

# Peripartum haptoglobinemia identifies dairy cows at risk for retained placenta and metritis

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## Introduction

Haptoglobin is an acute phase protein produced primarily in the liver in response to proinflammatory cytokines. Increased haptoglobinemia has been associated with several diseases in dairy cattle including mastitis, peritonitis, metritis, endometritis, and pneumonia. Retained placenta and metritis are postpartum uterine conditions that affect up to 15% and 20% of cows, respectively. Although conflicting data are reported on the direct detrimental impact of retained placenta and metritis on subsequent reproduction, these conditions have been associated with increased odds of endometritis and delayed ovulation later in the postpartum period, which may impair reproductive performance. Prediction of risk or early diagnosis of retained placenta or metritis could be used to reduce their impacts. The objective of this study was to determine whether peripartum haptoglobinemia can be used to predict retained placenta and metritis in dairy cows.

## Materials and Methods

A retrospective case-control field study was conducted by the use of data from two trials performed in Ontario (study A) and British Columbia (study B), Canada. Data from a total of 244 Holstein dairy cows (173 cows from three herds in study A and 71 cows from one herd in study B) were combined. Samples were selected randomly from cows having retained placenta only (RP; n = 44), metritis only (MET; 70), both RP and metritis (BOTH; 48), or unaffected by either disease (CONTROL; 82). Retained placenta was defined as retention of fetal membranes 24 hours after parturition and metritis as systemic illness including fever  $>103.1^{\circ}\text{F}$  ( $> 39.5^{\circ}\text{C}$ ) with fetid vaginal discharge occurring within the first 14 days-in-milk. A blood sample from coccygeal vessels was collected weekly from all cows in participating herds. Serum haptoglobin concentration was measured weekly from two weeks prepartum (weeks, -2 and -1) until three weeks postpartum (weeks, +1, +2, and +3).

Statistical analyses were performed in SAS with herd as a random effect. Haptoglobin data were considered in statistical analyses only if sampling occurred before disease diagnosis.

## Results

Cows in the RP group had greater haptoglobinemia than did the CONTROL group at week -1 (n = 244; RP, 0.28 g/L; CONTROL, 0.11 g/L; SE, 0.06;  $P < 0.01$ ) but not at week -2 (n = 71; RP, 0.19 g/L; CONTROL, 0.25 g/L; SE, 0.10;  $P = 0.98$ ). The odds of RP were 3.1 times higher ( $P = 0.02$ ) in cows with haptoglobin  $\geq 2$  g/L at week -1 than in cows with lower haptoglobinemia (sensitivity, 29.7%; specificity, 86.5%). Cows in the MET group had greater haptoglobinemia at weeks -1 and +1 than did control cows after adjusting (week -1, n = 244; MET, 0.26 g/L; CONTROL, 0.11 g/L; SE, 0.06,  $P < 0.01$ ; week +1, n = 244; MET, 0.79 g/L; CONTROL, 0.42 g/L; SE, 0.05;  $P < 0.01$ ) or not (week -1, n = 244, MET, 0.25 g/L; CONTROL, 0.11 g/L; SE, 0.06;  $P < 0.01$ ; week +1, n = 244; MET, 0.84 g/L; CONTROL, 0.46 g/L; SE, 0.06;  $P < 0.01$ ) for RP, season, and parity. Cows with haptoglobinemia  $\geq 0.2$  g/L at week -1 (odds ratio (OR), 2.6;  $P = 0.04$ ; Se, 23.0%; Sp, 81.4%) or  $\geq 0.9$  g/L at week +1 (OR, 3.5;  $P < 0.01$ ; Se, 49.4%; Sp, 69.8%) were more likely to have metritis in the final multivariable model.

## Significance

These data demonstrate that haptoglobinemia increases days before clinical signs in cows affected by RP and metritis, and as soon as one week prepartum. Haptoglobinemia could potentially be used as an early predictor for RP and metritis. However, the sensitivity of this approach was low. Approaches to prevention of RP and metritis in these early-identified cows require further investigation.