Biological pain indicators for the characterization of piglet pain during and after processing

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Key conclusions:

- Meloxicam was transferred successfully through sow's milk to piglets at levels found to be effective when extrapolated from other species.
- Over time, a difference was noted in both cortisol concentration and cranial skin temperature between groups treated with meloxicam and those treated with whey protein.

Introduction:

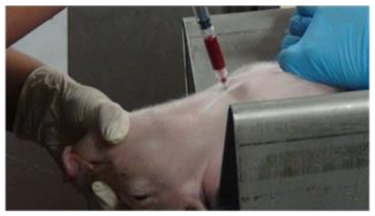
Pain alleviation is of great relevance to swine producers and consumers; however, the ability to objectively assess pain lacks validated methods. Behavioral parameters may vary widely within species and assessors, and some biological parameters used in research may not be suited for clinical assessment of pain. Physiological indicators are needed to characterize and consequently evaluate pain mitigation strategies.

Objective:

The objective of this study was to investigate and describe pain biomarkers in piglets undergoing processing. These biomarkers include cortisol, substance P, and infrared thermography (IRT).

Application:

Accurate quantification of pain can be useful in management and determining the efficacy of treatments. Plasma cortisol and IRT show promise as physiological means of measuring pain. However, it is clear **more studies are needed** for further investigation of reliable pain biomarkers and their correlation to production parameters, such as pre-wean mortality, weaning weight, and overall piglet health.



Blood samples and thermographic images were collected from these six piglets over a 72 hour period. Eight days post-farrowing, animals were examined for signs of NSAID toxicity.

Study Design:

Ten sows were selected, based on farrowing date, to receive meloxicam (n=5, 30 mg/kg) or equivalent volume of whey protein placebo (n=5) PO starting four days post-farrowing and continuing for three consecutive days. Blood and milk samples were taken from the sows and three piglets at 12 hour intervals starting four days post farrowing. Six different piglets from each litter were castrated (if male) or sham castrated (if female), tail docked and given an iron injection at five days post-farrowing. Blood samples were collected from these six piglets at predetermined times over an 84 hour period. Following blood sampling, each piglet was immediately placed in a non-restrictive plastic tub to obtain an infrared thermographic (IRT) image.

Data Analysis: Both cortisol and substance P were analyzed using radioimmunoassay. IRT images were analyzed for changes in temperature using research grade software (Thermacam Researcher Pro 2.8 SR-1, FLIR Systems). Data was analyzed using generalized linear mixed models fitted with the GLIMMIX procedure of SAS (SAS Institute Inc., Version 9.2).

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Results:

Mean (± SEM) plasma meloxicam at castration was 568.9 ±105.8 ng/mL was detected in piglets nursing on treated sows confirming that translactational drug transfer had occurred at levels extrapolated from other species to be effective. Translactational transfer of NSAIDs has been verified previously in humans. Plasma cortisol had a time by treatment interaction (*p=0.0009*)(Figure 1). There were no significant differences between groups for substance P concentrations (*p>0.6733*). There was a time x treatment effect for meloxicam and whey treated piglets for both cortisol (*p=0.0009*) and cranial infrared thermography temperature (*p=0.0148*). Differences between cranial skin IRT temperatures demonstrated a time by treatment interaction (*p=0.0148*).

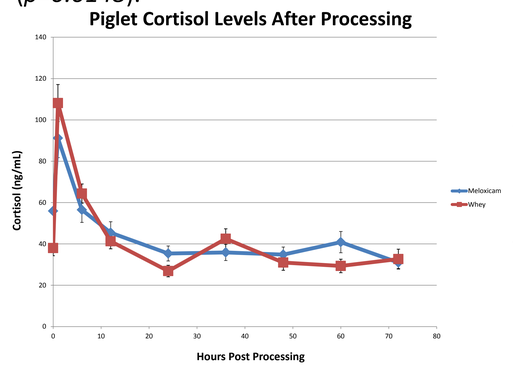
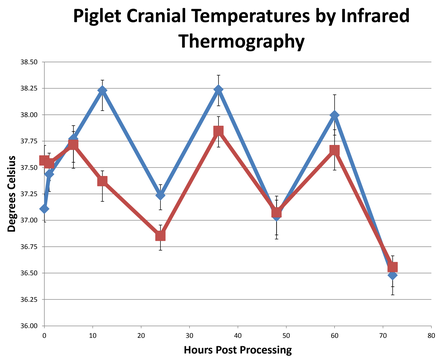


Figure 1 (left): Graph depicting the difference (*p=0.0009*) between change in cortisol between treatment and control groups over time. Both meloxicam and placebo piglets had peak cortisol levels at 60 minutes post castration. This finding is in agreement with previous studies that find castration has the greatest effects on cortisol for 30-90 minutes after castration.

Figure 2 (right): Graph illustrating the difference between piglet cranial skin temperatures, as measured by infrared thermography. **Figure 3 (below):** IRT images of a placebo (a) and meloxicam (b) treated piglet.



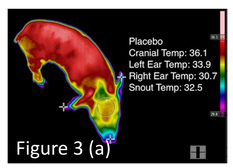


Figure 3 (a)

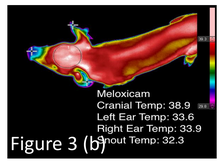


Figure 3 (b)

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