

Association Between Haptoglobin and Cow and Herd Level Outcomes

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Haptoglobin (HP) is an inflammation marker found in blood and is present at nearly zero concentration in healthy cows but increases over 100-fold at the onset of inflammation (Eckersall, 2000). Measuring HP in fresh cows may help us to identify cows that are at a greater risk of developing disease or provide additional tools for herd-level monitoring, which may help dairy producers improve their health management programs. Previous studies have found an association between elevated postpartum HP and disease, decreased milk production, and decreased reproductive performance; however, data are limited from large epidemiological studies (Huzzey et al., 2009; Dubuc et al., 2010; Huzzey et al., 2015; Nightingale et al., 2015). Therefore, the objectives were to 1) establish cow-level thresholds for HP concentrations to predict health disorders, 2) evaluate the association between elevated HP on milk production and reproductive performance, and 3) identify HP herd-alarm levels associated with herd-level changes in disease incidence, milk production, and reproductive performance.

Plasma samples were collected from 988 cows, 0 to 12 DIM, across 72 herds, and were analyzed for HP (University of Guelph Animal Health Laboratory). Results were previously reported by Kerwin et al. (2019; 2020). Cows with HP ≥ 1.52 g/L were 6.6 times more likely to be diagnosed with metritis ($P = 0.001$), HP ≥ 0.68 g/L were 4.9 times more likely to be culled within 30 DIM ($P < 0.001$), and HP ≥ 0.55 g/L were 2.5 times more likely to be diagnosed with metritis, clinical ketosis, a displaced abomasum, or any of the three disorders ($P = 0.003$). Cows with HP ≥ 0.55 g/L produced 386 kg less 305-d mature equivalent milk at the fourth test day (ME305; $P = 0.004$) and had a 25% decreased risk of conception by 150 DIM (Hazard ratio = 0.75; $P = 0.002$) than cows with low HP. Cows with elevated HP (≥ 0.55 g/L) had a median days to conception of 114 d compared to 101 d for cows with low HP (< 0.55 g/L). Similarly, cows with HP ≥ 0.68 g/L were 0.80 times as likely to conceive at first service ($P = 0.03$). The herd-alarm level associated with disease incidence was defined as $\geq 20\%$ of cows with HP ≥ 0.55 g/L, resulting in a 5.8 percentage unit increase in disease incidence ($P = 0.01$). The herd-alarm level associated with 21-d pregnancy rate was defined as $\geq 10\%$ of cows with HP ≥ 1.52 g/L, resulting in a 2.5 percentage unit decrease in 21-d pregnancy rate ($P = 0.09$). The herd-alarm level associated with conception risk at first service was defined as $\geq 20\%$ of cows with HP ≥ 1.52 g/L, resulting in a 6.4 percentage unit decrease in conception risk at first service ($P = 0.09$). There was not a herd-alarm level associated with ME305 or 21-d conception risk.

Our results support previous research at the cow level and provides the opportunity to evaluate HP status at the herd level. Although previous work has established herd alarm levels for metabolites associated with energy balance, measuring HP at the herd level can be used as a herd health-monitoring tool and provides a unique opportunity to

address nutritional and non-nutritional challenges that may lead to increased inflammation.

References

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