Use of rubber mats in farrowing pens for loose housed sows – does it prevent development of skin and claw abrasions in suckling piglets?

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Table of Contents

Abstract

Poor claw health of preweaning piglets is regarded as a major welfare issue in today's pig industry. Rough concrete flooring is a well known risk factor for development of abrasions on claws and limbs. The aim of the present study was to investigate if use of rubber mats on the solid laying area in the farrowing pen for loose housed sows, were able to prevent development of skin and claw abrasions in suckling piglets compared to the original solid concrete floor.

The study was carried out on two commercial piglet producing farms during February - December 2012. Two types of solid rubber mats with different softness were installed on the lying area. The harder mat (PORCA relax, Kraiburg Elastik GmbH) was installed in 3 pens in farm A and 2 pens in farm B. The softer mat (KKM Porca prototype, Kraiburg Elastik GmbH) was installed in 4 pens in farm A and in 2 pens on farm B. In total, the limbs and claws of 759 piglets from 67 litters were clinically examined when the piglets were 4-12 days old (18 litters from hard rubber pens, 16 litters from soft rubber pens, 33 litters from concrete pens).

Skin and claw abrasions were found in 72 % of the examined piglets in farm A and in 68 % of the examined piglets in farm B. Skin abrasions on the knee was the most common lesion found, followed by soft heel erosions, sole erosions and skin abrasions at the fetlocks. On both farms, installation of rubber mats (soft and hard) resulted in significantly less soft heel erosions ($p<0.05$). Sole erosions were also less found on both types of rubber mats in farm A but only on the softer mat (KKM porca prototype) in farm B compared to concrete flooring. However, use of rubber mats did not prevent piglets from getting skin abrasions on knees and fetlocks. In order to prevent all types of lesions, it is therefore advisable to also provide the pen with sufficient quantities of straw or similar material during the piglet's first days of life when the lesions develop.

Sammanfattning

Dålig klövhälsa hos smågrisar är ett vanligt förekommande problem i modern grisproduktion. Vassa betonggolv är en välkänd riskfaktor för att friktionsskador skall uppstå på klövar och ben. Syftet med denna studie var att undersöka om gummimattor som underlag på den fasta liggytan i en grisningsbox för lösgående suggor kunde förhindra uppkomsten av friktionsskador hos diande grisar jämfört med befintligt betonggolv.

Studien genomfördes på två svenska smågrisproducerande besättningar under februari till december 2012. Två typer av gummimattor med olika mjukhet installerades på liggytan. Den hårdare mattan (PORCA relax , Kraiburg Elastik GmbH) installerades i 3 boxar i besättning A och i 2 boxar i besättning B. Den mjukare mattan (KKM Porca prototype, Kraiburg Elastik GmbH) installerades i 4 respektive 2 boxar. Totalt undersöktes klövar och ben på 759 smågrisar från 67 kullar vid 4-12 dagars ålder (18 kullar på hårt gummi, 16 kullar på mjukt gummi, 33 kullar på betong).

Perforerande friktionsskador hittades hos 72 % av de undersökta smågrisarna i besättning A och hos 68 % i besättning B. Skavda framknän var den vanligaste typen av skada som registrerades följt av skador på ballar, sulor och kotor. I båda besättningarna medförde installation av mattor (mjuk och hard) signifkant lägre andel skadade ballar ($p<0.05$). Sulskador förekom också i mindre utsträckning men bara på den mjukare typen av matta i besättning B jämfört med betonggolvet. Numeriskt sågs färre halta grisar och färre smågrisar med klövbölder i kullar som gått på gummimattor. Däremot förhindrade inte mattorna att smågrisarna fick skavsår på knän och kotor. För att förebygga samtliga typer av friktionsskador bör man därför även förse boxen med tillräckliga mängder halm eller liknande material under den kritiska spädgrisperioden då skadorna uppstår.

