Acute phase protein response during acute ruminal acidosis in cattle

The aim of the study was to describe the acute phase protein and leukocyte responses in dairy heifers during acute, oligofructose-induced ruminal acidosis. The study included 2 trials involving oral oligofructose overload (17g/kg BW) to nonpregnant Danish Holstein heifers. Trial 1 included 12 heifers all receiving oligofructose, and the experiment consisted of a 3 day control period prior to overload and 9 days surveillance afterwards. Eight heifers were fed grass hay and 4 were fed barley silage. Trial 2 included 10 heifers receiving oligofructose, 4 were euthanized 24h after overload and 6 were euthanized 72h after overload. Six heifers received tap water as control treatment and were euthanized 72 or 96h later. Sampling of blood was performed at 6–48 hour intervals. Samples were analyzed for serum amyloid A (SAA), haptoglobin, and fibrinogen, and total white blood cell counts (WBC) were performed. Heifers receiving oligofructose developed a profound ruminal and systemic acidosis (in Trial 1 and 2 lowest ruminal pH was 4.3±0.2 and 3.8±0.02, respectively, and minimum SBE was −9.3±4.1 and −8.9±2.8, respectively). In Trial 1, SAA concentrations were higher than baseline concentrations on all time points from 6 to 216 hours after overload, and heifers fed hay had higher SAA levels (max. 290±151mg/L) than heifers fed silage (max. 225±137mg/L). In Trial 2, SAA concentrations in heifers receiving oligofructose were higher than control heifers at all time points from 12 to 72h after overload (max. 325±149mg/L). In Trial 1, haptoglobin concentrations for hay-fed heifers were higher than baseline concentrations at all time points from 36 to 168h after overload (max. 3449±1702mg/L). Heifers fed silage had lower haptoglobin concentrations than heifers fed hay at 60, 72 and 120h (max. 1802±950mg/L). In Trial 2, haptoglobin concentrations in heifers receiving oligofructose were higher than control heifers at all time points from 18 to 72h after overload (max. 4226±924mg/L). In Trial 1, fibrinogen concentrations did not differ from baseline concentrations at any time points. In Trial 2, fibrinogen concentrations in heifers receiving oligofructose were higher than control heifers at all time points from 36 to 72h after overload (max. 12.2±3.3g/L). In Trial 1, WBC did not differ from baseline concentrations at any time points. In Trial 2, WBC in heifers receiving oligofructose were higher than control heifers at 18 and 24h after overload (max. 13.7±4.3 billions/L). Feeding had no effect on plasma fibrinogen concentrations or WBC in Trial 1. Acute ruminal and systemic acidosis caused by oligofructose overload resulted in distinct acute phase protein and leukocyte responses in dairy heifers. The increased levels of serum acute phase proteins and leukocytes might be a result of ruminitis caused by the ruminal acidosis, of systemic effects of pro-inflammatory molecules translocating across the damaged ruminal epithelium, or a result of the systemic acidosis and accumulation of organic acids. In humans, inflammation has been linked to metabolic diseases. In cattle, studies into the possible links between acid-base changes, inflammation/innate immunity and metabolic disease are warranted as this might improve our understanding of the production disease complexes occurring in particular in the transition period.

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