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The effect of temporary confinement of hyperprolific sows in Sow Welfare and Piglet protection pens on sow behaviour and salivary cortisol concentrations

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ABSTRACT

The aim of this study was to investigate effects of confinement in Sow Welfare and Piglet protection pens (SWAP pen) for four days after farrowing on sow behaviour and salivary cortisol levels. Sows were randomly allocated to three treatments: loose-loose (LL), loose-confined (LC) or confined-confined (CC). Sows in LL were loose housed when they entered the farrowing unit until weaning. Sows in LC were loose housed to the end of farrowing and then confined to day 4 of lactation. Sows in CC were confined from day 114 of gestation to day 4 after farrowing. All sows were loose housed from day 4 to weaning. Regardless of treatment, sow behaviour was characterized by a low frequency of postural changes (<12 postural changes in 2-hour intervals) and a large proportion of time spent in lateral recumbency (80–120 min of 2-hour intervals), especially on days 1 and 2 after farrowing. Sows spent similar amounts of time lying lateral in the three treatments ($P = 0.67$). Standing occurred more during the day than during the night, but the diurnal pattern differed across treatments ($P = 0.008$). Postural changes increased during the day in all treatments but more so in LL than LC and CC ($P = 0.02$) and LL sows had higher frequencies of getting up ($P \leq 0.03$) and lying down ($P \leq 0.03$). Sows in LL had more nursings than LC and CC sows on day 1 ($P < 0.001$), and more nursings than CC sows on day 2 ($P = 0.04$) and day 3 ($P = 0.01$). Nursing duration decreased from day 1 to day 2 in all treatments ($P < 0.05$), and was further decreased to day 3 in LL ($P < 0.001$). Sows in LL terminated more nursings than LC and CC sows on day 3 ($P \leq 0.001$). Salivary cortisol concentration was higher in LL sows than LC sows on the day before farrowing (day −1) as well as day 1 and day 2 after farrowing ($P < 0.05$) and higher than CC sows on days −1–3 ($P < 0.01$). Salivary cortisol was higher in LC sows than CC sows on days 0 and 1 ($P < 0.05$). The results suggest that confinement in SWAP pens for 4 days after farrowing influenced sow behaviour, although only to a minor degree as very little activity occurred. Behavioural differences were not reflected in salivary cortisol concentrations but confinement before farrowing decreased the salivary cortisol response.

1. Introduction

The behavioural patterns of sows before, during and after farrowing are very different and this presents a challenge when it comes to designing a farrowing environment that accommodates the behavioural needs of sows around farrowing and in lactation. During nest building, the activity level of the sows increase significantly, whereas the activity level of sows are generally low and sow behaviour is characterized by prolonged lateral lying in the early days of lactation (Baxter et al., 2011; Weary et al., 1996). Research has documented that sow welfare is impaired in traditional crates (Baxter et al., 2012; e.g. Damm et al., 2005), however, due to a risk of increased piglet mortality if the sows are loose, crates are still the most widespread accommodation for farrowing and lactating sows. For an alternative system to be commercially viable, it should not only consider the needs of the sow, but also the needs of the piglets and the producer (Baxter et al., 2011). In an evaluation of alternative systems Baxter et al. (2012) identified designed pens as an alternative to conventional crates. Designed pens are pens with separate lying and dunging areas, features to support the sows' lying down movements and protection features for the piglets (Baxter et al., 2012). In a study of piglet mortality in a

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designed pen – the FF-pen (Freedom Farrowing pen) – the results showed that there was a large degree of variability in piglet mortality (Hales et al., 2014). The majority of pre-weaning mortality occurs in the first few days of lactation (Marchant et al., 2001) and previous studies have shown that confinement for 4–7 days after farrowing reduced piglet mortality compared to loose housed systems (Hales et al., 2015a; Moustsen et al., 2013). The SWAP-pen (Sow Welfare And Piglet protection pen) was developed as a modification of the FF-pen, where the front of the creep served as a swing-side that can be used to confine the loose housed sows for a short period of time when the piglets seem to need additional protection from the sow. The principle behind the pen was to satisfy the requirements for a loose housed sow during farrowing and lactation but to improve piglet survival in the first days of lactation. A study on piglet mortality in the SWAP pen demonstrated that pre-weaning mortality could be reduced by confining the sow around farrowing (Hales et al., 2015a). Confining the sows reduces the risk of dangerous behaviour such as fast lying down movements and rolling (Damm et al., 2005; Danholt et al., 2011; Weary et al., 1996) hence the risk of crushing should be reduced. Considering that sows are quite inactive in the early days of lactation, the physical restriction that confinement imposes on the sow in this period may not be as unfavourable for sow welfare as it may be in other more active periods, such as nest building. Confining sows for a short period of time is therefore expected to have lower impact on sow behaviour and physiology than if sows are confined for longer periods of time, as they are when confined in crates for the entire lactation period (Cronin et al., 1991). Hence, the objective of this study was to establish if sow behaviour and salivary cortisol concentrations were affected by confinement in SWAP pens in first 4 days of lactation compared to sows that were loose housed. We tested the hypothesis that confinement sows for the first 4 days of lactation did not affect sow behaviour or salivary cortisol levels.