Introduction

Several studies have reported a high prevalence of claw and skin abrasions in suckling piglets (Holmgren et al., 2008; KilBride et al., 2009a; Mouttotou et al., 1999; Penny et al., 1971). The claws of newborn piglets have an extremely soft horn tissue due to high water content. This makes them vulnerable to bruising during suckling (see figure 1). With age, horn tissue becomes harder and more resistant to injury (Mouttotou & Green, 1999). Piglets with claw and skin abrasions are less active than healthy littermates, indicating that these lesions are painful (Mouttotou & Green, 1999). It has also been shown that these lesions are highly correlated to lameness (Zoric et al., 2008). Poor claw health of pre-weaning piglets is thus regarded as a major welfare issue in today's pig industry.

Figure 1. Soft heel erosions in a five day old piglet (Photo: R.Westin)

Rough concrete flooring is a well known risk factor for development of lesions (KilBride et al., 2009b). According to Swedish animal welfare legislation (SJVFS 2010:15) at least half of the farrowing pen area must consist of solid flooring in Sweden. Concrete is the most frequently used flooring material on the laying area. As a result, skin abrasions on knees and fetlocks as well as sole and soft heel erosions are commonly seen among suckling piglets reared in Sweden. A survey conducted in 20 Swedish pig farms (Holmgren et al., 2008) showed that more than half of all examined piglets had skin abrasions on their knees. In general, 10 % of the piglets had been medically treated for lameness within their first week of life.

Rubber is softer and has a smoother surface compared to solid concrete. Recent research show that gestating sows will suffer from fewer hoof and leg injuries if the lying areas in the gestation housing are lined with rubber mats (TopAgrar, 2010). The hypothesis used here is that installation of rubber mats on the solid area in the farrowing pen will prevent development of skin and claw abrasions also in suckling piglets.

The aim of the present study was to investigate if installation of rubber mats on the solid laying area in the farrowing pen for loose housed sows were able to prevent development of skin and claw abrasions in suckling piglets compared to the original solid concrete floor.

Materials and methods

The study was carried out on two commercial piglet producing farms in the South-West (farm A) respectively the very South (farm B) of Sweden during February - December 2012. On both farms, a batch of sows farrowed every 8th week. All sows were a crossbreed of Swedish Landrace x Yorkshire.

In farm A, each farrowing pen had a total area of 6,4 m^2 (3,2 x 2,0 m) as shown in figure 2. Out of these, 4,0 m^2 consisted of solid concrete and the remaining 2,4 m^2 consisted of plastic slatted flooring. In farm B, pens were larger with a total pen area of 7,0 m^2 (3,35 x 2,1 m) as shown in figure 2. Solid concrete flooring covered 4,5 m^2.The remaining 2,5 m^2 was covered by plastic slatted flooring as in farm A. All sows were loose housed during farrowing and lactation.

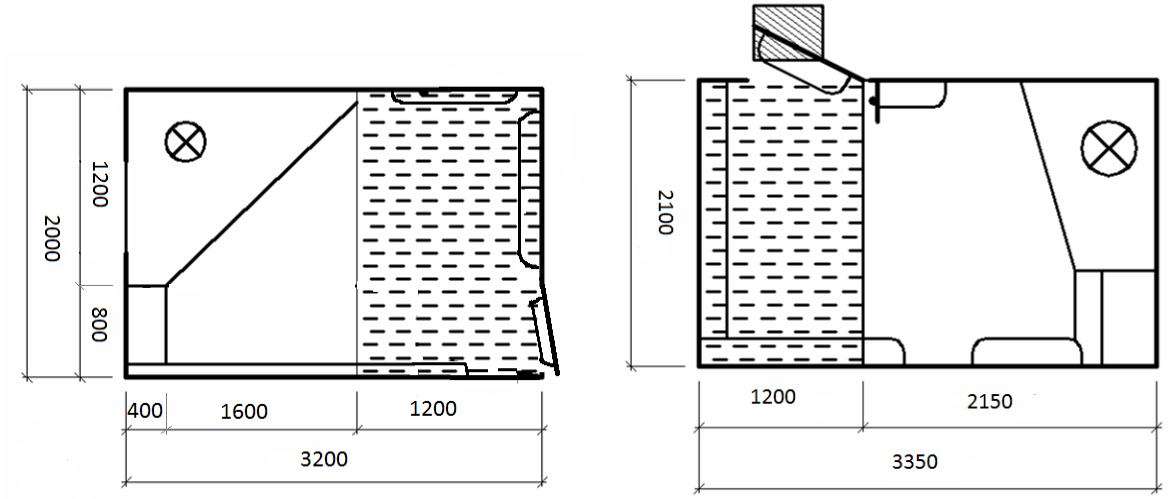

Figure 2. Design of farrowing pen in farm A (to the left) and farm B (to the right). Measurements displayed in mm. Modified after Johansson (2011).

