber-coated slats than on straw bedding. On the other hand, atypical lying-down and standing-up instances, slipping and falling were reduced on rubber-coated slats and on straw bedding compared to concrete slats. Displacements of lying animals were observed more often on rubber-coated slats than on concrete slats or straw bedding. In conclusion, rubber-coated slats improve traction on the ground but are not able to provide as soft a lying area as straw bedding. Rubber coating can thus serve to improve welfare for finishing bulls kept on concrete slats but cannot be considered equivalent to straw bedding.

Keywords: *animal welfare, finishing bulls, floor quality, lying behaviour, rubber-coated slats*

Introduction

Finishing bulls (*Bos taurus*) are often kept in pens with fully slatted concrete floors under intensive housing to keep labour input and production costs low. From an animal welfare perspective, however, slatted concrete floors are considered a welfare impairment. Finishing bulls reduce the time spent lying and the number of lying bouts per day in pens with fully slatted floors compared to housing systems with straw bedding (Andreae 1979; Graf 1987; Ruis-Heutinck *et al* 2000). They thus avoid lying down frequently on a hard surface. As slatted concrete floors tend to become slippery over time, slipping while standing up and lying down, as well as abnormal standing-up and lying-down movements, are more common in housing systems with concrete slats than in systems with straw bedding (Andreae 1979; Graf 1987). In addition to changes in behaviour, softer floors may lead to insufficient abrasion of the claws and to overgrown heel and sole horn (Thio *et al* 2005).

Recently, research into rubber-coated, slatted floors as an alternative floor material in housing systems for finishing bulls has intensified (eg Ruis-Heutinck *et al* 2000; Lowe *et al* 2001). In this study, we wanted to investigate the extent to which rubber-coated slats can improve concrete slats and how closely they approach the quality of straw bedding as a lying area in on-farm situations. We expected improved footing on the rubber surface compared to concrete but not necessarily as comfortable a lying area as straw bedding.

Materials and methods

Animals and housing

The study was conducted on a total of 18 groups on 12 farms. We observed seven groups on five farms with fully slatted concrete floors (50 animals in groups of 6-11 animals), five groups on five farms (of which three were the same farms as for the concrete slats) with rubber-coated, fully slatted floors (brand name: LOSPA, Kraiburg, Waldkraiburg, Germany [44 animals kept in groups of 7-11 animals]) and six groups on five farms with straw bedding (49 animals in groups of 6 to 11 animals). Space allowance per bull was 2.3 – 4.1 m^2 and 2.5 – 2.9 m^2 on concrete and rubber slats, respectively. In the pens with straw bedding the space allowance per bull ranged from 2.9 to 3.9 m^2 in the lying area and the total space allowance from 4.6 to 11.6 m^2. Though the systems differed in the available space per bull due to management practices, a graphical analysis of the behavioural parameters within housing system did not show any monotonous relationship with space allowance. Consequently, space allowance is considered a characteristic of the complete housing systems. Observations were

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from all seasons in all housing systems. Data on bull behaviour was recorded when the bulls reached on average 450 kg, ie towards the end of the finishing period (slaughter weight approximately 550 kg). The bulls were cross-breeds typically found in Swiss finishing bulls (Simmental, Brown Swiss, Limousin, Angus).

Behavioural parameters

In each pen, video recordings were made for 72 h. Behaviour was scored continuously for the individually marked bulls and results are presented on a per 24 h basis. Standing and lying was continuously recorded and the total lying duration, the number of lying bouts and the number of short standing bouts (< 5 min) were calculated. For all lying-down and standing-up instances it was noted whether they were atypical (horse-like), interrupted (animals move down or up on to their carpal joints and then back to their original posture) or whether they led to slipping or falling. In addition, displacements of lying bulls were counted.

Statistical analysis

(Generalised) linear mixed effects models were used to test differences in the behavioural parameters between housing systems (Pinheiro & Bates 2000; Venables & Ripley 2002; in R version 2.0.1, www.r-project.org). Housing system was used as the fixed explanatory variable. The bulls were considered to be nested in housing groups and thus a random term for the group was included in the model. The response variable lying duration was used directly and frequencies (count-based data: lying bouts, short standing bouts and displacements) were square-root transformed. Proportions of occurrences (atypical lying down, atypical standing up, interruptions, slipping and falling while lying down or standing up) included many zero values and were dichotomised and analysed based on the binomial distribution. Assumptions of the models were checked using graphical analysis of residuals.

