Prevalence of Locomotory System Disorders in Veal Calves and Risk Factors for Occurrence of Bursitis

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Summary

The study aimed to assess the prevalence of locomotory system disorders within a wide cross-sectional study in 174 veal calves farms and to investigate risk factors associated to disorders with a relevant prevalence (>1%). A representative sample of the European veal production systems was considered in the three major producing countries (100 in NL, 50 in FR, 24 in IT). One batch/farm was observed in three stages of the fattening. At each visit calves with evidence of bursitis, hoof lesions, joint lesions, and lameness were recorded. A set of production system descriptors gathered by an interview to the farmer were considered as potential risks. Results showed an average prevalence ≤1% of calves for hoof and joint lesions, and lameness at any stage. Bursitis was observed on 0.2%, 4.1% and 11.2% of calves at 3, 13 wks and at the end of fattening, respectively. Risk factors for bursitis were linked to concrete and wooden slatted floors, to space allowance ≤1.8 m^2/calf, and floors aged <8 years while type of housing system (small vs. large groups) was not relevant. There was a significant interaction between stage of fattening and type of floor on bursitis. At the early stage, slatted and bedded floor were similar while at the end of the fattening the highest least mean was observed for calves on concrete floors. Bedding materials had a preventive effect. Rubber or straw should be largely adopted for veal calves as alternative solutions to hard floors in order to improve animals' comfort, locomotory system health and welfare status.

Key words

veal calf, locomotory disorders, welfare, bursitis, risk factors

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Introduction

Locomotory system disorders are highly relevant for most farm-animal categories and in particular for dairy cows (Somers et al., 2005; Barker et al., 2010), beef cattle (Tessitore et al., 2009a; Tessitore et al., 2009b) and pigs (Gillman et al., 2008; KilBride et al., 2009). Pathological conditions of the locomotory system are reported to impair normal locomotion leading to the missfulfilment of a number of animals' needs, compromising subsequently the general welfare status of the animal as well as the productive performances (Barker et al., 2010). They can vary in severity. Some disorders such as those involving hoofs and joints may be particularly painful provoking lameness that is described as abnormality of movement caused by reduced ability to use one or more limbs in a normal manner. Lameness may range from reduced ability to complete inability to bear weight. Other disorders such as bursitis (swelling of the carpal bursae) are not painful (McAfee and Smith, 1988) and do not cause lameness but they are not normal and they represent a pathological response to an environment that is less than ideal. Most of the locomotory system disorders are, indeed, associated to inadequate floors and particularly to slatted floors in pigs (Gillman et al., 2008) and bulls (Tessitore et al., 2009a). Little is known on their incidence in the around six million veal calves reared yearly in Europe in group pens with fully slatted floors for four to six months.

Aim

It was aim of this paper to assess the prevalence of locomotory system disorders such as evidence of bursitis, hoof lesions, joint lesions, and lameness in veal calves. Nowadays veal calves production systems are standardized across Europe but some specific housing and management factors could still differentiate farms acting as detrimental factors for a poor health status of calves' locomotory system. A further aim of this study was to investigate potential risk factors for locomotory system disorders that showed a relevant prevalence (>1% of calves) among housing system, space allowance, type and age of the pen floor.

Material and methods

Prevalence of locomotory system disorders in veal calves were assessed in a cross-sectional field study that was carried out on 174 farms in the three main veal producing countries in Europe (100 farms in the Netherlands, 50 farms in France and 24 farms in Italy). Across the three countries, the sample of farms was chosen in order to reflect the proportions of the prevailing rearing systems operating in Europe in terms of type of housing (small or large groups). Indeed, the sample consisted of 149 farms housing calves in small groups (93 farms in the Netherlands, 35 farms in France and 21 farms in Italy) and 25 farms (seven farms in the Netherlands, 15 farms in France and three farms in Italy) adopting large groups. Within each country the sample considered farms located in the main regions where veal calves are reared and it was selected among farms belonging to integrators/owners willing to participate in the study.