Two types of solid rubber mats with different softness were installed on the lying area. The harder mat (PORCA relax, Kraiburg Elastik GmbH) was installed in 3 pens in farm A and 2 pens in farm B. The softer mat (KKM Porca prototype, Kraiburg Elastik GmbH) was installed in 4 pens in farm A and in 2 pens on farm B. The hard mat (PORCA relax) was 20 mm thick and had a bite-optimized protect surface and rigid edges specially designed for use in pig facilities. The softer mat (KKM porca prototype) was 30 mm thick and had the same bite-optimized protect surface but no rigid edges. The size of the mats were 1,2 x 2,0 m and were individually cut with a knife to fit the pen design and interior. No management routines were changed with the exception that cross fostering was only allowed between pens with the same type of flooring. All pens were provided with approximately 1 kg of chopped straw per day.

On farm A, the hard mats were installed in February and the softer ones in September 2012. In farm B, both types of mats were installed in February. The pens were cleaned after weaning of every farrowing batch. On farm A, this was done with a robot washer. In farm B, washing was done manually with a high pressure washer. After weaning of the last farrowing batch (December 2012), the mats were visually inspected. In farm A, the hard mats were removed and the underlying concrete floor was checked.

Clinical examination of piglets

In total, 67 litters from 5 farrowing batches on each farm were included in the study (18 hard rubber, 16 soft rubber, 33 concrete). Clinical examination of limbs and feet were performed on all piglets in each litter. Examination was performed when the piglets were 4-12 days old. Presence and number of lesions and its anatomic location (knee, fetlock, hook, coronary band, sole, soft heel, accessory digit, teat) were scored (see table 1) while the piglet was restrained by the observer. Also, injury caused by the sow (trauma) was recorded as well as if the piglet was lame or had been medically treated. The examination was performed by a veterinarian with experience of clinical examination of abrasions in piglets. The same veterinarian did the clinical examinations in all litters. In addition, parity of the sow and the number of piglets in the litter were recorded. Pen hygiene was visually scored on 0-3 scale (0=whole solid floor area clean and dry; 1=⅓ of the solid floor area dirty and/or wet; 2=⅔ of the solid floor area dirty and/or wet; 3= whole solid floor area dirty and/or wet).

Table 1. Definition of lesions

Lesion classification	
Skin abrasion - knee, fetlock, hook, coronary band	0 = Hairless patches can be present but the outer epidermis is unbroken. 1 = Loss of the outer epidermis resulting in an open wound or a healing wound with a scab on the cranial surface of the knee, fetlock, hook or the coronary band
Soft heel erosion	0 = Dark red pigmentation on the soft heel can be present but the outer epidermis unbroken 1 = Loss of the outer epidermis resulting in an irregular pit-like open wound
Sole erosion	0 = Dark red pigmentation of the sole can be present. Horny tissue can be worn down but no open wound or separation of the white line is present. 1 = Loss of horny tissue resulting in an irregular pit-like open wound or deep groove
Teat lesion	0 = Normal pink colour of the teat 1 = Dark red pigmentation of the teat or the teat completely worn off.
Claw abscess	0 = No swelling of the claw of the foot 1 = Swelling of the claw of the foot
Joint inflammation	0 = No swelling of the knee, fetlock or hook 1 = Swelling of the knee, fetlock or hook

