

Advances in the Use of Meloxicam as an Effective Means of Analgesia in Pig Production

Transmammary Meloxicam supplementation may be a practical means of pain relief to suckling piglets prior to painful procedures.

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Introduction

Intensively housed sows and piglets are subjected to painful procedures with minimal, if any, analgesia provided. These procedures fail to meet three of the Five Freedoms of animal welfare, more specifically freedom from discomfort, freedom from pain, injury and disease, and freedom from fear and distress (FAWC, 2009). Changes in legislation within the EU have mandated the use of analgesia and anaesthesia for castration in pigs >7 days of age, or castration by a licenced veterinarian if <7 days old (Dragset, 2011). Changes such as this emphasise the need for an effective and economical means of delivering pain relief to intensively housed pigs and those routinely undergoing painful procedures. This paper will discuss recent findings in the use of Meloxicam as a source of pain relief in pig production systems.

Discussion

Meloxicam is a long-lasting non-steroidal anti-inflammatory drug (NSAID) licensed for provision to food-producing animals in several countries. As such, it has been investigated for its welfare potential. A recent study (Tenbergen *et al.*, 2014b) assessed the impact of pain during farrowing on sow and piglet welfare. Pain may cause the sow to become restless, leading to an increased risk of crushing, reduced access to milk/colostrum for piglets and a subsequent reduction in piglet immunity. The study involved 3006 piglets and investigated the effects of Meloxicam, delivered to sows shortly after parturition, on nursing behaviour, and survival and growth of piglets. Sows that finished farrowing at about the same time were alternately assigned to either control or treatment groups (0.4mg/kg BW Meloxicam IM) within 12 hours of farrowing. Of these sows, 24 pairs (each 1 x control and 1 x treatment) were selected and measured for posture, time standing and rectal temperature. The results of this study demonstrated that sows receiving Meloxicam had piglets that gained more ($p=0.07$) weight after farrowing. While other findings were not significant, further research on the impact of Meloxicam in assisted/difficult farrowings is warranted to assess its potential benefits to the sow under these circumstances.

Previous studies have identified the painful nature of routine procedures such as castration in piglets (Moya *et al.*, 2008; Hay *et al.*, 2003), yet analgesia is rarely provided. One such study demonstrated that Meloxicam administered prior to surgical castration was efficacious in lowering plasma cortisol and ACTH concentrations post-castration (Keita *et al.*, 2010). Furthermore, a reduction in pain-related behaviours was observed post-castration when using Meloxicam (Hansson *et al.*, 2011). However, both studies failed to analyse the impact of NSAIDs on other routine procedures, such as teeth clipping and tail-docking.

A recent study investigated the effect of Meloxicam administration to piglets when provided prior to castration and tail-docking (Tenbergen *et al.*, 2014a). The effect on growth, mortality and pain mitigation was assessed. Piglets ($n=2888$) were randomly assigned to either a treatment group (0.4mg/kg BW Meloxicam) or control (placebo injection). Injections were carried out 30 minutes prior to surgical castration and tail-docking. The results of the study concluded that Meloxicam made no significant improvement to pig performance. However, pigs treated with Meloxicam showed significantly reduced isolation behaviours (isolating themselves from other piglets) and lower cortisol concentrations 90 minutes post processing when compared with the placebo groups. The reduced isolation provides increased opportunity for suckling with overall health and performance benefits for the piglets. Cortisol is one of the primary markers for stress associated with the procedure and thus its reduction can indicate a pain-mitigating effect.

As previously demonstrated through weight, behaviour and biochemical analyses, Meloxicam provides suitable pain mitigation and the benefits of improved health and welfare when provided to piglets undergoing painful procedures in early life. However, administration of Meloxicam to individual piglets would incur a significant increase in labour and time, reducing its appeal to producers. A recent study (Bates *et al.*, 2014) investigated the potential for transmammary administration of Meloxicam to piglets, the benefit of which is a significant reduction in piglet handling over directly administering Meloxicam. Furthermore, administration to the sow can be performed via oral preparations, reducing the number of injections for both sow and piglet.

In this study, 10 sows were randomly assigned after farrowing to a treatment group (30mg/kg BW Meloxicam) or control group (Meloxicam excipient) with treatment/control being administered over two consecutive feedings. Blood samples were taken from both sows and piglets to assess the pharmacodynamics of Meloxicam, pain markers (cortisol and Substance P) and infrared skin thermography used to identify thermographic changes among piglets. Most significant of the findings was evidence of Meloxicam within the plasma of the piglets at multiple time points following the commencement of treatment in the sows. The results showed that concentrations of Meloxicam were maintained in both sows and piglets for 72 hours following the cessation of treatment before a gradual decline in plasma concentration was seen. A significant ($p < 0.05$) reduction in the concentrations of PGE_2 at each time point indicates that Meloxicam in the lactating sow was an effective means of pain mitigation during castration and tail-docking in the piglets. Differences were seen in plasma cortisol concentrations, with Meloxicam treatment showing lower concentrations for the first 10 hours following processing. Furthermore, infrared thermography showed a significant ($p < 0.0001$) reduction in cranial temperature post-castration following Meloxicam administration, again suggesting reduced pain and stress. The primary limitation of transmammary drug administration is dosage, as this will vary depending on milk consumption by the individual piglet.

Conclusion

Routine procedures such as surgical castration and tail-docking are associated with pain and stress, as reflected by biochemical and behavioural responses. The provision of NSAIDs, such as Meloxicam, to both piglet and sow improves welfare. Transmammary Meloxicam supplementation now provides a practical means of pain relief to suckling piglets prior to painful procedures.

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