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Piglet mortality on farms using farrowing systems with or without crates

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Abstract

Crating sows in farrowing systems greatly restricts their normal behaviour, which is usually justified by the assumption that piglet mortality is higher with loose-housed sows. Based on experiments showing that this is not the case, farrowing crates were banned in Switzerland in 1997. Since then, many farms have introduced loose farrowing systems, enabling a comparison of piglet mortality in farrowing systems with and without crates based on a large sample size. Data of a sow-recording scheme (UFA2000) were analysed using generalised linear mixed-effects models with an underlying Poisson distribution. In 2002 and 2003, the average total piglet mortality on 173 farms (n = 18,824 litters) with loose farrowing systems amounted to 1.40 piglets per litter and did not differ from that of 482 farms (n = 44,837 litters) with crates (1.42 piglets per litter). Nevertheless, the number of crushed piglets was significantly higher in pens with loose-housed sows (0.62 versus 0.52 piglets per litter), whereas the number of piglets that died for other reasons was significantly higher in crates (0.78 versus 0.89 piglets per litter). Total piglet mortality was influenced by litter size at birth, age of the sow and season. Consequently, evaluation of the reproductive data of commercial farms shows that no more piglet losses occur in loose farrowing pens, common nowadays in Switzerland, than in farrowing pens with crates, and that litter size at birth is the main influence on piglet losses.

Keywords: *animal welfare, farrowing pens, loose-housing, piglet losses, reproductive performance, sows*

Introduction

Sows display very intensive nest-building behaviour in the hours before farrowing (Jensen 1989). Animals kept in farrowing crates also attempt to carry out this behaviour by amassing all the available straw or by working the pen fittings (Damm *et al* 2000; Jarvis *et al* 2001). The prevention of natural pre-farrowing behaviour and behaviour during farrowing by confining the sow in a crate has been found to be highly stressful (Jarvis *et al* 2001).

The negative impact of crating on the well-being of sows has led, in the last few years, to the development of farrowing pens in which the sow is not confined. In 1997, a revision of the Swiss Animal Protection Ordinance stipulated that "Farrowing pens shall be designed to provide sufficient space for the mother sow to turn around freely. While giving birth, the sow may be enclosed in a crate in exceptional cases." The transitional period for this provision will last until the end of June 2007. Since 1997, many farms have already introduced loose farrowing systems.

The aim of the present study was to determine, on the basis of a large sample size, whether or not there are differences between the reproductive performances of commercial farms with loose farrowing pens and those with crate systems.

Materials and methods

Data and sample sizes

For the calculations, we had at our disposal all the individual litter data for 2002 and 2003 from 830 farms which took part in the UFA2000 Swiss sow recording scheme. 240 of these farms used loose farrowing pens. The pens had surface areas varying from 5 to 12 m^2.

For the sake of more concise comparison and controlling for confounding variables, some individual farms and litters were excluded from data analysis. Farms which had less than 20 litters, which had average piglet losses of less than 4% for both years, or which attributed more than 90% of all losses to a single cause were excluded from the analysis. Also omitted were farms with loose farrowing pens with an option of confining the sow. Regarding litters, only those in which there were no piglets with abnormalities, litter size at birth was between three and 19 piglets, gestation period was between 111 and 119 days, lactation period was between 19 and 51 days, and where no piglets were added or removed for fostering, were taken for analysis. A systematic bias due to these criteria could not be detected in this sample.

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Table 1 Reproductive performances in commercial farms with loose farrowing pens and farrowing pens with crates.

	Farrowing system	
	Loose (mean + SEM)	**Crate (mean + SEM)**
Number of farms	173	482
Number of litters	18,824	44,837
Parity	4.1 (0.02)	4.0 (0.01)
Age at weaning (days)	35.8 (0.04)	35.1 (0.03)
Number of stillborn	0.6 (0.01)	0.7 (0.01)
Litter size at birth	11.0 (0.02)	11.0 (0.01)
Litter size at weaning	9.6 (0.02)	9.6 (0.01)
Number of losses per litter		
Total	1.40 (0.012)	1.42 (0.008)
Crushed	0.62 (0.007)	0.52 (0.004)
Other	0.78 (0.009)	0.89 (0.007)

Table 2 *P* and *F*-values of the variables analysed for their influence on total piglet losses; losses due to crushing, and losses due to reasons other than crushing (generalised linear mixed models).

