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Does the presence of shoulder ulcers affect the behaviour of sows?

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ABSTRACT

Shoulder ulcers are common in lactating sows. This case-control study compared behaviour of sows with shoulder ulcers (U-sows; N = 19) versus controls (C-sows; N = 19) and involved multiparous LxY sows, 14.7 ± 0.3 days post partum, kept in farrowing crates in a Danish herd. U-sows had at least one shoulder ulcer. Behavioural data were based on video recordings during a 24h period.

U-sows spent less time lying (P = 0.04), tended to perform more postural changes (P = 0.096), spent more time standing still (P = 0.02), showed increased shoulder rubbing (P = 0.03) and reduced nursing frequency (P = 0.03) compared to the controls. These results show that the behaviour of sows with shoulder ulcers differ from healthy sows, suggesting that U-sows experienced discomfort or pain, and indicating that maternal behaviour can be sensitive to the presence of shoulder ulcers. Further studies – focussing on temporal development of shoulder ulcers combined with behaviour of sows and piglets – are needed to clarify animal welfare impact.

1. Introduction

Shoulder ulcers are pressure sores commonly observed in the shoulder region of lactating sows (*Sus scrofa domestica)* kept in farrowing stalls (Bonde, 2008; Herskin et al., 2011a; Jensen et al., 2011). Internationally, the magnitude of the problem is confirmed by reports showing ulcer prevalence of 10–34% of lactating sows (e.g., Kilbride et al., 2009; Zurbrigg, 2006). The underlying pathogenesis is characterised by compression of blood vessels in the skin around the scapular spine, occurring when the sow lies laterally on a hard surface, and the bulk of her weight is pressed onto the shoulder region (Reese et al., 2005). Persistent compression of blood vessels leads to ischaemia in the area of blood supply, necrosis and subsequent ulceration (Jensen, 2009).

Although some attention have been directed at shoulder ulcers in recent years (Dahl-Pedersen et al., 2013; Herskin et al., 2011a; Jensen et al., 2011), the knowledge on its pathogenesis is still limited and the majority of scientific reports have focused on *post* or *ante-mortem* classification systems based on pathology (Jensen, 2009; Jensen et al., 2011, 2014; Lund et al., 2003), as well as identification of risk factors and possible treatment (Kaiser et al., 2013; Lundgren et al., 2011; Zurbrigg, 2006). Even though scoring of the presence of shoulder ulcers are involved in assessment of sow welfare (e.g., Welfare Quality ®, 2009), to date only very limited scientific documentation concerning possible consequences of shoulder ulcers in terms of animal behaviour is available (Dahl-Pedersen et al., 2013). In humans, where the integument shows significant histological and functional similarities to porcine skin (Mowafy and Cassens, 1975; Vardaxis et al., 1997), pressure sores have been reported to cause discomfort and pain, and patients mention that postural changes are one way to alleviate the pain associated with the lesions (Spilsbury et al., 2007).

One accepted way to investigate animal pain is via behavioural analyses (Weary et al., 2006). Herskin et al. (2009) showed that thermal nociceptive stimulation directed at the shoulder region of gilts led to an intensity dependent expression of behaviour such as rubbing the shoulder region against fixtures of the stall. Recently, Dahl-Pedersen et al. (2013) found increased rubbing in response to palpation in sows with scarred shoulders and traumatic neuromas, compared with sows with scarred shoulders without neuroma presence. These results suggest that one pain-related behaviour in sows with shoulder ulcers may be rubbing. Furthermore, due to the persistent nature of the lesions (Davies et al., 1997), expression of more protective behavioural elements such as altered body postures or restlessness (Gebhart et al., 2009) might also be used as behavioural indicators of pain in these situations.

In pig production, the shoulder ulcers typically develop and persist throughout the lactational period (Davies et al., 1997). Usually, maternal behaviour of mammals is critical for the survival of the young and is thus a highly motivated behaviour (Danchin et al., 2008). At present, however, it is not known whether maternal behaviour of sows, which is crucial for the survival of the piglets (Verstegen et al., 1998), is sensitive to the presence of shoulder ulcers.

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The aim of the present study was to examine the behavioural consequences of shoulder ulcers by comparing behaviour of sows with at least one shoulder ulcer with the behaviour of clinically healthy control sows approximately two weeks *postpartum*, a period where shoulder ulcers have been reported to be clinically evident (Davies et al., 1997; Kaiser et al., 2013; Reese et al., 2005). It was hypothesized that sow behaviour would be affected by the presence of shoulder ulcers leading to possible expressions of pain. However, based on the underlying high motivation for maternal care, significant effects of shoulder ulcers on maternal behaviour of the sows were not expected.

2. Materials and methods

2.1. Animals, housing and management

This observational case-control study involved 38 crossbred sows (Landrace × Yorkshire) from an anonymous commercial Danish sow herd, with approximately 36 weekly farrowings. The sow herd was included in the study based on geographical location and was known by the local veterinarian to have problems with shoulder ulcers. The experiment was performed from October 2011 to February 2012. All experimental sows were 14.7 ± 0.3 (mean ± SE) days *postpartum* (range 10–18) and multiparous. Parities ranged from 2 to 5.

