The Veterinary Journal 197 (2013) 211–215

Contents lists available at SciVerse ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Alternative solutions to the concrete fully-slatted floor for the housing of finishing beef cattle: Effects on growth performance, health of the locomotor system and behaviour

G. Cozzi *, E. Tessitore, B. Contiero, R. Ricci, F. Gottardo, M. Brscic

Department of Animal Medicine, Production and Health, University of Padova, Viale dell'Università 16, 35020 Legnaro (PD), Italy

ARTICLE INFO

Article history:
Accepted 3 March 2013

Keywords:
Finishing bulls
Slatted floor
Rubber mattress
Health
Behaviour

ABSTRACT

The aim of this study was to assess the effect of two potential alternative solutions to the concrete fully-slatted floor (FS), namely, a perforated floor (PF) and a perforated floor coated with a rubber mattress (RM), on growth, locomotor system health, and behaviour of intensively finished young bulls. Forty-eight male beef-crosses (Charolais × Aubrac) were allotted to six pens of eight animals (two pens/floor type) for a finishing period of 175 ± 7 days. Growth was recorded and two health checks and two 8-h behavioural observations were carried out by trained assessors 1 month after the beginning of the trial (Initial) and 2 weeks before slaughter (Final).

Feed intake was not affected by floor type, but average daily gain of RM bulls was higher than that of FS (1.37 vs. 1.19 kg, $P = 0.01$), with PF being intermediate (1.27 kg). Behavioural observations showed that FS bulls had a higher number of slipping events (6.5) than PF (2.1; $P = 0.01$) and RM bulls (0.9; $P < 0.01$). Bulls on FS showed more lying down attempts (2.2 vs. 0.1; $P = 0.001$), a lower number of lying/standing transitions (4.5 vs. 7.3; $P < 0.001$) and a longer lying duration (5.9 vs. 4.7 s; $P < 0.01$) than RM bulls. Signs of lameness were observed in five FS bulls at the final assessment. RM floor proved to be a good alternative to FS but it increased the likelihood of overgrown claws due to insufficient hoof wear.

Introduction

Housing beef cattle on fully-slatted floors has become popular in Europe since the late 1960s (Lenehan, 2003). This housing system has a higher initial cost than deep litter but it lowers the costs for bedding material and labour for its renewal. Farmers adopting fully-slatted floors use the smallest space allowance, increasing stocking density (SCAHAW, 2001). The majority of such systems use concrete slats that have been shown to be one of the main risk factors for occurrence of disorders of the locomotor system in dairy cows (Somers et al., 2005), beef cattle (Tessitore et al., 2009) and veal calves (Brscic et al., 2011). Concrete slats that are roughened to prevent slippage can wear hooves excessively while smooth slippery slats can increase the incidence of leg and claw injuries (Dumelow and Albutt, 1988).

Pathological conditions of the locomotor system have detrimental effects on cattle welfare and productivity (Kremer et al., 2007; Barker et al., 2010). Moreover, cattle housed on slats appear to show a natural aversion to walking and rising on them. Bulls kept on slatted floors do not perform some behaviours as often as they would in a more comfortable situation (Gygax et al., 2007a) and modify the lying down-standing up sequence spending less time lying compared to bulls on softer floorings (Ruis-Heutinck et al., 2000).

Alternative floorings have been proposed and tested as substitutes for slats in order to provide more comfort to cattle. Positive effects of rubber coated floors were observed on locomotion and gait in dairy cows (Telezhenko and Bergsten, 2005) and on bull behaviour (Lowe et al., 2001). Schulze Westerath et al. (2007) and Ruis-Heutinck et al. (2000) reported a lower incidence of lesions and lower occurrence of swellings of the joints in bulls housed on rubber coated compared to bare concrete slats. Better growth performance were reported for bulls kept on rubberised concrete floors (SCAHAW, 2001) but little is known on the effect on performance, health and behaviour of bulls of a perforated concrete floor which offers a different walking and resting surface compared to the fully-slatted floor.

Research on alternative flooring solutions in beef finishing facilities is rather limited, probably because of the cost of this type of floor as well as the short time spent by beef cattle in finishing units compared to dairy cattle. The aim of this study was to evaluate the effect of two potential alternative solutions to the concrete fully-slatted floor, namely, a fully-perforated floor and a rubber coated fully-perforated floor, on growth, health and behaviour of young bulls finished under intensive rearing conditions.

* Corresponding author. Tel.: +39 049 8272662.
E-mail address: giulio.cozzi@unipd.it (G. Cozzi).

