Livestock Science 205 (2017) 1–4

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

How do stocking density and straw provision affect fouling in conventionally housed slaughter pigs?

Mona Lilian Vestbjerg Larsen[a,*], Maja Bertelsen[a], Lene Juul Pedersen[a]

[a] Department of Animal Science, Aarhus University, 8381 Tjele, Denmark

ARTICLE INFO

Keywords:
Slaughter pigs
Fouling
Risk factors
Stocking density
Straw provision

ABSTRACT

The aim of the study was to investigate when fouling appears in conventionally housed slaughter pigs and whether stocking density and straw provision are risk factors to fouling. During four batches of a total of 112 pens with slaughter pigs, pens were randomly assigned to one level of each of two treatments: (1) stocking density of 1.21 (low, n = 56) v. 0.73 m^2/pig (high, n = 56), (2) 150 g of straw provided per pig per day on the solid floor (n = 56) v. no straw provided (n = 56). Fouling was recorded each day, and a pen had an event of fouling if at least half of the solid floor was wet with excreta and/or urine. Only the first event of fouling for each pen was included, and thus results represent whether a pen had a fouling event or not and when it happened. Data was analysed by using a Cox regression assuming proportional hazard and with right censoring of pens that never developed fouling. First event of fouling was mostly seen during the first week after insertion and in the last 3 weeks prior to slaughter (10 week study period). Pens with high stocking density had a 90% higher hazard of fouling compared to pens with low stocking density ($P = 0.016$), meaning that pens with a high stocking density had a higher risk of fouling and of developing it earlier. Pens with straw provided had a 49% higher hazard of fouling compared to pens with no straw provided ($P = 0.14$). No interaction was seen between stocking density and straw provision ($P = 0.80$). In conclusion, stocking density was a significant risk factor of fouling, whereas straw provision only indicated this numerically within the used experimental setup and chosen sample size. The results suggest that lowering the stocking density to a level of around 1.21 m^2/pig could reduce the risk of fouling in slaughter pigs. The relationship between fouling and straw provision needs further investigation.

1. Introduction

Fouling of slaughter pig pens happens when pigs change their excretory behaviour from occurring in the designated dunging area to the resting area. Conventional slaughter pigs are often housed in indoor pens with fully or partly slatted floors. The pens with partly slatted floor offer a solid lying area that is more comfortable to rest on and aims to encourage pigs to differentiate between the solid and slatted floor when resting and performing excretory behaviour. Pigs prefer to lie on the solid floor when not in heat stress (Aarnink et al., 1996), and the Danish legislation states that at least one third of the floor area should not be slatted (Ministry of Environment and Food of Denmark, 2017). Further, pens with solid flooring will decrease the manure surface and thereby the ammonia emission (Aarnink et al., 1996). It is considered both a welfare and environmental improvement to raise pigs on partly slatted floor; however, fouling is particularly a problem in pens with partly slatted floor. In addition, defecation on the solid floor area can result in a lower hygiene, bad air quality and higher ammonia emission, extra work for the farmer, disturbance of the pigs' resting behaviour and an increase in agonistic interactions (Aarnink et al., 1996; Hillmann et al., 2004; Smulders et al., 2006). For all of the above reasons, it is important to prevent fouling. However, fouling is a multifactorial problem and thus prevention is not a straightforward task. One way to prevent fouling could be to remove known risk factors. We recently published a literature review on risk factors to fouling in conventionally housed slaughter pigs (Larsen et al., 2017b) and found that earlier studies indicate that to decrease stocking density could decrease the risk of fouling, whereas to provide straw in the designated resting area might have the opposite effect. However, to our knowledge, no earlier study has directly investigated the risk of fouling with these two factors included. The aim of the current study was to investigate whether high stocking density and straw provision are risk factors to fouling. The hypothesis was that both a higher stocking density and straw provision would increase the risk of fouling. Furthermore, a second aim was to investigate when fouling appears during the slaughter pig period.

* Corresponding author.
E-mail address: mona@anis.au.dk (M.L.V. Larsen).

http://dx.doi.org/10.1016/j.livsci.2017.09.005
Received 4 July 2017; Received in revised form 4 September 2017; Accepted 7 September 2017
1871-1413/ © 2017 Elsevier B.V. All rights reserved.

Table 1
Temperature curve used for slaughter pigs as reference point for adjusting temperature in the slaughter pig section (SKOV A/S, Roslev, DK).

Day from insertion	1	7	14	21	28	35	42	64
Temperature in °C	21	20	19	18	18	18	17	17

2. Materials and methods

The present experiment was conducted from 2015 to 2016 in accordance with a protocol approved by the Danish Animal Experiments Inspectorate (Journal no. 2015-15-0201-00593). This study uses the same animals as Larsen et al. (2017a), and further details about the experimental setup can be found there.