	Causes of piglet losses					
	Total		**Crushed**		**Others**	
	***P*-value**	***F*-value**	***P*-value**	***F*-value**	***P*-value**	***F*-value**
System	0.23	$F_{1, 653} = 1$	< 0.001	$F_{1, 653} = 19$	0.01	$F_{1, 653} = 7$
Year	0.57	$F_{1, 27,369} = 0$	0.97	$F_{1, 27,369} = 0$	0.60	$F_{1, 27,369} = 0$
Season	< 0.001	$F_{2, 27,369} = 13$	0.03	$F_{2, 27,369} = 3$	< 0.001	$F_{2, 27,369} = 17$
Interaction of year × season	0.057	$F_{2, 27,369} = 3$	0.003	$F_{2, 27,369} = 6$	0.16	$F_{2, 27,369} = 2$
Litter size at birth	< 0.001	$F_{1, 27,369} = 9589$	< 0.001	$F_{1, 27,369} = 3,430$	< 0.001	$F_{1, 27,369} = 5,822$
Partity class	< 0.001	$F_{4, 27,369} = 25$	< 0.001	$F_{4, 27,369} = 6$	< 0.001	$F_{4, 27,369} = 23$
Interaction of litter size × parity class	< 0.001	$F_{4, 27,369} = 22$	< 0.001	$F_{4, 27,369} = 6$	< 0.001	$F_{4, 27,369} = 18$

Causes of piglet losses

In the UFA2000 sow recording scheme, various causes may be given for the death of piglets (crushed, runts, bitten to death, *Escherichia coli* diarrhoea, etc). In commercial farms, there is often some uncertainty as to the exact cause of loss. Crushed piglets, however, can usually be readily recognised as such. Therefore, all causes of loss were categorised as 'crushed' or 'other' reasons than being crushed.

Statistical analyses

The analysis was performed with the absolute number of piglet losses, using generalised linear mixed-effects models with underlying Poisson distribution by S-Plus 6.1 Professional Edition for Windows (Insightful Corp, Seattle, USA).

As explanatory variables, we analysed the influence of the following on piglet mortality: farrowing system (farrowing pen with or without crate); year (2002, 2003); season (cold, hot, between seasons); litter size at birth; and the parity class of the sow (first parity, 2-3, 4-6, 7-8, > 8).

For each of the outcome variables (total piglet losses, losses due to crushing, losses for any other reasons) we chose the following model:

$$y_{ijklmn} = \mu + \alpha_i + \gamma_{ij} + a_k + b_l + c_m + \beta_1 \times \text{sqrt}(d) + e_n + b_l \times c_m + \beta_2(e_n) \times \text{sqrt}(d) + \varepsilon_{ijklmn}$$

where y_{ijklmn} = number of piglet losses per litter; μ = overall mean; α_i = random effect of farm; γ_{ij} = random effect of sow in farm; a_k = fixed effect of farrowing system; b_l = fixed effect of the year; c_m = fixed effect of the season; d = litter size at birth (transformed by square root); e_n = fixed effect of parity class; $b_l \times c_m$ = interaction of year and season; $\beta_2(e_n) \times \text{sqrt}(d)$ = interaction of parity class and litter size; ε_{ijklmn} = error term.

Results

Parity, age at weaning and number of stillbirths were almost identical in both farrowing systems. Litter size at birth and at weaning were the same in both systems (Table 1).

The farrowing system had no significant influence on the total piglet losses (Table 2). In the farrowing pens without crates, there were significantly higher losses due to crushing, but significantly fewer deaths due to other causes. The season also had a significant impact on all categories of losses. In addition, there was a significant interaction between the year and the season for losses due to crushing.

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Litter size at birth, parity class of the sow and their interaction significantly influenced piglet losses.

Discussion

The evaluation of the reproductive data of a large number of commercial farms revealed that there were no differences between loose farrowing pens and farrowing pens with crates in terms of total piglet losses. In farrowing pens without crates, more piglets were crushed, but fewer were lost owing to other causes.

Similar results were obtained by Cronin *et al* (2000), Weber (2000) and Stabenow (2001). In contrast, other studies showed that in loose farrowing pens, higher losses occurred primarily due to crushing (Blackshaw *et al* 1994; Marchant *et al* 2000). On closer inspection of these studies, though, it is striking that higher total piglet losses occurred particularly in farrowing pens with a small surface area. In pens with a surface area equal to or greater than 5 m^2 (as with the pens in this study), differences between loose and crated sows in terms of piglet losses were no longer detectable.

According to Blackshaw and Hagelsø (1990), sows group their piglets together before lying down, by extensively rooting, scratching and turning around on the lying surface. This causes the piglets to gather together, whereupon the sow carefully lies down beside them. Fraser (1990) found that underweight piglets are more often crushed. Piglets of weak constitution will probably not regularly gather in a group with the rest of the litter before the sow lies down which increases the likelihood of them getting crushed by loose-housed sows. In crates they will die later for other reasons. This may explain why in this study, losses due to crushing were higher in loose farrowing pens than in farrowing pens with crates but the number of total losses did not differ.

Sow factors, especially litter size at birth, had highly significant influences on all categories of piglet losses. It is known that variation of birthweight of piglets within a litter is increased in larger litters, which leads to weaker piglets at greater risk of dying (Marchant *et al* 2000).

In conclusion, the present study, which was based on a large sample size, proves that fears of increased piglet losses in loose farrowing pens are not justified, provided that pens of an appropriate size are used.

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