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Effects of meloxicam on milk production, behavior, and feed intake in dairy cows following assisted calving

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ABSTRACT

Parturition is a necessary event for production in dairy cattle, and assistance at calving is common. There is limited use of nonsteroidal antiinflammatory drugs for the alleviation of calving pain and a paucity of research on the effects of these drugs on postpartum health and performance. This randomized triple blind clinical trial involved Holstein cows (n = 42) and heifers (n = 61) that experienced an assisted parturition. These animals received either 1 injection of meloxicam (0.5 mg/kg of body weight) or placebo subcutaneously 24 h following calving. Outcome measures included dry matter intake (DMI) and milk production for the first 14 d in milk, blood metabolites sampled over 12 d, health events for the first 60 d in milk, as well as lying and feeding behavior 24 h following injection. Continuous data were analyzed using multivariable regression models. Binary outcomes were analyzed using a mixed logistic model with cow modeled using a random intercept. This study failed to show any significant effects of treatment on DMI, milk production, blood metabolites, or health events. A possible explanation for the lack of treatment differences could be that the meloxicam was administered too late after calving. Meloxicam increased feeding time as well as bunk visit frequency in the 24 h following injection. Regardless of treatment, animals that had retained fetal membranes produced less milk and had higher serum haptoglobin concentrations. Future research is warranted to examine the effects of antiinflammatory drugs administered closer to the time of calving on health and production.

Key words: nonsteroidal antiinflammatory drug, dystocia, pain, welfare

INTRODUCTION

Parturition is necessary for dairy production and assisted calving is common. Calving is a painful event that leads to inflammation (Bionaz et al., 2007). Dystocia rates are higher in North America (>10%) compared with other parts of the world (<5%), and, regardless of country, are much higher in primiparous animals (Mee, 2008). Severe dystocia (i.e., cases requiring either heavy tractive force with a calf puller, extensive corrections of malpositions, or caesarean section) was associated with reduced viability of the calf and reduced fertility and survival of the dam (Tenhagen et al., 2007). Dystocia negatively affected early lactation performance in Holstein cows, with peak yield lowered by 0.39, 2.2, 2.2, and 2.5 kg for cows in parities 1 to 4, respectively (Atashi et al., 2012). Dystocia is a risk factor for metritis and for purulent vaginal discharge (Dubuc et al., 2010).

In a questionnaire to cattle veterinarians in the United Kingdom, the median estimate of pain of dystocia was 7 out of 10 (Huxley and Whay, 2006). Sixty-six percent of respondents indicated using a nonsteroidal antiinflammatory drug (**NSAID**) in some cases of dystocia (Huxley and Whay, 2006). In a survey on analgesic use among Canadian veterinarians in 2004–2005, the mean estimate of pain level was 5.3 out of 10 (Hewson et al., 2007). Thirty-four percent of veterinarians provided analgesia to some or all cases of dystocia (Hewson et al., 2007). Despite the apparent recognition that dystocia is painful, little is known about the effects of pain resulting from difficulty or assistance at calving on production or health, or about the effects of NSAID to treat dystocia (Laven et al., 2012) and thus more work is warranted. In addition, there is a paucity of data on approaches to control this pain with medication. Insofar as we know, this is the first study to evaluate the short-term benefits of NSAID treatment following dystocia, despite the relatively common use of NSAID by veterinarians (Laven et al., 2012).

Consumption of amniotic fluid by the cow was shown to provide some analgesic effect from endogenous opioids (Pinheiro Machado et al., 1997). Current recom-

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mended management practices, such as removing the calf immediately after birth (National Farm Animal Care Council, 2009), and the relatively high incidence of dystocia likely result in many cows not being able to benefit from the ingestion of amniotic fluid. Therefore, some analgesic assistance in the form of an antiinflammatory drug may prove to be beneficial to these animals. The objective of this study was to evaluate the effect of meloxicam on behavior, health, and production in cows with assisted calving. The hypothesis was that the administration of meloxicam following assisted calving would improve feed intake and milk production and reduce inflammation and pain in dairy cows.

