

Housing of Pregnant Sows in Loose and Confined Systems – a Field Study. 3. The Impact of Housing Factors on Claw Lesions

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Gjein H. and R.B.Larssen: Housing of pregnant sows in loose and confined systems – a field study. 3. The impact of housing factors on claw lesions. Acta vet. scand. 1995, 36, 443-450. – The relationship of claw lesions to housing was studied in 36 sow herds. Eighteen herds with loose housing of pregnant sows and 18 herds with confined (stalled or tethered) pregnant sows, were followed over a 12 month period. Fifteen of the loose housing herds had partly slatted concrete floors, while 3 herds had other types of flooring. The mean herd prevalence proportion of sows with major claw lesions in loose housing herds with partly slatted floors was about twice as high as in the herds with confined sows. In the only loose housing herd with deep litter based on straw, the prevalence proportion of sows with major claw lesions was lower than any of the other loose or confined herds.

Within herds with loose sows on partly slatted floors, the prevalence proportion of sows with major claw lesions seemed to be higher in the loose housing compartment than in the farrowing compartment. The prevalence proportion of sows with major claw lesions did not differ between loose herds with plastic slats and loose herds with concrete slats.

pig; feet injuries; slatted floors; deep litter; epidemiology.

Introduction

Claw lesions are a common problem in intensive pig production and are a major cause of lameness in pigs. Claw lesions are a result of housing, management, heredity and nutrition (Jensen 1979, Simmins & Brooks 1988, de Koning *et al.* 1990).

It has been shown that the type and condition of flooring material are important for the development of claw lesions. Slatted floors of low quality can cause foot and leg injuries (Smith & Robertson 1971), floors with a rough concrete surface have been shown to have a higher frequency of claw lesions than floors with a smooth concrete surface (Wright *et al.* 1972). New concrete floors are associated with feet

problems (Kovacs & Beer 1979). Pigs reared on floors with 100% slats (concrete or plastic) have more claw lesions than pigs reared on floors with 50% slats and 50% concrete, however, the best floor is soil (Fritschen 1979). Group housing of sows on partly slatted floors without bedding has been associated with claw lesions and lameness (de Koning *et al.* 1990, van der Meulen *et al.* 1990, van der Wilt *et al.* 1992).

The present field investigation was conducted to study the relationship between housing of sows, and health and welfare. In this paper, the frequency of claw lesions in relations to type of housing, compartment of house and type of floor are presented.

Materials and methods

Design

The study was a prospective open cohort study (multiple cross sectional) in 36 herds during a period of 12 months with animals leaving or entering the herds at any time. All sows in the farrowing and pregnant sows compartment in the herds were subject to 3 clinical examinations (October 1989, April 1990 and October 1990). To be included in the study, the herds had to have installed new floors within the last 5 years. Details about design and selection of herds are described elsewhere (Gjein & Larssen 1995 a).

Herds

The cohort of loose herds included 18 herds, and 15 of these herds had partly slatted concrete floors without or with very little bedding. All these herds had electronic sow feeding. Twelve herds had concrete slats and 3 herds had plastic slats. The plastic slats were 10 mm wide and the slots were also 10 mm. The concrete slats were 90 mm wide and separated by a slot of 20-22 mm. The area with slats was 25-35% of the total floor area in all the loose herds. Average number of sow-years in these 15 herds was 39.2 (26-70), and the group size of pregnant loose sows was between 15 and 40. One sow-year is the equivalent of a sow older than 6 months that spends a complete year in the herd, however only sows that subsequently farrow are included.

One loose herd had deep litter based on straw, one had a concrete floor without slats and with a partly deep litter of sawdust. These 2 herds were kept separate during the analysis due to the difference in flooring. One herd was excluded after the examination in April '90, because the herd then changed from a partly slatted floor to a deep litter of straw.

The cohort of confined (stalled or tethered) herds included 18 herds. Fifteen of these herds had concrete floor without slats, while 3 herds

had partly slatted concrete floor in the pregnant sow compartment. The concrete slats were 90 mm wide and separated by a 20-22 mm wide slot. Average herd size was 30.1 year-sows (17-53).

Either no or a small amount of sawdust was used as litter in the pregnant sow compartment both in the confined herds and in the loose herds with partly slatted floors. In the farrowing compartment all herds used abundant bedding. The quality of the concrete floor was good in all herds.

Further details about the herds are described elsewhere (Gjein & Larssen 1995 a).

Clinical and post mortem claw examinations

All 4 claws of the hind legs of all sows in the herds were examined clinically 3 times at 6 months intervals. Over a period of 10 months, claws from sows that were slaughtered were collected and examined for gross lesions post mortem. Further details about the claw examinations are described elsewhere (Gjein & Larssen 1995 b).

