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Effects of pen floor and class of live weight on behavioural and clinical parameters of beef cattle

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ABSTRACT – The study compared behaviour and clinical parameters of beef cattle housed on two different types of floor (fully slatted *vs.* deep litter) considering animals belonging to 2 live weight classes (less *vs.* more than 350 kg). The assessment of behavioural and clinical parameters was carried out in 20 intensive farms, all rearing imported bulls. Floor type had no effect on cattle behaviour except for the duration of the lying down sequence, which lasted more for bulls kept on slats. Slatted floor increased also the likelihood of occurrence of hair and skin lesions and lameness. On the other hand, bulls cleanliness was more likely to be impaired on bedded floor. Regarding the class of live weight, behavioural observation showed lighter animals performing more antagonistic interactions, while horning resulted more frequent in heavier bulls. Avoidance distance test indicated that bulls >350 kg were more fearful of humans. About health status, light animals were more affected by respiratory disease and hairless patches, likely because they are more sensitive to the stressful situations imposed by their transfer and adaptation to the new housing environment of the fattening unit. The risk of skin lesions and dirtiness increased instead in heavier bulls.

Key words: Beef cattle, Welfare assessment, Type of floor, Live weight.

Introduction – Nowadays, the farm animal welfare issue is earning a wide importance for the public opinion, as well as for the scientific community. In this context, the European Commission has adopted from 2006 a Community Action Plan on the Protection and Welfare of Animals, that aims at promoting high animal welfare standards in every rearing system of all Member States. Currently many scientific groups are working to find reliable welfare indicators to be used for the main livestock species. Most of young bulls fattened in Italy are imported from foreign Countries, and they arrive to the Italian farms at a wide range of live weights (80-400 kg) (Federici and Rama, 2007). Almost all the Italian beef farms located in the Po Valley adopt an intensive rearing system, with cattle housed in multiple pens on deep litter (DL) or fully slatted (FS) floor (Cozzi, 2007). However, this latter type of pen floor has been hardly criticized by some cattle welfare experts, because it is considered not completely respectful of bulls needs. (EU-SCAHAW, 2001). The aim of this study was to evaluate how pen floor (TF) and class of cattle live weight (WC) may affect behavioural and clinical parameters of young bulls fattened under intensive rearing conditions.

Material and methods – Twenty intensive beef cattle farms were selected for this research, according to the experimental design presented in Table 1.

All the animals were imported from foreign Countries, mainly France and Austria. Every farm was visited once during the first quarter of 2008, in order to assess cattle behaviour and clinical parameters. Each visit considered 2 h of direct observation of the animals housed up to 12 pens to assess the following behavioural parameters: avoidance distance at the feeding rack (Waiblinger *et al.*, 2003), percentage of animals lying, standing or feeding/drinking and the duration of the lying down sequence. The type of interactions between pen-mates

Table 1. Experimental design and average space allowance (mean ±SE).

Type of floor	Fully slatted (FS)		Deep litter (DL)	
	≤350kg	>350kg	≤350kg	>350kg
Class of live weight				
Number of farms	4	6	6	4
Average space allowance, m ² /head	1.9±0.4	3.8±1.0	2.7±1.2	4.4±1.5

and their frequencies were also recorded. Displacement, chasing, head-butt and fighting were considered as negative interactions, whereas horning and social licking were considered as positive. The clinical measurements

consisted on the evaluation of the presence/absence of some pathological and less healthy conditions, such as skin hairless patches and lesions, overgrown claws, thinness, coughing, nasal and ocular discharge, dirtiness and lameness. All behavioural and clinical measurements were carried out in all the farms in the same order by the same assessor. Statistical analyses were performed using the GLM procedure (SAS, 1990) for behavioural traits and coughing. The model included the effects of type of floor and class of live weight and their interaction. For lying down duration, the model considered only the effect of the floor type, since this parameter was recorded only in heavier class of animals. All the remaining clinical traits were recorded as dichotomous variables and they were analysed by Logistic Regression procedure (SAS, 1990). Factors were compared using the Wald Chi-Square Test. The threshold of statistical significance was set at P<0.05 for all the variables.

Results and conclusions - Type of floor did not affect all behavioural traits, except for lying down duration, which was longer for FS than DL bulls (Table 2). This result was consistent with what reported by Wechsler (2007).

