

## Effect of hypomagnesemia and cold exposure on tissue responsiveness to insulin in sheep given a low magnesium and high potassium diet

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### Abstract

Hypomagnesemia in ruminants has been shown to be associated with cold stress and with altered insulin secretion and sensitivity. However, the relationship between hypomagnesemia and tissue responsiveness to insulin in ruminants exposed to cold environment is still unclear. The hyperinsulinemic euglycemic clamps, four insulin infusion rates (1, 2, 4 and 8 mU · kgBW<sup>-1</sup> · min<sup>-1</sup> for four sequential periods of 2-h each) were performed to determine combined effects of hypomagnesemia and cold exposure (0°C) on tissue responsiveness to insulin in sheep. The low magnesium (0.05% Mg) and high potassium (4.20% K) diet and cold exposure decreased ( $P < .05$ ) plasma Mg levels compared with those of the control diet (0.28% Mg/0.52% K) and the thermoneutral environment (20°C). In the euglycemic clamps, cold exposure increased ( $P < .01$ ) the pooled glucose infusion rate (GIR) across various insulin infusion rates in both diet treatments, though the increases in GIR were small for the low Mg/high K diet. In the cold environment, the GIR was lower ( $P < .01$ ) for the low Mg/high K diet-fed sheep than for the control diet-fed sheep. The maximal insulin-induced increase in GIR was lower ( $P < .01$ ) in the hypomagnesemic sheep than in the control sheep during cold exposure, and the insulin level resulting in half-maximal GIR tended to be higher in the hypomagnesemic sheep than in the control sheep. These results indicated that hypomagnesemia in ruminants depressed the enhanced tissue responsiveness to insulin in the cold environment, and decreased insulin-mediated glucose disposal. © 2001 Elsevier Science Inc. All rights reserved.

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