Each claw lesion was classified into one of 6 categories modified from Brooks *et al.* (1977): side wall crack, heel lesion, overgrown heel, crack in the white line, crack in the junction heel-toe and toe crack and scored according to Gjein & Larssen 1995 b.

Claw lesions were scored from 1 (normal) to 5 (very serious lesion). The scoring was a subjective characterization of the overall seriousness of the lesion. Factors that were important in the scoring were the extent and depth of the lesion and secondary changes caused by the claw lesion (Gjein & Larssen 1995 b).

The sows experienced a change in housing and floor type when moved from the farrowing compartment to pregnant sow compartment (35-70 days after farrowing). The influence of this change on the prevalence of claw lesions was examined by splitting the sow observations

Table 1. Mean prevalence proportion of sows with one or more major claw lesions (score ≥ 3) of hind feet in loose and confined herds; and the average number of claw lesions (score ≥ 2) per hind foot.

Examination	Time	Housing of pregnant sows	Number of herds.	Mean prev. (%)	CI (95%)	Relative Risk	Average no. lesions per hind foot	
							Sows with major lesions	All sows
Clinical	Oct.'89	Loose	16	54*	47-61	1.5	1.7	1.2
		Confined	18	35	29-40	1.0	1.4	0.9
	Apr.'90	Loose	16	67 *	58-75	1.8	1.9	1.5
		Confined	18	37	30-44	1.0	1.4	0.9
	Oct.'90	Loose	15	81 *	75-88	2.1	2.3	2.0
		Confined	18	38	30-46	1.0	1.8	1.1
Post mortem	Dec.'89 - Sep.'90	Loose	15	84 *	76-93	1.8	2.8	2.7
		Confined	18	47	31-63	1.0	2.1	1.5

* The mean prevalence proportions of major claw lesions in loose and confined herds were significantly different ($p < 0.05$).

into monthly periods after farrowing. The sows were divided into young sows (one litter) and older sows (≥ 2 litter) when looking at the effect of the time after farrowing on the prevalence of claw lesions. The number of litters of the sows and farrowing date were obtained from the Norwegian sow recording scheme.

Statistical methods

The sow observations used in this paper were based on 3 clinical examinations of the same variables on all sows in each herd and one post mortem examination. Thus dependency existed among the sow observations both between examinations and within herd. This was taken into account during the analysis. When data are presented we thus distinguish between herd and sow observation as the unit. Herd was used as unit when comparing loose and confined housing systems (Table 1). Sow observation was used as unit when describing the frequency distribution of claw lesions (Figure 1), and when comparing the relationship between claw lesions and time after farrowing (Figure 2).

The statistical tests were performed using data obtained at each of the four examinations and using herd as the unit. The prevalence proportions in cohorts loose and confined were compared by use of means with 95% confidence intervals (CI). Statistical Analysis System (SAS Institute Inc. 1989) was used for data processing and statistical analysis. No statistical analysis was carried out using sow observation as unit, since the observations were not statistically independent observations, however, the 95% CI for the group means are marked in Fig. 2.

Results

Prevalence proportion of claw lesions in loose and confined herds of hind feet

The prevalence proportion of sows with major claw lesions (score ≥ 3) was significantly ($p < 0.05$) higher at all examinations in the herds with loose sows on partly slatted floors than in the herds with confined sows (Table 1). The relative risk of having a major claw lesion was between 1.5 and 2.1 higher in the loose herds

FIGURE 1

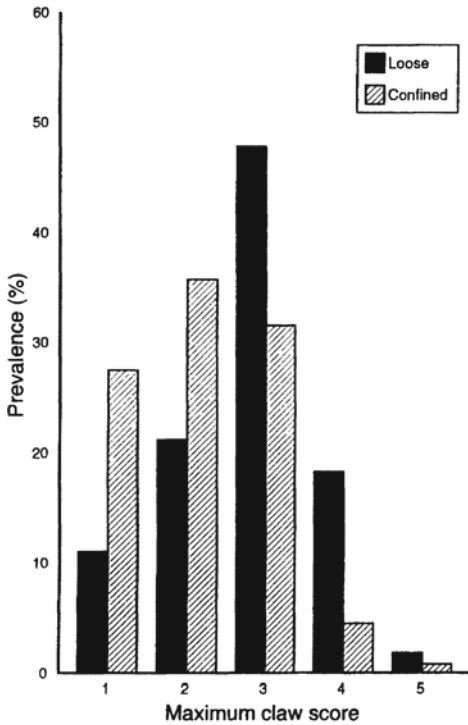


Figure 1: Frequency distribution of all sow observations in the 3 clinical examinations according to their maximum claw score, loose and confined herds (loose sow observations: $n = 1436$, confined sow observations: $n = 1260$).

than in the confined herds (Table 1). The prevalence proportion of sows with major claw lesions increased during the observation period in the loose housing herds.

