Measuring the efficacy of flunixin meglumine and meloxicam for lame sows using nociceptive threshold tests

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Abstract

Lameness in breeding swine can cause severe pain leading to on-farm welfare issues and significant economic impacts. Non-steroidal anti-inflammatory drugs including meloxicam and flunixin meglumine are commonly used in veterinary medicine for their analgesic and anti-inflammatory properties. Pressure algometry and thermal sensitivity tests are non-invasive methods to quantify pain sensitivity using nociceptive thresholds to provoke withdrawal responses on lame and sound legs. The objective of this work was to determine the effects of these drugs on nociceptive thresholds in sows induced lame using pressure algometry and thermal sensitivity tests. Lameness was induced in 24 mature, mixed-parity sows using a chemical synovitis model and three treatments were compared: meloxicam (1.0 mg kg⁻¹ PO), flunixin meglumine (2.2 mg kg⁻¹ IM) and sterile saline (IM). Pressure algometry was measured on sound and lame rear legs with three replicates at three landmarks. Thermal sensitivity tests were done on sound and lame rear legs with three replicates using a thermal stimulus at one landmark. From 37 to 72 h after lameness induction, meloxicam- and flunixin meglumine-treated sows tolerated higher pressure algometer nociceptive thresholds compared to saline-treated sows. Changes in thermal nociceptive thresholds were evident at the T_max time-points for meloxicam administration and 72 and 168 h post lameness induction for flunixin meglumine-treated sows. In conclusion, flunixin meglumine and meloxicam administration mitigated pain sensitivity in lame sows post lameness induction when pain sensitivity was evaluated with pressure algometry. These analgesic drugs may be a key tool to manage pain associated with lameness.

Keywords: animal welfare, flunixin meglumine, lameness, meloxicam, nociceptive threshold, swine

Introduction

Pain has been defined by the International Association for the Study of Pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (IASP 2004). Lameness associated with painful joint lesions has been identified as a welfare challenge for confined sows (Elmore et al 2010) with lameness ranked as the third most common reason for culling sows, comprising 15% of culled sows marketed in the United States (Schenk et al 2010). Culling sows prior to completion of the third parity has been identified as an economic loss as pig producers are neither able to pay off individual sow costs nor capitalise on the benefits of higher sow retention rates (Stalder et al 2000, 2003).

Diagnosis of pain associated with lameness is a difficult process due to unique individual experiences with pain (Gaynor & Muir 2009) and differences noted in pain tolerance and reaction between species, breeds, sex, age, pain duration and stimulus severity (Matthew 2000). Danish animal welfare scientists and veterinarians reported that fractures, osteochondrosis dissecans (OCD), and infectious arthritis were ranked highest for pain severity for lameness in swine (Jensen et al 2012).

Nociceptive threshold testing, such as pressure algometry and thermal sensitivity tests, can be used for clinical evaluation of painful conditions and analgesic efficacy. Nociception is the process by which the detection, transduction, and transmission of a noxious stimulus to higher centres of the central nervous system occurs (Livingston 2006). Mechanical and thermal nociceptive thresholds (MNT and TNT) can be defined as the amount of pressure or heat stimulation necessary to produce a behavioural response indicative of pain sensitivity (Haussler et al 2007). Mechanical and thermal nociceptive threshold tests have been used as objective pain assessment tools in a variety of livestock animals including broilers (Hothersall et al 2011), dairy cattle (Veissier et al 2000; Herskin et al 2003, 2009; Dyer et al 2007; Heinrich et al 2010; Fitzpatrick et al 2013;