The protocol consisted of three on-farm visits carried out by trained veterinarians on one batch of about 200-300 calves per each farm. The visits were planned at different phases of the fattening period and they were carried out respectively at about three weeks after the arrival of the calves at the fattening unit (early phase - 1st visit), at nearly 13 weeks of rearing (middle phase - 2nd visit), and at the end of the rearing cycle at about two weeks prior to slaughter (end stage - 3rd visit). During each visit the veterinarian visually assessed every individual calf of the batch and recorded the number of calves with evidence of bursitis, hoof and joint lesions, and lameness according to the Welfare Quality® (2009) protocol. Animal manipulation and any kind of measure carried out touching the calves was avoided. Data regarding veal calves production system's characteristics such as type of housing, type of floor, space allowance, and floor age were collected from an interview to the farmer/stockperson. The questionnaire was drawn up within the Welfare Quality® project in order to obtain as much environmental information as possible in a short time, avoiding the direct collection of additional data by the assessor. The duration of the fattening cycle was calculated in weeks as distance between the week of arrival of the calves at the fattening unit and the week of slaughter.

Data gathered in the cross-sectional study were submitted to descriptive statistics in order to study prevalence and position parameters of the problems in the three stages of the fattening using Proc Univariate (SAS, 2008) and to assess farm distribution according to the production system's characteristics using Proc Freq (SAS, 2008). Floor age, that was originally recorded as a continuous variable, was grouped according to the distribution of the farms into 3 classes (new = aged less than four years; mid = aged from five to eight years; old = aged more than eight years) in order to have a reasonable proportion of farms in each class. The potential risk factors impairing bursitis were investigated adopting Proc Genmod (SAS, 2008) in order to obtain odds ratio and 95% confidence interval for the main effects that resulted associated to the locomotory system problem for $P<0.1$ in the one-way logistic regression analysis according to McCullagh and Nelder (1983).

After normalization of the prevalence of bursitis with the log transformation, data were submitted to multivariate analysis with Proc Mixed (SAS, 2008). The model considered week of observation, space allowance, type of floor, floor age, interactions of these effects with week of observation as fixed effects, farm as random effect and duration of the fattening cycle as covariate.

Results and discussion

Veal calves production systems are rather standardized across European countries with the prevalent adoption of small groups (5-15 calves/pen) and a smaller proportion adopting large groups (26-80 calves/pen). These features along with other housing and management traits allowed discriminating the sample of 174 farms considered in the study as reported in Table 1. Individual space allowance was below or just equal to the legal requirement of 1.8 m^2/calf up to 280 kg of live weight in the large majority of farms while only one third of the farms adopted a larger space allowance throughout the entire fattening cycle. Almost 80% of the farms had wooden slats as type of flooring while only 6.3% of farms adopted rubber or straw as extra bedding materials. Concrete floors (either fully slatted or partially slatted and full) were still present in 14% of the farms.

Table 1. List of veal calves production system's characteristics considered as potential risk factors for occurrence of bursitis and number of farms included in the sample according to each factor level

Risk factor	Level of the factor	Number of farms
Housing system during fattening	Small group (≤ 15 calves/pen)	149
	Large group (> 15 calves/pen)	25
Type of floor	Slatted wooden floor	138
	Concrete floor	25
	Rubber or straw covering	11
Space allowance	≤ 1.8 (m^2/calf)	117
	> 1.8 (m^2/calf)	57
Floor age	≤ 4 (years)	37
	5 - 8 (years)	50
	> 8 (years)	36

Data from the first and third visit of one farm were missing due to practical problems (Table 2). Results regarding descriptive statistics related to the number of calves visited per farm and prevalence of locomotory system disorders in the three stages of the fattening are presented in Table 2. Evidence of signs of bursitis showed an increasing trend throughout the fattening going from almost no calves involved at an early stage to an average of 11.2% of calves affected at the late stage. The increasing trend for the prevalence of bursitis during fattening is in line with previous studies on beef cattle that reported an increased susceptibility to locomotory system disorders, and bursitis in particular, towards later stages of the fattening cycle when animals are heavier (Tessitore et al., 2009a). Hoof and joint lesions were almost null at all three stages of the fattening cycle underling that these are not relevant problems in veal calves as they are for cows (Somers et al., 2003). Lameness showed also a low prevalence with ≤1% of the observed calves involved and this result could be expected, particularly when considering that hoof disorders account for about 90% of all lameness incidents in dairy cattle (Weaver, 2000). Prevalence of lameness and bursitis are in accordance with findings from Tessitore et al. (2009b) on bulls even though a higher prevalence could be expected for bulls since they are heavier.