Considering the effect of the class of live weight, the frequency of feeding/drinking was reduced in heavier bulls and this trend confirmed previous results reported by Gottardo *et al.*, (2004). The percentage of lying was higher for heavier bulls and this behaviour could be a consequence of the increased space allowance (Table 1). Space allowance could also justify the reduced frequency of negative interactions and the increasing of horning behaviour (Table 2). Type of floor and class of live weight did not affect the occurrence of head-butt, fighting and social licking (0.57±1.49, 0.02±0.18 and 0.59±1.04 events/bull/h, respectively). The avoidance distance

test showed heavier bulls being more fearful than lighter ones (Table 2). Most of the light animals raised in the Italian fattening units are weaned artificially and therefore they are used to be approached by humans. French bulls, which represented a large portion of the animals included in the heavy weight class, are instead weaned and kept on pasture almost until the time of their export (Federici and

Table 2. Least square means of bulls behavioural parameters and coughing.

	Type of floor (TF)		Live weight class (WC)		Significance		RMSE
	FS	DL	≤350 kg	>350 kg	TF	WC	
Behavioural traits:							
Feeding/Drinking ¹	15.5	14.20	19.05	10.67	ns	***	15.25
Lying ¹	42.2	44.48	39.09	47.59	ns	*	26.57
Displacement ²	0.09	0.05	0.13	0.01	ns	***	0.19
Chasing ²	0.05	0.02	0.07	<0.01	ns	**	0.16
Horning ²	0.60	0.82	0.44	0.98	ns	**	1.34
Avoidance distance, cm	41.0	44.8	30.4	55.3	ns	***	56.53
Duration lying down, s	5.71	4.31	-	-	***	-	1.70
Clinical traits:							
Coughing ²	1.48	1.66	2.07	1.07	ns	***	1.40

¹% of bulls; ²events/bull/h; ***=P<0.001; **=P<0.01; *=P<0.05; ns=P>0.05.

Table 3. Estimation of the odds ratios for the clinical parameters assessed (P<0.05).

Effects	Wald test Confidence limits at 95%					
	Type of floor (DL vs. FS)			Live weight class (≤ 350 vs. >350 kg)		
	Odds Ratios	Mini-mum	Maxi-mum	Odds Ratios	Mini-mum	Maxi-mum
Nasal discharge	ns	ns	ns	1.63	1.04	2.53
Hairless patches	0.48	0.37	0.62	1.58	1.21	2.05
Skin lesions	0.14	0.09	0.22	0.55	0.37	0.82
Dirtiness	4.39	2.92	6.61	0.33	0.22	0.51
Lameness	0.22	0.06	0.79	ns	ns	ns

consistent with these findings, the likelihood of occurrence of hairless patches was increased in light bulls (Table 3). Estimated odds ratios for hair and skin damages and lameness were significantly higher for FS than DL bulls, confirming the results of previous comparisons (Gottardo *et al.*, 2003; Somers *et al.*, 2005). On the other hand, in accordance with Gottardo *et al.*, (2003), bulls cleanliness was more likely to be impaired on bedded floor. Heavy bulls spent more time lying down (Table 2) and this may have increased their likelihood of being dirtier. The low frequency observed for the other clinical traits (overgrown claws, ocular discharge, diarrhoea, thinness, bloated rumen) did not allow to perform their statistical analysis.

Results of the present study showed that in comparison with DL, FS floor has a limited effect on beef cattle behaviour, while it is expected to increase the incidence of integument alterations and lameness. However, DL can not be considered the best solution for intensive housing of beef cattle unless its renewal is a routine practice of the farm management. Regarding bulls live weight, negative interactions among pen-mates are more frequent in lighter and younger animals, which are also more sensitive to respiratory disorders. In heavier bulls, regardless of the type of pen floor, an adequate space allowance can be an effective strategy to lower agonistic interactions as well as the risk of disease occurrence.

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Rama, 2007). Clinical signs of respiratory diseases (coughing and nose discharge) were not affected by the type of pen floor, whereas they were increased significantly for light bulls (Tables 2 and 3). These animals are more sensitive than older cattle to stressful situations like transport, regrouping, thermal stress, change of housing system, which can suppress their immune system (Salak-Johnson and McGlone, 2007); under these circumstances, the outbreak of respiratory disorders and mycosis is increased. Con-