Statistical analysis

All statistical analysis was performed using the Stata software (Stata release 11; StataCorp LP, College Station, Texas, USA). The amount of piglets affected with lesions (one or several) on the farm level was calculated for each anatomic location (knee, fetlock, hook, coronary band, sole, soft heel, accessory digit, teat). Also, the number of lesions on each location were summarised for all individuals (knee maximum 2 lesions/piglet; fetlock max. 2 lesions/piglet; hook max. 2 lesions/piglet; coronary band max. 8 lesions/piglet; sole max. 8 lesions/piglet; soft heel max. 8 lesions/piglet; declaw max. 8 lesions/piglet; teat max. 16 lesions/piglet). In a second step, the mean proportion of lesions found on the litter level

was calculated for each anatomic location. For instance, if 5 of 10 piglets in a litter had a lesion on one knee each, the average amount of knee injury was 25 % in that litter (5 piglets x1 lesion)/(10 piglets x 2 max. lesions/piglet). This calculation was also performed for the parameters *trauma*, *claw abscess*, *joint inflammation* and *lame* (max. 1 lesion per piglet).

Statistical comparison of the amount of lesions found in each location was performed on litter level basis (one observation per litter). Data was found not to be normally distributed, hence non-parametric tests were used for comparison. Statistical test of significance for overall comparison of the three floor categories (hard rubber mat, soft rubber mat, concrete) was conducted using the Kruskal-Wallis analysis of variance. Significance level was set at $p<0.05$. The analysis was performed for each farm separately. Pair wise comparisons between the different floor categories were performed when overall statistical significance was found. This was done by using the Mann-Whitney U test for comparison of independent groups.

During examination, it was recorded if the piglet was medically treated or not. It was however often not possible to differ treatment for lameness from treatment for other causes such as diarrhoea if the lameness was no longer apparent. The parameter *treatment* was therefore excluded from further analysis.

Results

In total, 759 piglets were clinically examined in 67 litters. A summary of recorded descriptive parameters is found in table 2.

Table 2. Summary of means (min-max) of descriptive parameters in relation to flooring material on the solid laying area in the farrowing pen.

	Farm A			Farm B		
	Concrete	**Rubber mat - hard**	**Rubber mat - soft**	**Concrete**	**Rubber mat - hard**	**Rubber mat - soft**
No. of litters	14	11	8	19	7	8
No. of piglets	187	141	85	193	75	78
Litter size at examination	13.5 (10-16)	13.0 (8-15)	10.5 (4-14)	11.6 (9-15)	12.1 (9-15)	11.4 (9-14)
Parity	2.5 (2-4)	2.6 (2-3)	2.8 (2-4)	3.4 (1-8)	3.1 (2-6)	3.4 (2-7)
Age at examination, days	8 (5-11)	8 (5-11)	10 (9-12)	7 (4-10)	6 (4-8)	6 (4-8)
Hygiene score[1], median	0.5 (0-2)	1 (0-3)	1 (0-2)	0 (0-2)	0 (0-1)	0 (0-1)

[1]Hygiene score: 0=whole solid floor area clean and dry; 1=⅓ of the solid floor area dirty and/or wet; 2=⅔ of the solid floor area dirty and/or wet; 3= whole solid floor area dirty and/or wet.

Skin and claw abrasions were found in 72 % of the examined piglets in farm A and in 68 % of the examined piglets in farm B. Skin abrasions on the knee was the most common lesion found, followed by soft heel erosions, sole erosions and skin abrasions at the fetlocks. Lesions were very seldom recorded at the coronary band, accessory digit or hook. Teat lesions were recorded in 6,1 % of the examined piglets in farm A respectively 11,3 % in farm B. An overview of the lesions recorded with respect to type of flooring is shown in figure 3 (farm A) and figure 4 (farm B).