2.1. Animals, housing and management

The experimental units were 112 pens with a total of 1624 slaughter pigs. The pens were divided between four batches (batch 1, 3 and 4: n = 32 each; batch 2: n = 16) running from June 2015 to November 2016. Two sections with 16 identical pens in each were used in the experiment (during batch 2, only one section was used). The pigs were inserted into their respective slaughter pig pen at an average weight of 31.6 ± 6.6 kg. The pens were 13.52 m^2 in size with the floor divided between one third of slatted, drained and solid concrete floor. For both the slatted and drained floor, the gap between the slats was 2 cm. The slats were 8 cm in width for the slatted floor and 18 cm in width for the drained floor. Table 1 shows the temperature curve used (SKOV A/S, Roslev, DK). The climate in the sections was evaluated each morning and adjusted according to the needs of the pigs by a parallel shift of the temperature curve of 0.5–1.5 °C up or down. The stable staff adjusted the climate on section level if they saw pigs lying on the slatted floor before they entered the section (not possible later in the slaughter pig period, when pigs were taken up most of the space in the pen when lying down). Each pen included an automatically controlled sprinkler system (SKOV A/S, Roslev, DK) above the slatted floor. This was turned on the whole time during all rounds from 0800 to 2000 h except if the outdoor temperature fell below 5 °C. The system followed a linear curve going from 1% at a 0.5 °C increase from the temperature curve to 100% at a 4.0 °C increase. At 1%, the sprinklers were turned on with 45 min' intervals for 1 min and at 100% with 20 min' intervals for 3 min. In the current study, the minimum was 14%.

2.2. Experimental design

The experiment had a 2 × 2 factorial design with the slaughter pig pens assigned to one level of each of two treatments: (1) stocking density of 0.73 m^2/pig (high) v. 1.21 m^2/pig (low, **STOCK**), and (2) provision of straw v. no provision of straw (**STRAW**). Each level of each treatment was assigned to 16 pens in batch 1, 3 and 4 and to eight pens in batch 2. The assignment of the treatment STRAW was done in blocks of four pens for each level, and the two STOCK treatment levels were randomly assigned with two pens of each stocking density within each block. This random assignment of treatments to pens was performed independently for each batch. Slaughter pig pens with the high stocking density included 18 pigs and three feeding places, while slaughter pig pens with the low stocking density included 11 pigs and two feeding places. Pens provided with straw received 150 g of straw per pig per day on the solid floor. During batch 1, 2 and 3, the straw provided was long straw at a length of 8–10 cm, while during batch 4 half of the pens received long straw, while the other pens received chopped straw cut to a length of 3–4 cm. However, no difference was seen between the two straw length treatments in the number of first fouling events or in an average clotting score of the slats, and thus this factor was not included in the following statistical analysis.

2.3. Identification and definition of a fouling event

During the daily check-up performed by the herd staff from 1000 to 1200 h, a protocol for scoring diarrhoea, fouling and tail biting events was followed. A fouling event was defined to be when more than half of the solid floor was wet with excreta and/or urine.

2.4. Statistical analyses

In the following analysis, only the first event of fouling for each pen was included. Thus, results represent whether a pen had a fouling event or not and when it happened; not the total number of fouling events for a particular pen. All statistical analyses were performed in R (R Core Team, 2016) using the package 'survival' for survival analysis (Therneau, 2015). Data were modelled by a Cox regression assuming proportional hazards. The survival object contained the information of whether a pen had a fouling event during the study period and which day during the study period the first fouling event occurred. Pens which did not develop a fouling event during the entire slaughter pig period were right censored. The model included the main effects STRAW, STOCK and the interaction between the two. The model further included stratification for batch number. The model was reduced according to a 5% significance level ($P < 0.05$). The results are presented as frequency/incidence of first fouling event and differences are presented as hazard rate ratios (HRR) with connected 95% confidence intervals (**CI**).

A post hoc power analysis was performed using the 'powerSurvEpi' package in R (Qui et al., 2015) with an effect size (HRR) of 1.9 for STOCK and 1.49 for STRAW (based on results from the model described above) and sample size of both treatment and control group of 56. This resulted in a power of only 0.66 for STOCK and 0.40 for STRAW. The effect of STOCK and STRAW should have been 2.2 and 1.91, respectively, or a higher sample size should have been used to get a power above 0.80 usually seen as the minimum when designing animal studies (Charan and Kantharia, 2013).

3. Results

3.1. Incidence of fouling

Out of the 112 pens included, 59 pens developed at least one event of fouling during the slaughter pig period (53%). The number of pens with a first event of fouling within each week of the study period divided between the four batches can be seen in Table 2. Incidences divided between the two treatments STRAW and STOCK can be seen in Table 3.

3.2. Risk factors to fouling

No interaction was seen between the two treatments STRAW and STOCK (P = 0.80). The hazard of fouling was 90% higher in pens with high stocking density compared to pens with low stocking density. The hazard of fouling was 49% higher when straw was provided compared to when no straw was provided to the pen, although, this was not significant. Statistical results can be seen in Table 4 and the development of first fouling events for each treatment is illustrated in Fig. 1.

Table 2
Frequency of first fouling event divided between the four batches and 10 weeks of study period.

	Week number										Total
Batch no.	1	2	3	4	5	6	7	8	9	10	
1	5	0	2	2	1	1	1	2	1	5	20
2	0	0	0	0	1	2	0	3	3	1	10
3	2	0	0	0	1	1	1	4	1	2	12
4	2	1	0	0	3	3	2	1	0	5	17
Total	9	1	2	2	6	7	4	10	5	13	59

Download English Version:

https://daneshyari.com/en/article/5542905

Download Persian Version:

https://daneshyari.com/article/5542905

Daneshyari.com