Results

The type of floor did not influence the total lying duration ($F_{2,15} = 0.07$, $P = 0.93$, Figure 1[a]), but the number of lying bouts was increased on straw bedding in comparison to concrete and rubber-coated slats ($F_{2,15} = 7.66$, $P = 0.005$, Figure 1[b]) and the number of short standing bouts increased from concrete to rubber-coated slats and straw bedding ($F_{2,14} = 35.48$, $P = 0.001$, Figure 1[c]). Atypical lying down and standing up was increased on concrete slats in comparison to rubber-coated slats and straw bedding (lying down: $F_{2,15} = 5.48$, $P = 0.016$, Figure 1[d]; standing up: $F_{2,15} = 4.17$, $P = 0.036$, Figure 1[e]). Interrupted lying-down and standing-up movements could be observed on concrete and rubber-coated slats more often than on straw bedding ($F_{2,15} = 8.94$, $P = 0.003$, Figure 1[f]). Slipping and falling while lying down or standing up were mostly observed on concrete slats (slipping: $F_{2,15} = 1.96$, $P = 0.18$, Figure 1[g]; falling: $F_{2,15} = 5.62$, $P = 0.015$, Figure 1[h]). Displacements of lying animals occurred more often on rubber coated slats than on concrete slats or on straw bedding ($F_{2,15} = 8.85$, $P = 0.003$, Figure 1[i]).

Discussion

The reduced number of lying bouts and short standing bouts on the rubber-coated slats in comparison to straw bedding indicated that the quality of the lying surface on rubber-coated slats was lower (Graf 1987; Lidfors 1992; Mogensen *et al* 1997). The rubber-coated slats were similar to the concrete slats regarding the number of lying bouts and were intermediary regarding short-standing bouts. On the other hand, the traction on rubber-coated slats was comparable to straw bedding and much better than on concrete slats, resulting in similar values for rubber-coated slats and straw bedding for atypical lying down and standing up and slipping and falling while lying down or standing up.

Though traction was judged favourable, the proportion of interrupted lying-down and standing-up instances on rubber-coated slats was more comparable to the proportion on concrete slats than on straw bedding. Such interruptions could be socially mediated in that animals interrupt their movements when other specific animals are too close (Ruis-Heutinck *et al* 2000). This was likely to occur more often in the restricted space in pens with concrete and rubber-coated slats compared to pens with a straw bedded lying area which provided an extra feeding area. With regard to the number of displacements of lying animals occurring at a much higher rate on rubber-coated slats than in the other two systems, it can be hypothesised that such displacements also occur more often with restricted space but only provided that traction on the ground is good.

The differences in lying comfort and traction documented by the results of our study are in line with the preferences that finishing bulls show for different floor qualities in a choice test. Lowe *et al* (2001) reported that finishing bulls had a decreasing preference for straw, sawdust, rubber-coated and concrete slats.

Animal welfare implications

The housing conditions of finishing bulls kept on rubber-coated slats were enhanced compared to concrete slats, in that traction on the ground was increased. On the other hand the quality of the lying area on rubber-coated slats did not reach the level of systems using straw bedding regarding lying behaviour. Rubber coating can thus serve to improve welfare of finishing bulls compared to concrete slats but cannot be considered equivalent to straw bedding.

