

Particle-Induced X-ray emission analysis of serum trace and major elements in cattle with acute coliform mastitis

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Abstract

The aim of the present study was to evaluate the reliability and effectiveness of the direct determination of trace and major element concentrations in serum samples collected from dairy Holstein cattle with acute coliform mastitis (n=53) and healthy controls (n=39). Twenty-eight elements (Na, Mg, Al, Si, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ce, Ni, Cu, Zn, Ga, As, Se, Br, Rb, Sr, Y, Zr, Nb, Mo, and Pb) were detected by particle-induced X-ray emission (PIXE). Significant differences were observed in serum Fe, Zn, and Br concentrations, but not in those of the remaining twenty-four elements. Furthermore, serum Fe concentrations ($0.751 \pm 0.583 \mu\text{g/ml}$, n=18) were significantly lower in dairy cattle with a poor prognosis than in those with a good prognosis ($0.945 \pm 0.393 \mu\text{g/ml}$, n=35, $p < 0.05$) and healthy controls ($1.458 \pm 0.391 \mu\text{g/ml}$, n=39, $p < 0.01$). We proposed a diagnostic cut-off point for serum Fe concentrations of $< 0.82 \mu\text{g/ml}$ based on receiver operating characteristic (ROC) curves in order to identify cattle with a poor prognosis. The results of the present study indicated that assessing the elemental composition of serum, particularly iron, is a promising prognostic tool for determining the outcomes of cattle with severe acute coliform mastitis.