Because of the low prevalence (≤1%), hoof lesions, joint lesions and lameness were excluded from further investigations, whereas a risk factor analysis was carried out for bursitis.

The distributions of the farms according to the prevalence of bursitis at the middle and end stage of the fattening are shown in Figure 1a and 1b. At these two stages of the fattening, the maximum prevalence of bursitis reached about 70% of calves in some farms. This very high prevalence suggests that a remedial action plan should be applied to improve the health status of calves at least in the worst 7 and 15% of farms, respectively.

The analysis of factors impairing bursitis carried out in the current study underlined that the different housing system (small vs. large groups) was not a risk. The most relevant factors are listed in Table 3. Concrete and fully slatted wooden floors highly increased the risk of developing bursitis compared to floors with rubber or straw. This confirms findings reported in

Table 2. Prevalence and position parameters of bursitis, hoof lesions, joint lesions and lameness (% of calves interested by the problem/calves observed) in white veal calves farms in three different stages of the fattening

Item	3 wks of fattening (n=173)				13 wks of fattening (n=174)				2 wks before slaughter (n=173)			
	Mean	SEM[1]	Min	Max	Mean	SEM	Min	Max	Mean	SEM	Min	Max
N. calves observed	252.1	5.84	53.0	432.0	252.5	5.70	72.0	427.0	247.8	5.71	38.0	422.0
Bursitis	0.2	0.03	0.0	4.0	4.1	0.75	0.0	70.2	11.2	1.10	0.0	68.9
Hoof lesions	0.05	0.02	0.0	1.9	0.3	0.04	0.0	2.9	0.1	0.02	0.0	1.1
Joint lesions	0.5	0.14	0.0	22.0	0.2	0.03	0.0	2.0	0.1	0.03	0.0	3.3
Lameness	0.8	0.20	0.0	27.0	1.0	0.09	0.0	7.3	0.4	0.05	0.0	5.9

[1] SEM = standard error of the mean

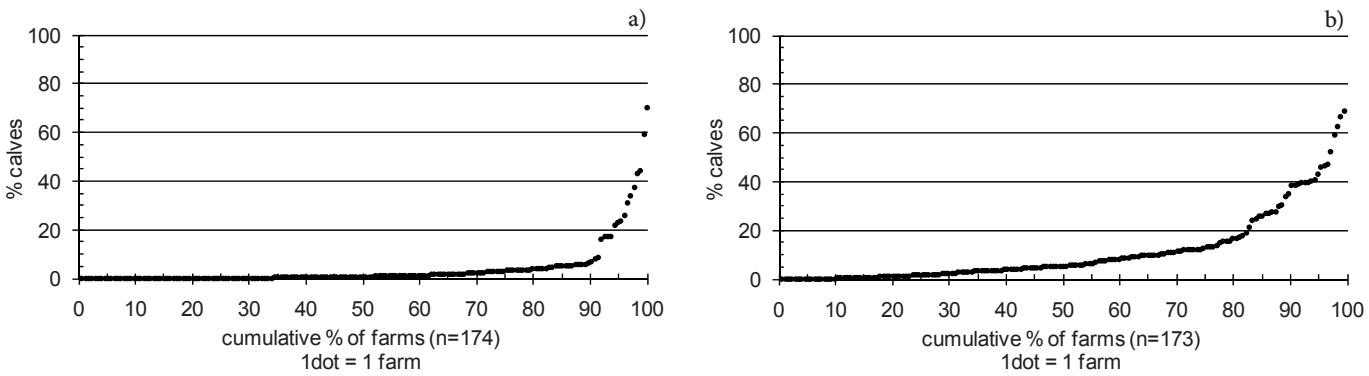

Figure 1. a) Distribution of the farms according to the prevalence of bursitis at 13 weeks of fattening; b) distribution of the farms according to the prevalence of bursitis 2 weeks before slaughter

Table 3. Odds ratio and 95% confidence interval resulting from the risk factor analysis for occurrence of bursitis in 174 veal calves farms