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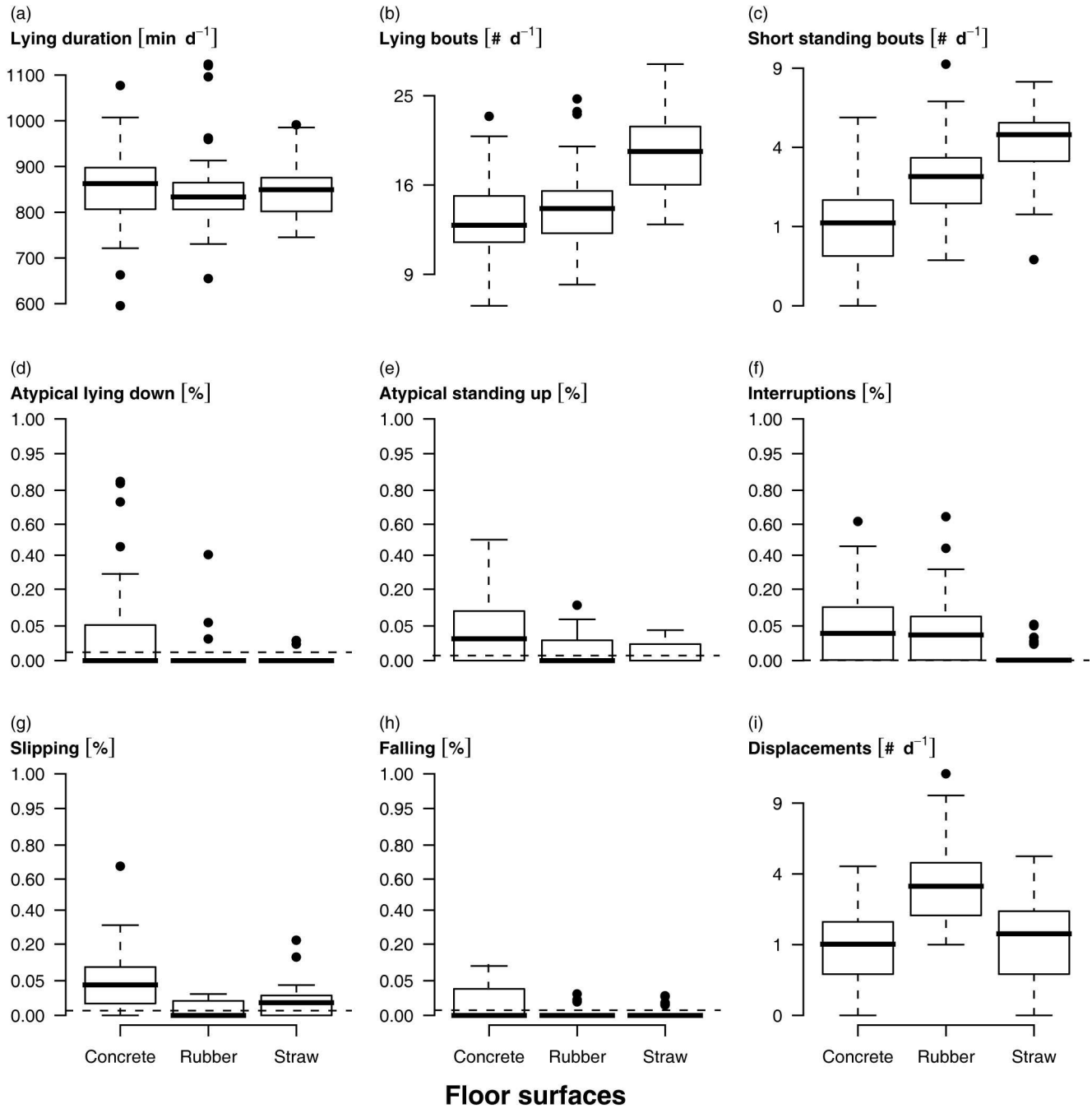
Figure 1



Influence of floor quality (concrete slats, rubber-coated slats or straw bedded lying area) on total lying duration (a), number of lying bouts (b), number of short standing bouts (c), proportion of atypical lying down (d), proportion of atypical standing up (e), proportion of interrupted lying-down and standing-up movements (f), proportion of lying-down and standing-up movements with slipping (g), with falling (h) and the number of displacements of lying animals (i). Y-axes are transformed in the same way as for statistical models with continuous response variables (square root for count-based data in panels [b], [c], [i]; arc-sinus square-root for proportions in panels [d]-[h]). Proportions were evaluated statistically using a dichotomised response variable (proportion > 0). For these variables the boundary, drawn at half the minimal observed value above zero, is indicated by the horizontal dashed lines.

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