The average number of claw lesions (score ≥ 2) per hind foot was also higher among sows in loose herds than among sows in confined herds, at all examinations.

The loose herd with a floor of deep litter based on straw had an average prevalence proportion of sows with major claw lesions on hind feet of 21% at the 3 clinical examinations. Thus this

FIGURE 2

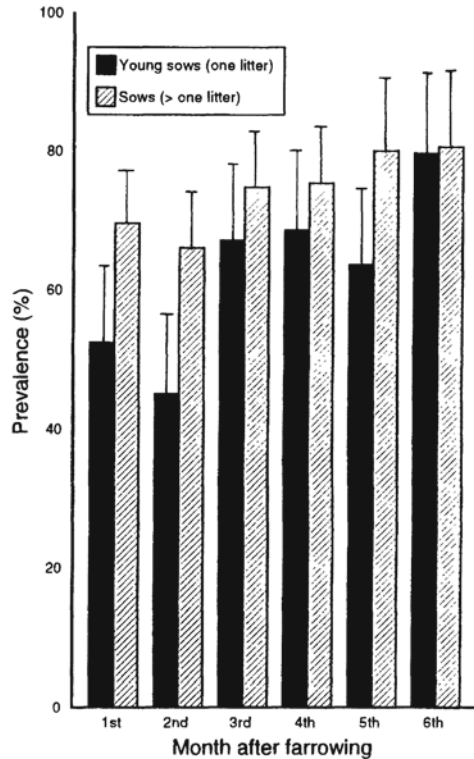


Figure 2: Mean prevalence proportion (with 95% CI) of sows with major claw lesions (score ≥ 3) in relation to time after farrowing, loose herds ($n = 1129$). In loose herds 307 sows were not included in the figure due to not having farrowed (gilts = 300), or due to missing values (7).

herd had less claw lesions than any of the confined herds and any of the loose herds with partly slatted floors. The loose herd with deep litter of sawdust had less claw lesions than the loose herds with partly slatted concrete floors. This herd had an average prevalence proportion of sows with major claw lesions of 45% in the 3 clinical examinations.

Maximum claw score on hind legs

Fig. 1 shows the frequency distribution of all sow observations in the 3 clinical examinations

according to their maximum claw score. Sows in the loose herds had a major claw lesion of one of the hind claws in 68% of the observations, as oppose to 37% in the confined herds.

Claw lesions in relation to time after farrowing

The prevalence proportion of sows with major claw lesions seemed to decrease from the first to the second month in the farrowing crate, while it seemed to increase during the period in the loose housing compartment (Fig. 2), especially among the young sows (one litter).

In the confined herds the prevalence proportion of claw lesions did not increase among the young sows during pregnancy. Among the older sows in the confined herds there was a tendency for the prevalence proportion of sows with major claw lesions to increase at the end of pregnancy.

Claw lesions in relation to type of floor

The loose herds with partly slatted concrete floors had 2 types of slats; 12 herds had concrete slats and 3 herds had plastic slats. There was no difference in the frequency of major claw lesions between the loose herds with the 2 kinds of slats. In the herds with concrete slats 68% of the sows had major claw lesions on the hind legs compared to 69% in the herds with plastic slats.

There was no significant difference ($p > 0.05$) in the prevalence of claw lesions between the 15 confined herds with concrete floor without slats, and the 3 confined herds with partly slatted concrete floor. In the herds with no slats 37% of the sows had major claw lesions while in the herds with partly slatted floors 30% of the sows had major claw lesions.

Discussion

This investigation showed that loose housing of sows on partly slatted concrete floors leads to severe problems with claw lesions. The preva-

lence proportion of sows with major claw lesions was significantly higher in herds with loose housing of pregnant sows on partly slatted floors than in herds with confined sows on concrete or partly slatted concrete floors. These results are in accordance with the observations of de Koning *et al.* (1990) who compared loose housing, cubicle housing and tethering of pregnant sows.

There are 2 main factors that may explain why the sows in loose housing herds are more prone to claw lesions, namely, the type of floor and the free movement of the sows.

Both the slats and the concrete floor may damage the claws. Slats with a wide slot (>18 mm) are especially harmful for young sows with small claws (Geyer & Troxler 1988). Walking or running on slats often results in claw lesions. However, the part of the concrete floor without slats may also cause claw lesions. On average in the loose housing herds 70% of the floor was concrete floor without slats. Claw lesions on the plantar part of the foot can be the consequence of a concrete floor with no or small amount of litter. The wear and tear on the claws are greater on free moving sows than on fixed sows.

