Developments in the Use of Meloxicam as Pre-operative Pain Relief during Surgical Castration of Piglets

Discusses the issue of surgical castration without pain mitigation and explores possible methods of pain relief to improve piglet welfare.

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Introduction

Castration is one of many routine invasive procedures carried out on commercially farmed piglets. The primary purpose of castration is to prevent boar taint, an unpleasant flavour found in the meat of entire males. Castration also reduces unwanted aggressive and sexual behaviours (Prunier *et al.*, 2006). Surgical castration is still legally performed without anaesthesia or analgesics, despite growing evidence that it "clearly induces behavioural and physiological responses indicative of pain" (Borell *et al.*, 2009). Broadly speaking, our options are either to reduce the pain of castration, or avoid it altogether (Aluwé *et al.*, 2014). The difficulty lies in finding a method that is both welfare-friendly and economically feasible at a farm level (Tenbergen *et al.*, 2014). This paper focuses on developments in using meloxicam as pre-operative pain relief.

Discussion

Meloxicam is a non-steroidal anti-inflammatory drug (NSAID) used to treat pain. Prior studies have already suggested its efficacy and it is already approved for use in swine in Canada and the European Union (Bates *et al.*, 2014). However, these studies were small and lacked emphasis on commercial practicality. To address this issue, Tenbergen *et al.* (2014) and Aluwé *et al.* (2014) conducted two large field trials to examine the effect of intramuscularly administered meloxicam on piglet growth and mortality. Aluwé *et al.* (2014) examined performance, based on weight gain and carcass traits. The treatment group (n=2406) was injected with meloxicam 15 minutes prior to castration while the control group (n=2182) was castrated without pain mitigation. Tenbergen *et al.* (2014) additionally examined pain responses. The treatment group (n=777) was injected with meloxicam and the control group (n=787) was injected with a placebo (both at 0.4mg/kgBW) 30 minutes prior to castration. Weaning weight and mortality data were collected for all piglets. A smaller subset (n=126) was assessed for pain biomarkers.

The results of both studies showed no correlation between treatment and growth rate. Average daily gain, growth-feed ratio, carcass weight and lean meat percentage did not differ significantly between the meloxicam group and the control group. Nor did treatment correlate with mortality rate during weaning, growing or finishing (Aluwé *et al.*, 2014; Tenbergen *et al.*, 2014). Treatment actually reduced mortality in piglets nursing from older sows (Tenbergen *et al.*, 2014). Hence, pre-operative analgesia was shown to have no adverse effects on production traits.

Tenbergen *et al.* (2014) also investigated plasma cortisol concentrations and isolation behaviour as pain biomarkers. Isolation behaviour is unusual for social animals like pigs and therefore a possible symptom of pain (Borell *et al.*, 2009). Piglets in the meloxicam group displayed less isolation behaviour (13% of the meloxicam group isolated themselves, compared to 30% of the placebo group). The meloxicam group also had significantly lower plasma cortisol concentrations than the placebo group (by 49.4nmol/L) 90 minutes post-castration (Tenbergen *et al.*, 2014).

Intramuscular injection is not the only method of administering meloxicam. Administered orally to lactating sows it can potentially be transferred to the entire litter via milk, eliminating the need for individual injections. Bates *et al.* (2014) aimed to demonstrate the transfer of NSAIDs through milk in swine, and assess the efficacy of the subsequent analgesic effect.

The study conducted by Bates *et al.* (2014) involved 10 sows. Treatment began on Day 4 after farrowing and continued for six days. The treatment group (n=5) received meloxicam, the control group (n=5) received a whey protein placebo (both given at 30mg/kgBW divided between two feedings per day). The male piglets were surgically castrated on Day 5 after farrowing. Blood samples, followed by infrared thermography, were taken at several time points until Day 8 after farrowing.

The results demonstrated successful transmammary transfer of meloxicam. At every time point post-treatment, meloxicam was identified in the plasma of all meloxicam piglets. No meloxicam was detected in control piglets. Furthermore, meloxicam piglets also exhibited decreased plasma prostaglandin E_2 (PGE_2) – prostaglandins contribute to pain and meloxicam inhibits it (Bates *et al.*, 2014).

The results also demonstrated a successful analgesic effect. Like Tenbergen *et al.* (2014), Bates *et al.* (2014) used plasma cortisol concentrations as a pain biomarker. Meloxicam piglets displayed lower plasma cortisol concentrations than control piglets until 10 hours post-castration. Bates *et al.* (2014) additionally examined cranial skin temperature. Animals in pain often exhibit lower cutaneous temperature as blood is shunted away from the skin towards the organs. Control piglets had lower cranial temperatures compared to meloxicam piglets (Bates *et al.*, 2014).

Plasma cortisol concentrations, as used by Tenbergen *et al.* (2014) and Bates *et al.* (2014), has its limitations as a pain biomarker because it can be influenced by unrelated variables. Nevertheless, it remains the easiest way to identify piglet pain (Tenbergen *et al.*, 2014). Research also suggests that increased plasma cortisol concentrations post-castration can be solely attributed to the castration procedure (Prunier *et al.*, 2006). The study by Bates *et al.* (2014) is the first peer-reviewed study on transmammary transfer of meloxicam. That said, the sample size was small and the dosage rates were experimental, limiting the results' practical usefulness for the time being. It would be interesting to see this study conducted on a larger scale in the future.

Conclusion

The use of meloxicam as pre-operative pain relief is a suitable alternative to surgical castration without pain mitigation. Meloxicam had no adverse effects on important production traits (such as growth rates, carcass yield and carcass quality) in two separate large-scale studies involving thousands of pigs (Tenbergen *et al.*, 2014; Aluwé *et al.*, 2014). Meloxicam also reduced plasma cortisol concentrations, isolation behaviour and cranial skin temperature, findings that are consistent with effective pain relief (Tenbergen *et al.*, 2014; Bates *et al.*, 2014). Additionally, meloxicam can be successfully transferred from sow to piglets through milk, which offers a less invasive and less time-consuming method of administration (Bates *et al.*, 2014). While it cannot yet be applied practically at a farm level, it sets down the foundation for further developments in the area. Together, the results of these studies offer a promising outlook on the future of pain relief in commercially farmed piglets.

References

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