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The effect of post-farrowing ketoprofen on sow feed intake, nursing behaviour and piglet performance

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ABSTRACT

Farrowing is a critical time for sows and piglets. Poor post-farrowing sow recovery, and piglet mortality represent a welfare concern, as well as an economic loss to the pig industry. Providing a non-steroidal anti-inflammatory drug (NSAID) to the sow post-farrowing may improve sow welfare and productivity and thereby improve health status and welfare of the piglets, which would be of economic benefit to pig producers. This study investigated the production effects of providing the NSAID ketoprofen post-farrowing, to 24 primiparous (gilts) and 32 multiparous (sows) breeding pigs, in a randomised, blinded, placebo-controlled trial. Gilts and sows were allocated to receive ketoprofen (treated) or the equivalent volume of saline (control) by intramuscular injection 1.5 h after the last piglet birth. Data collected included sow feed intake, immune transfer (colostrum and piglet serum immunoglobulin-G (IgG)), nursing behaviour and piglet weight, and mortality. An additional factor in this study was that 13 individuals required additional treatment in the days after farrowing for post-farrowing illness. Therefore, data were analysed using mixed models, including treatment (treated or control), parity group (gilt or sow), and additional treatment (yes or no) as fixed factors. Stepwise binomial logistic regression was used to analyse the association between the experimental factors (treatment, additional treatment, gilt or sow), along with other gilt/sow, litter, and piglet-based measures, with piglet death before weaning. Few treatment effects were seen, with parameters being more affected by whether gilts and sows were treated for illness, or between gilts and sows. The only variable to differ by treatment was suckle grunt duration, which was greater for control compared with treated dams ($P = 0.05$). Feed consumption was greater for sows compared with gilts on days 6 and 7 post-farrowing, and serum IgG was greater in piglets from sows than gilts ($P < 0.05$). Feed consumption was reduced in dams needing additional treatment, from days 2–7 post-farrowing, and those developing illness consumed less feed overall ($P = 0.004$). The best regression model for predicting the odds of a piglet dying before weaning included number born alive ($P = 0.03$), requiring additional treatment ($P = 0.006$), being male ($P = 0.0005$), and pre-farrowing gilt/sow back-fat ($P < 0.0001$), which increased the log-odds of death, whereas, piglet body weight decreased the log-odds of death ($P < 0.0001$). This study did not demonstrate clear benefits to ketoprofen, however, high individual variation in piglet mortality, indicates potential for targeted NSAID use.

1. Introduction

Farrowing is a critical time in pig production. A common feature of modern pig production is increased litter size, and as the sow must produce enough milk to feed the litter, feed volume and composition must adjust to cope with the increased demand (Theil, 2015). Further, each piglet must have access to a functioning teat as soon as possible after birth to consume colostrum, followed by milk in order to survive (Baxter et al., 2013). Therefore, the sow must recover quickly following farrowing, including feeding and drinking. However, at that time the immunocompetence of the sow is impaired and as parturition is physically demanding, the vulnerability to illness in early lactation is increased (Friendship and O'Sullivan, 2015).

Post-partum dysgalactia syndrome (PPDS) describes any condition that affects milk production in the sow, including infections of the uterine tract (metritis) and udder (mastitis), but milk production can also decline with no obvious signs of infection (Klopfenstein et al., 2006). A number of non-infectious causes of PPDS have been discussed (Klopfenstein et al., 2006) and pain experienced by the sow could contribute to a decreased interest in the piglets and a reduction in milk

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let down (Peltoniemi and Oliviero, 2015). This has resulted in recent research administering non-steroidal anti-inflammatory drugs (NSAIDs) post-farrowing and measuring the benefits to health, welfare and productivity (Homedes et al., 2014; Mainau et al., 2016, 2012; Sabaté et al., 2012; Tenbergen et al., 2014; Viitasaari et al., 2014, 2013).

A previous study, involving 15 commercial farms, investigated the production benefits of providing the NSAID ketoprofen post-farrowing to all sows, and demonstrated a reduction in piglet mortality and a greater number of piglets weaned (Homedes et al., 2014). Another study found no piglet performance benefits of administering ketoprofen, but did identify other sow health and welfare benefits including a reduced loss in back-fat, body condition and constipation, less severe shoulder sores, and a delay in feed refusal (Viitasaari et al., 2013). Two studies in which meloxicam was administered after farrowing found no mortality differences but did show an increased average daily weight gain of low birth weight piglets (Mainau et al., 2012) and a tendency for increased piglet weight gain of litters of 11–13 piglets (Tenbergen et al., 2014). Another study using oral meloxicam, demonstrated improvements in piglet weaning weight, average daily gain, and plasma IgG concentrations measured on day 1 and 2 post-farrowing (Mainau et al., 2016). The administration of NSAIDs in addition to antibiotics has also been shown to aid in treatment of infectious causes of PPDS (e.g. Hirsch et al., 2003; Tummaruk and Sang-Gassanee, 2013) and on a farm with a high incidence of PPDS, piglet mortality was reduced and the number of piglets weaned increased in sows given ketoprofen and antibiotics (Sabaté et al., 2012).

