



Stimulation of PTHrP release and calcium mobilization to avoid periparturient hypocalcemia in dairy cows

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Key words

Serotonin, hypocalcemia, calcium mobilization, 5-hydroxy-l-tryptophan, dairy cow, early lactation

Aim of the study

To infuse 5-hydroxy-l-tryptophan (5-HTP), a 5-HT precursor, before parturition in order to increase 5-HT concentrations in blood and, in turn, increase calcium concentrations in blood around parturition, reducing the incidence of HC in cows.

Material and methods

In this study, 20 Holstein dairy cows were randomly assigned to two experimental groups. Ten animals received a daily i.v. infusion of one liter of 0.9% NaCl (control; C). The other 10 animals received one liter of 0.9% NaCl containing 1 mg of 5-HTP/kg BW daily (5-HTP group). Infusions were performed beginning on day 10 before estimated parturition. Infusions were conducted until the day of parturition, resulting in at least 4 days of infusion. Until parturition, blood samples were collected every morning before the infusions, and after parturition daily until day 7, and on day 30. Milk yield was recorded during this period.

Results and significance

No differences between groups were observed for blood glucose, magnesium, beta-hydroxybutyrate, insulin, glucagon, adiponectin, leptin, haptoglobin and non-esterified fatty acid concentrations. Serum 5-HT concentration was increased until day 5 after parturition in the 5-HTP group compared to the C group. Colostrum 5-HT concentrations were higher in the 5-HTP group than in the controls (37.10 ± 3.12 vs. 25.02 ± 2.75 nM; $P < 0.05$), but differences were undetectable in milk 7 days after parturition (13.43 ± 1.12 vs. 14.63 ± 1.13 nM; $P > 0.05$). Serum total calcium concentrations decreased in both groups around parturition ($P < 0.05$), however, 5-HTP group had higher blood calcium concentrations than controls on day 1 (1.93 ± 0.06 vs. 1.62 ± 0.09 mM) and day 2 (2.07 ± 0.04 vs. 1.83 ± 0.07 mM), respectively ($P < 0.05$). The concentration of pyridinoline (PYD), an established marker for calcium release from the bone to the bloodstream, increased on day 1 postpartum only in the 5-HTP group. In control cows, PYD concentrations did not change on day 1 postpartum. Additionally, colostrum yield (first milking) was lower in the 5-HTP group compared to the C group (5.63 ± 0.34 vs. 8.56 ± 0.47 kg; $P < 0.05$), but no differences in colostrum IgG concentration were detected (68.41 ± 5.20 vs. 60.70 ± 10.27 mg/mL; $P > 0.05$). Milk yield did not differ between groups during the rest of the experiment. In conclusion, 5-HTP infusions increased blood 5-HT concentration. Moreover, 5-HTP can reduce the decline in blood calcium concentration around parturition, and hence the occurrence of clinical or subclinical hypocalcemia. Finally, 5-HTP appears to cause a reduced colostrum production, without affecting IgG concentrations, indicating the colostrum produced is sufficient to fulfill the needs of the offspring.

Publications, posters and presentations

Hernández-Castellano, L. E.; Hernandez, L. L.; Weaver, S. R.; Bruckmaier, R. M. 2017. Increased serum serotonin improves parturient calcium homeostasis in dairy cows. Journal of Dairy Science IN PRESS

Hernández-Castellano, L. E.; Hernandez, L. L.; Sauerwein, H.; Bruckmaier, R. M. Endocrine and metabolic changes in transition dairy cows are affected by pre-partum infusions of a serotonin precursor.

Hernández-Castellano, L. E., Weaver, S. R.; Hernandez, L. L.; Bruckmaier, R. M. Increasing blood 5-hydroxy-L-Tryptophan concentration for prevention of periparturient hypocalcemia in dairy cows. 2016 ASAS-ADSA-CSAS-WSASAS Joint Annual Meeting. 19-23 July 2016, Salt Lake City (USA)

Hernández-Castellano, L. E., Weaver, S. R.; Hernandez, L. L.; Bruckmaier, R. M. Prevention of hypocalcemia in periparturient dairy cows: the key role of serotonin. 16th International Conference on Production Diseases in Farm Animals. 20-23 June 2016, Wageningen (The Netherlands)

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