Risk factor	Levels	Odds Ratio	Standard Error	95% confidence interval	P
Type of floor	Slatted wooden floor	1.475 E^9	1.05	1.33 E^9 - 1.64 E^9	<0.001
	Concrete floor	4.254 E^9	1.00	4.25 E^9 - 4.254 E^9	<0.001
	Rubber or straw	-	-	-	-
Space allowance	≤ 1.8 (m^2/calf)	1.4	1.07	1.3 - 1.6	<0.001
	> 1.8 (m^2/calf)	-	-	-	-
Age of the floor	≤ 4 (years)	2.1	1.06	1.9 – 2.4	<0.001
	5 - 8 (years)	1.2	1.07	1.0 – 1.3	0.02
	> 8 (years)	-	-	-	-
Week of observation	3 wks of fattening	0.0	1.40	0.0 – 0.01	<0.001
	13 wks of fattening	0.3	1.05	0.2 – 0.3	<0.001
	2 wks before slaughter	-	-	-	-

the literature for other farm-animals where concrete floors and slatted floors are the mostly incriminated from the animal welfare point of view (Telezhenko et al., 2007; Gillman et al., 2008). It has been reported that cattle housed on slatted floors do not perform all normal behaviours as often as they would do in an outdoor situation. Moreover, on these hard surfaces cattle show signs of discomfort since they fear to walk and rise naturally (Tessitore et al., 2009b). It is also likely that intermittent mild trauma to the precarpal area occurs during the transition from standing to lying position on floors lacking of bedding materials (Fathy and Radad, 2006). Recumbency on sternum with all legs underneath is the most frequent lying position for veal calves. This might furthermore increase the prevalence of bursitis on hard floor types. The risk of occurrence of bursitis increased also when a space ≤ 1.8 m^2/calf was adopted compared to a larger space allowance (Table 3). It is likely that calves who benefit of more space change their lying position from sternal to lateral, stretching out one or more legs. This should result in a lower incidence of swelling of the carpal bursae. The risk of occurrence of bursitis increased also when calves were housed on new floors compared to floors aged more than eight years. New floors are harder and more slippery when compared to older floors that are more likely to be worn out by a prolonged use.

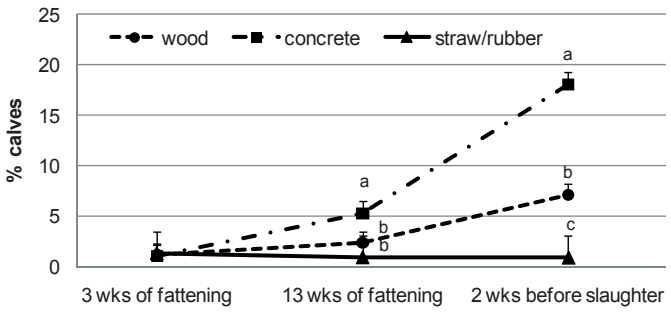

Figure 2. Prevalence of bursitis according to the effect of the interaction between week of observation and type of floor (P<0.001); a ,b, c = indicate significant differences within week of observation for P<0.05

As expected, the early stages of the fattening cycle acted as preventive measures for occurrence of bursitis compared to the final stage. This is in line with results reported by Tessitore et al. (2009a) on bulls.

Regardless of the duration of the fattening cycle, in the multivariate analysis bursitis was significantly affected by the type of floor (P<0.05), the interaction between week of observation and type of floor (P<0.001), and the interaction between week of observation and floor age (P<0.05). Results of the effect of the most significant interaction (week of observation X type of floor) are shown in Figure 2. There is no effect at the early stage of the fattening while remarked differences occurred at the end of the fattening. The highest least mean was observed for calves housed on concrete floors both, at the middle and the late stages. Wooden slatted floors showed an intermediate prevalence at the late stage of fattening. No differences were observed between wooden slats and floors covered with bedding materials at the middle stage. The use of bedding materials, however, determined the lowest prevalence of bursitis. This positive effect underlines the need to use rubber mats or straw as alternative solutions to concrete floors in order to improve calves' comfort around resting, health of the locomotory system and welfare status (Lowe et al., 2001).

Conclusions

Locomotory system disorders are less relevant for veal calves than for other farm-animal categories. However, the increasing prevalence of bursitis towards the end of the fattening cycle points out that they should not be completely neglected in veal calves. The association between bursitis and risk factors such as type of flooring and space allowance pointed out that the options adopted to increase the welfare status of these animals (e.g. bedding materials and larger space) can give beneficial effects also on the health status of the locomotory system. This should spur researchers to investigate different alternative flooring solutions for veal calves and farmers to apply on-farm the most suitable ones.

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