The importance of the 2 factors, floor and movement of the sows, was confirmed by the tendency to increasing prevalence of claw lesions following the change from farrowing compartment to the loose housing compartment. The time in the farrowing crate seemed to be beneficial for healing of the claw lesions. The farrowing crate contained a lot of straw or sawdust and did not have concrete slats. In addition, the sows were quiet and bodyweight decreased. All these factors improve claw health. The effect of better flooring in the farrowing box was possibly obscured because of the healing time of injured claw. The claw horn grows at an average rate of 10 mm per month (Johnston & Penny 1989). This slow healing process may explain why the decrease in prevalence in

claw lesions first appeared in the second month after farrowing.

With the relatively small group sizes in this study (15-30 sows), the rank order in the group was disturbed every time new sows were admitted. The fighting and running observed during the re-establishment of rank order may have contributed to the increase in prevalence of sows with major claw lesions in the loose housing compartment. *De Koning et al.* (1990) also reported that the number of claw lesions increased during the dry sow period. These investigators found that loose sows at 4 weeks gestation had less claw lesions than sows at 15 weeks gestation.

In the present study, no difference was found in claw lesions between loose herds with plastic slats and loose herds with concrete slats. The plastic slats had a smaller gap between the slats which should be better for claw health, but appeared to be more slippery for the sows, which could have an adverse effect on claw health.

The loose herd with deep litter based on straw had a lower prevalence of sows with major claw lesions than the other loose herds and was even lower than the prevalence in fixed herds. Other studies have shown that claw lesions are not a problem in loose housing of sows with deep straw bedding (*Peet 1990, Svendsen 1990*).

In the present study, the number of all claw lesions per hind foot among sows with major claw lesions was higher than the mean for all sows. Thus, sows with high maximum scores also had many claw lesions.

Several reports have shown that nutritional factors especially biotin deficiency can be responsible for claw lesions (*Brooks 1982, Kornegay 1986, Misir & Blair 1986, Simmins & Brooks 1988*). Biotin deficiency, however, does not seem to be an important factor for the claw lesions observed in the present study. Blood samples from 5 sows in each herd showed that there was no correlation between biotin level in the

blood and claw lesions in the herd (unpublished data).

The observed increase in prevalence of major claw lesions over the 3 examinations is difficult to explain. It may have been an effect of age, the average age of loose sows was higher at the last examination than the first and the prevalence of claw lesions tended to increase from litter one to litter 3 (*Gjein & Larssen 1995 b*). The possibility that it could have been an observer effect can not be excluded.

Claw lesions were more severe and more frequently observed at the post mortem examination of claws from slaughtered sows, compared to the clinical examination in the herd. This may be explained by a more thorough examination of the claws in the laboratory. In addition, many of the sows were slaughtered just because of claw lesions (*Gjein & Larssen 1995 a*).

Comparisons between different housing systems are difficult, because variation in management and stockmanship often confounds the results. The results in this study are based on a subjective scoring of the claw lesions observed both in the herd, and at a laboratory examination of claws from slaughtered sows. A subjective scoring model is not an ideal method of evaluation, but in a clinical study it is the most practical approach and is commonly used and accepted. The main result, the difference in prevalence of claw lesions between the 2 kinds of herds was reproduced at all the 4 examinations.

Conclusions

This study showed that loose housing of pregnant sows on partly slatted concrete floor was associated with claw problems. The risk of finding a sow with major claw lesions in the loose herds with partly slatted concrete floors was nearly twice as high as in the confined herds. The claw problems increased during the period the sows were in the loose housing com-

partment. Deep straw litter has been associated with minimal claw lesions in this and other studies, and appears to be the most appropriate type of flooring for loose housing of sows.

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Sammendrag

Løsgående og fikserte gjeldpurker - en feltstudie av helse og velferd. 3. Klauvskader: Oppstallingsfaktorer.

Sammenhengen mellom oppstallingsmetode og klauvskader ble studert i 36 purkebesetninger. Atten besetninger med løsgående og 18 med fikserte eller oppbundne gjeldpurker ble fulgt i 1 år. Femten av løsdriftsbesetningene hadde betonggulv med spalter på en tredel av gulvarealet, 3 besetninger hadde en annen type gulv.

Klauvskadene ble gitt karakter fra 1 til 5, skader fra 3 til 5 ble klassifisert som alvorlige skader. Løsdriftsbesetningene med spaltergulv hadde dobbelt så

høy prevalens av purker med alvorlige klauvskader som besetningene med fikserte og oppbundne purker. Løsdriftsbesetningen med halmtalle hadde lavere prevalens av purker med alvorlige klauvskader enn besetningene med fikserte og oppbundne purker. I løsdriftsbesetningene med betonggulv og spalter

var det høyere prevalens av dyr med alvorlige klauvskader i gjeldpurkeavdelingen enn i fødeavdelingen. Det var ikke noe forskjell på prevalensen av purker med klauvskader i løsdriftsbesetningene med betongspalter og i løsdriftsbesetningene med plastspalter.

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