2. Materials and methods

The study was conducted in a Danish 1250 sow piggery (Krannestrup, Mejlby, Denmark) with Danish Landrace × Danish Yorkshire sows farrowing in weekly batches. All procedures involving animals was conducted in accordance with the guidelines of the Danish Ministry of Justice with respect to animal experimentation and care of animals under study.

2.1. Experimental design

A total of 144 sows of parity 1 and 2 were randomly allocated to one of three treatments previously described by Hales et al. (2015a): loose-loose (LL, n = 48), loose-confined (LC, n = 48) or confined-confined (CC, n = 48). Sows in LL were loose housed from entry to the farrowing unit to weaning after 4 weeks of lactation. In LC, sows were loose housed from entry to completion of farrowing (birth of placenta). When farrowing was completed sows were confined to day 4 of lactation. In CC, sows were loose housed at entry and confined from day 114 of gestation until day 4 after farrowing. Confinement ended on day 4 and sows in LC and CC were loose housed for the rest of lactation. First parity sows were randomly allocated to one of the treatments and were as far as possible, kept in that treatment for the following farrowing.

Of the 144 sows, 60 sows were randomly selected based on parity (10 sows of parity 1 and 10 sows of parity 2 in each treatment) as experimental subjects for the behavioural analyses. The parity 2 sows had been housed in the same treatment during their first lactation but were only observed during their second lactation.

2.2. Housing

In the mating unit sows were housed in a group housed system with free access feeding stalls and in the gestation unit sows were housed in a group housed system with electronic sow feeding. Five days before expected farrowing the sows were moved to individual Sow Welfare And Piglet protection (SWAP) pens (Fig. 1), previously described by Hales et al. (2015a), in the farrowing unit. The farrowing unit was an environmentally controlled building with five regular sections of 58 pens each, ventilated via diffuse ventilation with supplemental air inlets and partial pit ventilation to a temperature of 18–20 °C. The SWAP pens measured 210 × 300 cm, had 60% solid concrete floor and 40% slatted cast iron floor (>40% void). In the SWAP pen sows were loose housed but the pens were also fitted with an option to confine the sow for a few days. To satisfy the thermal needs of the new-born piglets the creep area was heated via floor heating (~42 °C) that in the first four days of lactation was supplemented with a heat lamp (150 W). The floor heat in the creep area was used until piglets were weaned and sawdust was spread in the creep as bedding material. In addition to the floor heat in the creep there was a circuit for floor heat in the sow area that was on for the first four days after parturition.

2.3. Animals and management

Gilts (Danish Landrace × Yorkshire) were purchased at approximately six months of age and all animals were artificially inseminated with semen from Duroc boars (Hatting KS, Horsens, Denmark). The sows were fed a lactation diet based on barley, wheat and soybean meal that contained 8.7 MJ potential physiological energy/kg feed (Boisen, 2001) and 7.5 g standardized ileal digestible Lysine per kg feed. Sows were fed 3 times a day (7:30, 12:30 and 15:30) when loose housed and confined sows were fed 2 times a day (7:30 and 15:30) according to the same feeding curve. Straw was provided daily to all sows during the 12:30 feeding to ensure all sows had incentives to get up at all feeding times. When the confined sows were no longer in confinement they were fed 3 times a day.

All routines and procedures followed the normal management practice of the herd. Sows were regularly checked for onset of farrowing from 07:00 in the morning to 22:00 in the evening and obstetric aid was provided when the staff deemed it necessary. At the day of birth dry umbilical cords were cut off when piglets were inspected and injected with 0.5 ml antibiotics (Clamoxyl Prolongatum, Orion Pharma Animal Health, Nivaa, Denmark). Litters were equalized when piglets were 12–24 h old when it was expected that all piglets had consumed colostrum. All litters were equalized to 13–14 piglets within treatment and surplus piglets were moved to a nurse sow. When piglets were 3 days old they were tail docked, injected with a mixture of pain relief (0.2 ml per pig, Melovem, Salfarm Denmark, Kolding, Denmark) and iron (Solofer, Vitfoss, Gråsten, Denmark), orally administered Baycox (Bayer A/S, Copenhagen, Denmark) and males were surgically castrated.

2.4. Behavioural observations

Video cameras (PTZ Security IR-Dome model no. 795JH, PTZ Security, Esbjerg, Denmark) were placed above the sows and recordings commenced on day 113 of gestation until day 5 after farrowing. The video recordings were stored in avi format (3 fps) on a hard drive using Axxon Next software (AxxonSoft, Moscow, Russia) and converted to jpg files (1 fps) in OGG software (Hoo Technologies, Santa Barbara, USA). The jpg files were imported to RADRA (Pig Research Centre, Copenhagen, Denmark) (Oxholm et al., 2014) where the behavioural observations were conducted. The date and time of last born piglet was recorded and the date of the first time