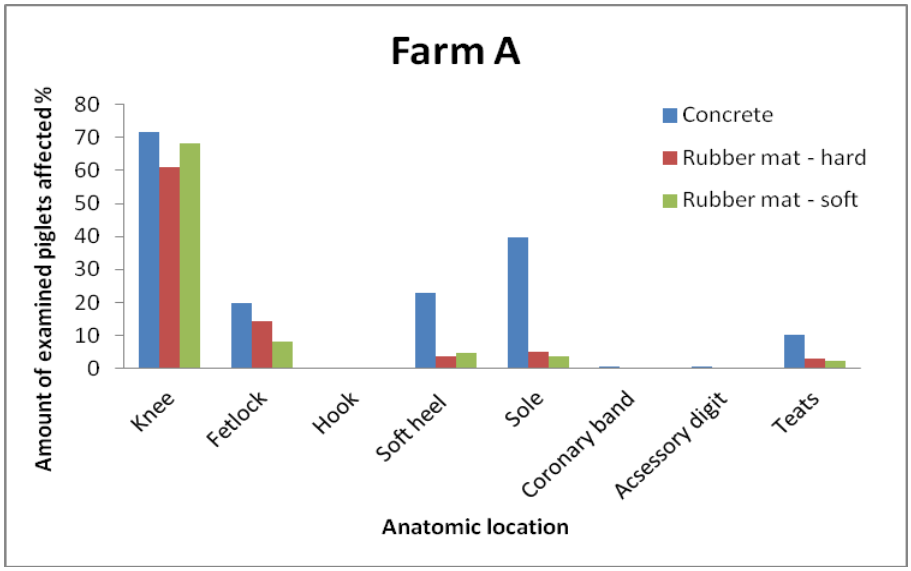

Figure 3. Amount of examined piglets affected with abrasions with respect type of flooring on farm A.

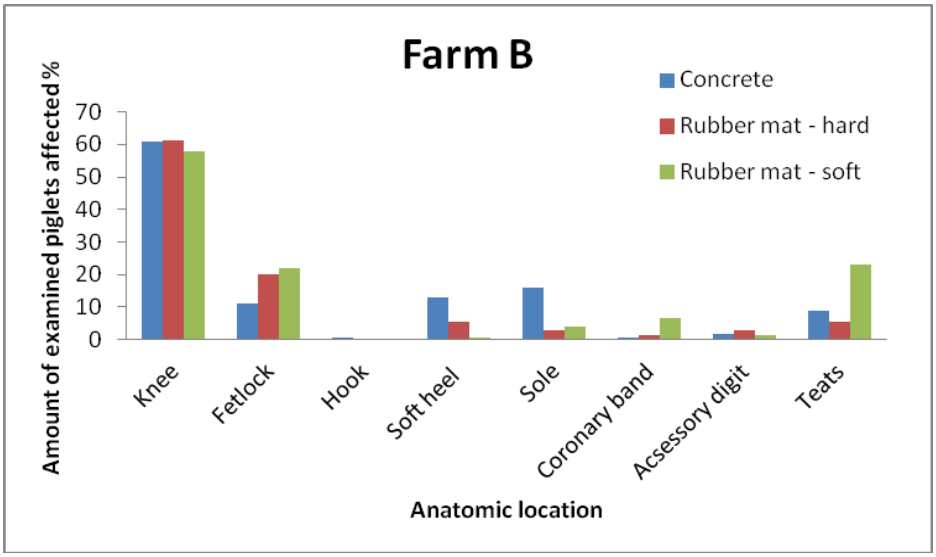

Figure 4. Amount of examined piglets affected with abrasions with respect type of flooring on farm B.

In table 3 (farm A) and table 4 (farm B) means for the proportion of abrasions recorded on each anatomical location at the litter level are presented. On both farms, use of rubber mats (soft and hard) resulted in significantly less soft heel erosions ($p<0.05$). In farm A the difference was large with 10,7 % injured soft heels in litters on concrete compared to 1,0 and 1,4 % in litters on hard and soft rubber mats. Sole erosions was also less found on both types of rubber mats in farm A but only on the softer mat (KKM porca prototype) in farm B compared to concrete flooring. Numerical differences with less lame piglets and fewer piglets with claw abscesses in rubber mat pens were found in both farms. However, this difference was not statistical significant.

Table 3. Litter means for the proportion of lesions (%) found on each anatomical location in farm A.

	Concrete	Rubber mat - hard	Rubber mat - soft
No. of litters	14	11	8
Sole	5.5[a]	0.6[b]	0.8[b]
Soft heel	10.7[a]	1.0[b]	1.4[b]
Coronary band	0.05	0.08	0
Accessory digits	0.06	0	0
Fetlock	14.5	12.3	7.6
Knee	64.1	56.2	62.9
Hook	0	0	0
Teats	1.0	0.2	0.2
Trauma	1.6	2.0	0
Claw abscess	3.7	2.4	1.0
Joint inflammation	1.6	0	0
Lame	8.7	2.0	2.9

[a,b] Different letters indicate that there is a statistical difference between the floors, $p<0.05$.