During pregnancy, the sows were kept in a loose-housing barn and fed restrictively by use of a transponder system according to Danish pig production standards. Feeding level was adjusted according to individual body condition and feed intake, with an optimal body condition score (BCS) of 3 (scoring system described by Sørensen, 2010). One week before expected farrowing, the sows were moved to the farrowing barn. During the entire lactation (four weeks), all sows were kept in individual farrowing pens with conventional farrowing crates (made of steel bars) centrally positioned in the pen. All pens were equipped with a metal piglet creep positioned either to the left or right side of the sow. Farrowing pens were placed in five separate farrowing sections (1–5) within the same building with 49, 63, 20, 40 and 44 farrowing pens, respectively. All farrowing sections were managed comparably with a room temperature of 17–21°C, measured weekly at noon during the experimental period. Artificial light was provided from approximately 7 am to 5 pm. Only section 3 had windows and inflow of natural light. In sections 2 and 3, the farrowing pens were equipped with partially slatted plastic floors (slatted floor in the last third of the pen), whereas the other sections had fully slatted metal flooring. The dimensional details of the pens varied between the farrowing sections and between the individual pens (length of pens: 250–280 cm; width of pens: 140–170 cm; length of crates: 190–200 cm; width of crate at rear end 50–80 cm; at the front end 50–70 cm).

Management routines such as the castration of the piglets, tail docking and feeding were similar in all five farrowing sections. After farrowing, the litters were cross-fostered to 12–14 piglets within 12 hours after birth. All sows were fed a commercially available dry feed for lactating sows ("So die vak 15 + 5", Danish Agro, Karise, Denmark). In the farrowing barn, the sows were fed restricted with 1.5 feed units per day from 2 to 3 days before farrowing, provided automatically three times a day (7 am, 3 pm and 10 pm). Additionally, the sows were provided with rye pellets and rolled barley daily. After farrowing, the feed was adjusted according to intake to approximately 9 feed units per day.

The piglets had access to dry feed ("Danish grow Sm 250", Danish Agro, Karise, Denmark) for *ad libitum* intake from birth. Sows and piglets had free access to water from nipples placed in the feed trough and centrally in the pen, respectively.

2.2. Experimental design

This study was designed as an observational adjusted case-control study, and run over 13 successive blocks. Potentially, each block involved all sows expected to farrow that week, and according to the practice of the farmer, all sows to farrow in one week were kept together in the same section, chosen by the farmer. Due to technical limitations, we could not include more than five sows per block in the study. In cases where more than five sows met the criteria for experimental inclusion, the choice of experimental animals was randomised and a minimum of one sow from each of the two experimental groups (one U-sow and one C-sow) was selected per block. All five farrowing sections were used at least once during the experiment. For the C-sows, the distribution between barn sections was: 5, 4, 1, 5 and 4 sows for the five sections respectively. For the U-sows, 5, 9, 1, 2 and 2 sows were kept in the five sections, respectively. One week before expected farrowing, all pregnant sows in a section of the barn (block) had their shoulders clinically screened to exclude the presence of shoulder ulcerations. If ulcerations were observed at this time, the sows were excluded from the study. The shoulder region was defined as a square of 15 × 15 cm surrounding the bony prominence, the tuber of the scapular spine (based on definition by Jensen et al., 2011). Behavioural consequences of shoulder ulcers were examined by comparing the behaviour of sows with at least one shoulder ulcer (U-sows) vs. clinically healthy sows (C-sows). For each block, all behavioural comparisons and clinical data were collected on two consecutive days (*d0 and d1)* approximately two weeks *post partum.* On *d0,* all sows examined clinically three weeks earlier were subjected to another clinical examination in order to be included as U- or C-sows. Sows that were alert and did not show signs of decreased appetite (quantified around noon), overgrown hoofs, difficulties in getting up, unhealthy udder, open skin lesions, rectal temperature over 40 °C (Table 1) or had been treated with antibiotics or pain relief since farrowing (based on the farmers records), could be included as C-sows. U-sows were included based on the same criteria as the control animals, except for the presence of at least one clinically evident shoulder ulceration (based on the definition by Jensen, 2009) including visible ulcerations and different degrees of scab presence or healing). Each block of experimental sows contained at least one U-sow and one C-sow. In total, 19 sows were included in each experimental group.

2.3. Data collection

2.3.1. Behavioural observations

An infrared video camera (Monacor type-TVCCD-190COL, Bremen, Germany) was fixed in front of each pen, approximately 3 m above the floor, ensuring a full view of the entire pen. The behaviour of the sow was continuously recorded for 24 hours (from approximately 11 am on *d0*) and saved digitally using MSH-Video Server (version 5.0.11.136, M. Shafro & Co, Riga, Latvia). Analyses were made by focal sampling and continuous recording (Martin and Bateson, 2007), and included time stamps for each behavioural bout. Behavioural observations were done using MSH-Video Client (version 5.0.11.136, M. Shafro & Co, Riga, Latvia) and an ethogram of the behavioural elements is shown in Table 2. The choice of behavioural elements was based on existing literature and a pilot study. One observer, familiar with the MSH-Video Client software, performed all behavioural analyses. Although the observer was blind to the experimental treatments, the animal identification could not be avoided, e.g. U-sows with big ulcers.

2.3.2. Clinical examinations

Table 1 lists the clinical measures examined on *d0*. A clinical examination focusing on the shoulder regions of the standing sows were conducted approximately 24 hours after initiation of video