Ketoprofen is an NSAID with anti-inflammatory, analgesic, and antipyretic properties, which was shown to reach maximum levels approximately one hour after intramuscular (IM) injection in pigs (Raekallio et al., 2008), and reduced nociceptive thresholds in piglets with kaolin-induced inflammation up to 24 h after IM injection (Fosse et al., 2011). This study investigated the use of ketoprofen after farrowing for primiparous (hereafter referred to as gilts) and multiparous (referred to as sows) breeding pigs. The aim was to evaluate the benefits of post-farrowing ketoprofen in terms of: i) gilt/sow feed intake; ii) immune transfer using IgG from colostrum and piglet serum; iii) piglet performance including growth and mortality; and iv) nursing behaviour. Based on previous studies, our hypothesis was that prompt post-farrowing treatment with ketoprofen improves sow recovery, including feed intake, and piglet performance through immune transfer and nursing behaviour.

2. Materials and methods

This experiment was carried out under UK Home Office Licence, in compliance with EU Directive 2010/63/EU and following approval from the SRUC Animal Welfare and Ethical Review Body (AWERB).

2.1. Animal housing and husbandry

Thirty-two Large White × Landrace multiparous (mean parity 4.63 ± 0.43) and 24 primiparous sows were used in this study. The study was carried out at the SRUC pig research farm (Midlothian, UK), with gilts and sows farrowing in nine batches between February and October 2014. No more than five days before the expected farrowing date, gilts and sows were moved into individual farrowing crates (1.8 × 0.5 m), with solid concrete flooring (1.8 × 1.5 m), a small slatted area at the back (0.5 × 0.5 m) and a water and feed trough at the front. Piglets had access to a heated creep area (1.5 × 0.65 m) in front of the water and feed trough. Gilts and sows were fed a standard pelleted lactation diet twice daily at 0745 and 1530 and had continuous access to fresh water. Gilt and sow crates were cleaned daily at the morning feed, and they were provided with fresh, long-stemmed straw. Additional straw was added and manure removed at the afternoon feed in the days preceding farrowing. Lights were switched on immediately before the morning feed, turned off at 1630 and an additional night-light was provided in the centre of each room of crates.

During the experiment and only after the six hour post-injection data collection, cross-fostering was conducted where necessary to even up litter sizes to maximise piglet survival as per normal farm practice. Cross fostering was conducted regardless of experimental treatments. When litter sizes were uneven, the largest piglet(s) were removed and placed on a gilt or sow with a smaller litter. Beyond the time of cross-fostering, data for individual foster piglets was then recorded against the foster sow. Piglets received an intramuscular injection of iron on day 3 post-farrowing, and on the fourth week after farrowing (mean age 26.39 ± 0.20), weaning took place. At weaning, piglets were ear tagged and vaccinated (CircoFLEX) as per farm practice.

2.2. Blinding and treatments

This study was a randomised, blinded, placebo controlled trial, with gilts and sows allocated to receive a single intra-muscular (IM) injection of ketoprofen (Ketofen; Merial Animal Health Limited, Harlow, Essex, UK) or the equivalent volume of saline, 90 min following the birth of the last piglet. Gilts and sows in each batch were randomly allocated to receive either ketoprofen (*treated*; 3 mg per kg bodyweight or 1 ml per 33 kg pre-farrowing bodyweight rounded down to the nearest 0.5 ml) or the equivalent volume of saline as a placebo control (*control*). The 56 individuals were balanced as much as possible across batches and for parity over the two treatment groups, however, an error in the treatment allocation, resulted in unbalanced groups for gilts (gilts: treated, n = 11, control, n = 13; sows: parity 2–4; treated, n = 9, control, n = 8; parity 5–7; treated, n = 5, control, n = 6; parity 8+; treated, n = 2, control, n = 2). One experimenter allocated individuals to the two treatment groups and a second added the ketoprofen or saline to individual brown medicine bottles, sealed with rubber stoppers (Adelphi Healthcare Packaging, Haywards Heath, West Sussex, UK), which were labelled only with the individual gilt or sow ear tag for identification. Ketofen contains the active ingredient ketoprofen at 100 mg/ml contained in a solution of l arginine, benzyl alcohol (10 mg/ml), citric acid monohydrate and water. It is a clear colourless solution, with low viscosity, making it indistinguishable from the saline placebo to the third experimenter administering the injection, who was unaware of the treatment.

Individuals were closely monitored for signs of farrowing, by observation at twice daily feeding and through remote monitoring using a CCTV digital surveillance system around the clock. Once the piglet expulsion phase began, the time of each piglet birth was recorded; and 90 min after the last piglet birth and the gilt or sow appeared to have finished farrowing, ketoprofen or saline was administered by intramuscular injection. Ketoprofen or saline were injected into the neck muscle, just behind the ear using an 18 gauge, 1.5 in. needle attached to a PVC extension tube and using a 10 or 20 ml syringe (Henry Schein Animal Health, Dumfries, Dumfries and Galloway, UK). Following treatment administration, individuals were left undisturbed.

2.3. Piglet measurements

Six hours after the treatment administration, the litters were processed and three piglets per litter were blood sampled. All piglets were collected and shut into the heated creep area during processing. Each piglet was weighed, crown-rump length measured (from the tail base to the top of the crown, in between the ears) and were labelled numerically on the back with a permanent marker. Three piglets per litter were selected to be blood sampled for immunoglobulin-G (IgG), based on weight: one less than 1.3 kg, one between 1.31 and 1.63 kg and one greater than 1.64 kg, balanced across litters for sex. If piglets at all weight ranges were not available, alternatives were selected as close as possible, and very weak piglets were avoided.

Selected piglets then had a topical local anaesthetic cream (EMLA) applied to their right ear. Each piglet was then held, while cotton wool