Table 4. Litter means for the proportion of lesions (%) found on each anatomical location in farm B.

	Concrete	Rubber mat - hard	Rubber mat - soft
No. of litters	19	7	8
Sole	3.3[a]	1.2[ab]	0[b]
Soft heel	3.8[a]	0.4[b]	0.3[b]
Coronary band	0.05	0.1	1.6
Accessory digits	0.2	0.4	0.1
Fetlock	8.3	14.7	16.8
Knee	56.4	53.4	51.6
Hook	1.8	0	0
Teats	1.0[a]	0.7[a]	4.5[b]
Trauma	5.2	2.1	8.6
Claw abscess	6.4	3.8	3.1
Joint inflammation	1.8	0	0
Lame	6.8	2.6	2.7

[a,b] Different letters indicate that there is a statistical difference between the floors, $p<0.05$.

The working staffs were pleased with the rubber mats and they did not find them slippery. All rubber mats stayed intact during the whole study period (February – December 2012). According to the working staff, the sows showed very little interest in the mats and were seldom observed rooting or trying to chew on the edges. In farm A, the hard mat was removed in two pens at weaning of the last studied farrowing batch. At this point of time, very little manure was present on the solid concrete floor but a lot of moisture had accumulated beneath the mats (se figure 5).

Figure 5. When removing the hard rubber mats after 10 months, a lot of moisture was found beneath. (Photo: R. Westin)

Discussion

The results from this study show that use of these types of rubber mats in the farrowing pen decreased the proportion of sole and soft heel erosions compared to concrete flooring in alignment with the hypothesis. Numerically less lame piglets and a lower proportion of claw abscesses found in litters in rubber mat pens on both farms also indicates that use of rubber mats may be positive for the claw health in suckling piglets. A previous Swedish study by Holmgren et al.2008, demonstrated a clear correlation between sole erosions and development of claw abscesses. With the limited number of litters, this could however not be verified in the present study.

Skin abrasions on the knees and fetlocks were the most common recorded lesions. This is in alignment with several other studies (Holmgren et al., 2008; Mouttotou & Green, 1999; Zoric et al., 2008). However, on knees and fetlocks no difference was found between the different flooring materials. Hence, use of rubber mats does not seem to prevent all types of lesions caused by bruising during suckling at the first day of life as expected. Use of 15 kg of straw given at one occasion two days prior to farrowing (see Westin et al., 2013 for details) has been shown to decrease the prevalence of knee and fetlock lesions (Westin et al., 2008). Also a moderate supply of straw given daily (2 kg + 2 hg per piglet) resulted in less injured knees compared to use of smaller amounts of straw (1 kg + 1 kg per piglet daily)(Zoric et al., 2009). To combine use of rubber mats with provision of straw in sufficient quantities is therefore advisable in order to completely prevent bruising.

The soft and the hard rubber mat showed almost no differences in claw and limb lesions compared to each other. In farm B more injured teats were found on the softer mat but since the number of litters is small and this was only seen on one farm it is possible that this difference could be due to other reasons.

The rubber mats used in this trial were not slippery according to the working staff. Slippery floors, such as polyurethane coated concrete has been shown to increase the number of piglets damaged by the sow (Boström, 2011; Johansson, 2011). This was not seen in the present study. This confirms that the working staff’s observations most likely were correct although no scientific research about slipperiness was performed within this project.

Conclusion

Use of rubber mats on the solid laying area in farrowing pens for loose housed sows prevents development of sole and soft heel erosions in suckling piglets. However, use of rubber mats does not prevent piglets from getting skin abrasions on knees and fetlocks which is the most common type of lesion found in piglets reared under Swedish conditions. In order to completely prevent bruising, it is therefore advisable to combine use of rubber mats with provision of straw or similar material in sufficient quantities during the piglet's first days of life when the lesions develop.

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