

Physiological Response to Magnesium Supplementation in Lactating Dairy Cows

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Magnesium (Mg) is an essential mineral for all cattle, especially lactating cows and as such is routinely administered as a feed supplement. A diet low in Mg can have serious implications on performance and ultimately lead to hypomagnesemic tetany and death in ruminants. The aim of this study was to investigate the physiological response to Mg supplementation in lactating dairy cows.

Forty lactating cows were randomly allocated to 4 balanced groups on the basis of current milk production. The animals were assigned to one of four groups: Control (T0) - No Mg supplementation; Treatment 1 (T1) - Daily Mg supplementation equivalent to *Rumevite™ Magnesium Block*; Treatment 2 (T2) - Dosed with 1 *Rumetrace™ Magnesium Capsule*; and Treatment 3 (T3) - Dosed with 2 Capsules at the commencement of the study. The cows grazed as a single herd on spring pasture from paddocks that typically induce subclinical Mg deficiency. On day 0, tail blood and urine samples were taken from all animals and on day 1, cows were dosed accordingly. Blood and urine samples were taken on days 7, 14 and 21 from all four groups. Samples were couriered to an independent laboratory for analysis (Regional Laboratory Services, Benalla, Victoria). General animal health and daily milk production was also recorded during the course of the study.

The mean serum Mg concentration in the control animals on day 0 was 0.97 ± 0.03 (SEM) mmol/l. This value was within the normal physiological range (0.70 – 1.23mmol/l) for this mineral (Radostits et al. 2000). The mean serum Mg concentration measured in the control animals did not change markedly during the course of the study (Table 1). Furthermore, mean serum Mg concentrations did not appear to differ significantly between days 0 and 21 in any of the three treatment groups. The second parameter to be measured, urine Mg concentration, ranged from 2.41 ± 0.63 to 3.35 ± 0.81 mmol/mOsmol in the control animals. The normal physiological range for Mg concentration in the urine is 2.00–10.00mmol/mOsmol, low urine Mg levels (<2.00mmol/mOsmol) are indicative of hypomagnesemia. An increase in urine Mg levels was observed in each treatment group between day 0 and day 21, as shown in Table 1.

Table 1. Serum and Urine Magnesium Concentrations in Lactating Dairy Cows Treated as Follows: Control – No Supplementation, T1 - Dosed with Rumevite™ Magnesium Block, T2 – Dosed with 1 Rumetrace™ Magnesium Capsule or, T3 – Dosed with 2 Rumetrace™ Magnesium Capsules. Values are Mean ± SEM

Treatment Group	Serum Mg (mmol/l)		Urine Mg (mmol/mOsmol)	
	Day 0	Day 21	Day 0	Day 21
Control	0.97 ± 0.03	1.01 ± 0.02	2.41 ± 0.63	3.35 ± 0.81
T1	0.98 ± 0.03	1.01 ± 0.03	1.90 ± 0.36	3.33 ± 0.83
T2	0.95 ± 0.03	0.95 ± 0.04	1.22 ± 0.47	3.07 ± 0.74
T3	1.00 ± 0.02	1.06 ± 0.03	2.88 ± 0.56	4.03 ± 0.60

Magnesium is an essential macromineral, the physiological levels of which are closely correlated with dietary intake in ruminants. In the current study, cattle were grazed on low Mg pastures and the effect of different Mg supplements investigated. Animals supplemented with Mg during the course of the study did not express elevated serum levels. As blood Mg levels are tightly controlled by homeostatic feedback mechanisms it was not unexpected that this physiological parameter remained unchanged. The major excretory pathway for excess Mg in the ruminant is through the urine. It would be expected that if a hypomagnesemic animal was supplemented with Mg, as the nutritional demands of the animal were being met, the level of Mg in the urine would rise (Subcommittee on Mineral Toxicity in Animals, 1980). An increase in urine Mg from day 0 to day 21 was observed in all groups (Table 1). Furthermore, when initial urine Mg measurements were entered as a covariate, there was evidence to suggest that a causal relationship existed between Mg supplementation and the observed increase in urine Mg levels.

Radostits O.M. et al (2000): “Veterinary Medicine”, 9th ed. (W.B. Saunders Company Ltd)

Subcommittee on Mineral Toxicity in Animals (1980): “Mineral Tolerance of Domestic Animals”, (National Academy of Sciences)

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