MATERIALS AND METHODS

General Information

This randomized controlled trial involved Holstein cows (n = 42) and heifers (n = 61) that experienced assisted parturition at the Elora and Ponsonby Dairy Research Centers, University of Guelph (Guelph, ON, Canada), with enrollment into the study taking place between January 2009 and January 2011. Calving difficulty was scored as follows: 1, an easy pull by one person with no mechanical assistance, or 2, a difficult pull with more than one person, with mechanical assistance, or a combination of both. Cows that had a fetotomy or caesarean section were excluded. Whether the animal had retained fetal membranes at 24 h postcalving was recorded systematically. Animals with assisted calving were blocked into primiparous and multiparous groups, and into calving difficulty, and randomly assigned within blocks to receive meloxicam [n = 51; 0.50 mg/kg of BW, Metacam 20 mg/mL solution for injection; Boehringer Ingelheim (Canada) Ltd., Burlington, ON, Canada] subcutaneously once 25.4 h (±2.9 SD) following calving or to be negative controls (n = 52; injection of a similar volume of placebo (the medication vehicle solution with no active ingredient once 25.0 h ± 2.8 SD). Personnel administering the treatments, recording data, and performing statistical analyses were blinded to treatment assignments.

Cows were housed in tie-stalls through the previous lactation and late gestation, and heifers were loose housed until 9 wk before expected calving when they were moved to a tie-stall. All animals were moved to individual calving pens (7.0 × 3.1 m; straw pack bedding in one half and wood shavings over mattress filled with rubber crumbs in the other half) 2 d (±1.8 SD) before expected calving based on their due date and appearance of early calving signs (e.g., filling of the udder). Cows remained in the maternity pen for 2 d (±0.69 SD) after parturition before moving to the tie-stall for lactation. All animals in both barns were fed the same TMR twice daily (0730 and 1300 h) for ad libitum intake. The diet in the calving pens was composed of 1 kg of hay, 1.6 kg of haylage, 6.6 kg of corn silage, 0.80 kg of high-moisture corn, and 2 kg of commercial protein and mineral supplement for dry cows (DM basis: CP: 14% DM, ADF: 23–25% DM, NDF: 35–40% DM, fat: 3.6–3.8% DM, and net energy: 1.45 Mcal/kg). The lactation diet was composed of 1.5 kg of hay, 6.2 kg of haylage, 6.2 kg of corn silage, 4.8 kg of high-moisture corn, and 5 kg of supplement containing soybeans, vitamin, protein, and mineral (DM basis: CP: 17% DM, ADF: 20–21% DM, NDF: 30–35% DM, fat: 3.6–3.8% DM, and NE: 1.62–1.67 Mcal/kg) and formulated to meet requirements (NRC, 2001) for a 650-kg cow producing 35 kg/d of milk at 3.8% fat. Tie-stalls had feed dividers between cows so that individual feed intakes could be measured.

DMI, Milk, and BW Data

Individual daily feed intakes were recorded from the time the cow entered the maternity pen and then in the tie-stalls until 14 DIM. Samples of the prepartum diet and the early-lactation diet were collected twice weekly and frozen at –20°C for later analysis. Intake calculations were based on the amount fed to the animal, the orts recovered, and the DMI analysis of the samples. Milk yield was recorded twice daily until 14 DIM. All cows were weighed at enrollment in the study (2 d before expected calving at movement into the calving pen) and at 60 DIM.

Blood Collection and Analysis

Blood samples were obtained by coccygeal venipuncture immediately after calving and 1, 3, 6, 9, and 12 DIM. The d 1 blood sample was taken at the time of treatment administration and all other blood samples were taken in the morning, approximately 3 h after feeding, allowed to clot for 1 h, and centrifuged at 7,000 × *g* (model CL international clinical centrifuge, International Equipment Co., Needham, MA) to collect the serum. Blood serum was frozen and submitted for analysis to the Animal Health Laboratory, University of Guelph. Serum was analyzed for BHBA, NEFA, glucose, calcium, and haptoglobin. All analyses were conducted using a Roche Cobas 6000 c501 automated chemistry analyzer (Roche Canada, Laval, QC, Canada). The NEFA and BHBA concentrations were determined using Randox NEFA and Randox BHBA kits (Randox Laboratories Canada Ltd., Mississauga, ON, Canada); the analytical sensitivity was 0.10 mmol/L for both assays. The inter- and intraassay coefficients of variation