1090-0233/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.tvjl.2013.03.001

Materials and methods

Animals, housing and management

The study was carried out in a beef cattle farm located in the Po Valley (Italy). The finishing trial considered 48 male beef crosses (Charolais × Aubrac) imported from France at about 12 months of age. After arrival, all bulls were kept in a receiving barn on deep litter for a 30-day adaptation period. At the start of the study, bulls were weighed and divided according to their live weight into six groups of eight animals each and randomly allocated to one of six pens which had one of three floors: (1) a fully-slatted floor (FS), made of concrete slats 100 cm long and 12.5 cm thick with a 3 cm gap (Fig. 1); (2) a perforated floor (PF), made of drilled concrete panels (10 panels/pen) with 70 holes of 6.5 cm of diameter/m^2 (Fig. 2). This alternative flooring system, that has a similar cost to FS (25–30 €/m^2),[1] was chosen on the basis that when animals slip, that holes, unlike slats will not result in claw entrapment; (3) a perforated floor coated with a rubber mattress (RM), made of a 2 cm thick rubber mattress (Eurosteinit) with holes that matched those of the perforated concrete floor underneath (Fig. 3). The cost of this flooring system was 60 €/m^2.

The experimental pens were located indoors in the same barn and all were 5.50 × 4.45 m in size giving a space allowance of 3 m^2 per bull and space at the manger of 70 cm/bull. Water was provided by two pressure bowls/pen. Bulls were fed a total mixed ration ad libitum once daily (Table 1) during the finishing period which lasted from September 2009 to March 2010. Feed samples were collected weekly throughout the study and they were analysed for chemical composition according to AOAC (1990).

Growth performance and health of the locomotor system

All bulls were weighed twice, at the beginning and at the end of the finishing period, to calculate individual average daily gain (ADG). Daily feed intake was measured at pen level as the difference between the amount of feed distributed and the residue left in the manger 24 h later. Individual bull health was monitored by recording the medical treatments throughout the finishing period. Clinical signs of impaired health of the locomotor system, such as lameness, skin lesions, carpal bursitis, and overgrown claws, were assessed in two sessions carried out 1 month after the beginning of the trial (Initial) and 2 weeks before the expected slaughter time (Final). The health check was carried out by a trained veterinarian at 0600 h recording all parameters as binary variables (presence/absence). Lameness was assessed according to the Welfare Quality protocol for beef cattle (Welfare Quality, 2009). Occurrence of skin lesions was recorded when the animal had wounds, hairless patches or abrasions, regardless of the etiologic causes. Carpal bursitis was recorded when macroscopic signs of swollen carpal joints were present. Overgrown claws were recorded when at least one claw was overgrown (increased front wall length from hairline to the tip of toe with reduced toe angle).

Behaviour

In order to assess the behaviour of bulls during the experimental period, 8-h observation sessions were made on the same 2 days as the health checks. The observation period started after feed distribution at 0930 h. Cattle were observed by two trained assessors located on top of an elevated platform placed in the middle of the feeding alley allowing a complete view of the experimental pens. Behavioural assessments of postures (standing/lying) and activities (eating and ruminating) of each bull were performed using the scan-sampling technique (Martin and Bateson, 1993) with a 5 min interval between two consecutive scans. Lying posture was recorded as sternal recumbency when all four limbs were folded underneath the body, extended limbs when one or both front limbs were stretched out, or lateral recumbency when all four limbs were stretched out. Slipping, mounting, fighting and social licking were recorded as events at the pen level using the behaviour sampling technique (Martin and Bateson, 1993). Additionally, in order to obtain information about bulls' confidence in transitioning from standing to lying and vice versa, the number of unsuccessful attempts to lie down and the number of transitions were recorded. Individual durations of both lying and rising transitions were measured by stopwatch.

Statistical analysis of data

All data collected in this study were statistically processed using SAS (2008). Pen was the experimental unit for feed intake, behavioural data gathered using the behaviour sampling technique and number of unsuccessful attempts to lie down. All the other variables were recorded at individual level with animal as statistical unit. Normal distribution of data was tested using the Shapiro–Wilk test and data were considered normally distributed for $W \geqslant 0.90$. Lying in lateral recumbency was not normally distributed and it was submitted to a $[\ln(x+1)]$ transformation.

[1] €1 = approx. £0.86, $1.30, at 3 March 2013.

Fig. 1. Fully-slatted concrete floor used in the experimental pens.

Fig. 2. Perforated concrete floor used in the experimental pens.

Fig. 3. Perforated concrete floor coated with a rubber mattress used in the experimental pens.

Individual live weights and ADG were analysed using a linear model (PROC GLM) which included the fixed effects of type of floor and pen within type of floor, using a split plot design with pen as test error for the type of floor. Feed intake was analysed using a linear model including the fixed effects of type of floor, pen within type of floor (main plot error), week of fattening, and the interaction between type of floor and week of fattening. Health parameters, recorded at individual level as binary variables, were analysed using a logistic regression procedure (PROC LOGISTIC) with the effects of type of floor (FS as reference), assessment (initial as reference) and their interaction. Behavioural data recorded by scan-sampling were processed using a linear model that considered the fixed effects of the type of floor, pen within type of floor (main plot error), assessment and the interaction of type of floor and assessment. Behavioural data recorded at pen level using behaviour sampling and the number of unsuccessful attempts to lie down were both analysed