FINAL REPORT: MARINE MAGNESIUM TRIAL

Presented by Christian Cruywagen
Department of Animal Sciences
Stellenbosch University
South Africa

INTRODUCTION

The objective of the trial was to compare Marine Mg and a conventional commercial MgO as sources of magnesium to dairy cows when Marine Mg was fed at levels equivalent to 50% or 25% of that of MgO. The effect was to be tested on blood and milk Mg levels. Following the approval of the final protocol and experimental diets, the trial was executed on the Welgevallen Experimental Farm of the Stellenbosch University. The trial commenced with an adaptation diet from 9 – 30 September 2010, followed by the treatment diets that were fed from 1 – 11 October. The procedure and results will be discussed in the following sections.

MATERIALS AND METHODS

Animals

Thirty lactating Holstein cows, with an average milk production of 28.3 ± 1.9 (SE) kg/d and weighing 642 ± 12.4 (SE) kg were used in the trial. Cows were stratified according to body weight and then randomly allocated to one of three treatments. The cows were housed in a small free stall barn that was divided into three lots for the trial. Cows had sufficient bunker space and free access to clean, fresh water.

Treatments and diets

The cows received 22 kg/d of a semi-complete pelleted feed and oat hay *ad lib.* The basal diet that was fed during the adaptation and experimental periods, was the same for all three treatments, except for the mineral premix. During the adaptation period, all the cows received the same semi-complete feed where no magnesium was added in the premix. The intention was to lower the blood Mg levels to sub-optimal levels. During the experimental period, the premix in the semi-complete feeds differed between treatments as follows:

Treatment 1 (Control): MgO included to deliver 36 g of Mg/d
Treatment 2: Marine Mg included to deliver 18.2 g of Mg/d
Treatment 3: Marine Mg included to deliver 9.1 g of Mg/d

Samples and data

Blood was collected from the caudal vein (tail vein) on each of the last six days of the adaptation period and on each of the first five days of treatment. Plasma samples were then put on ice and taken to a veterinary diagnostic lab on the same day for Mg analysis.

Milk samples were taken on the last day of the trial and analysed for Mg.

Statistical analysis

Cows were randomly allocated to the three treatments. The pre- and post-treatment periods were regarded as main effects, together with treatment and blocks, where the pre-and post-treatment period of each cow formed a block. Outliers (18 values out of the data set of 330 values) were removed from the plasma data set, but none from the milk data set. Data were then subjected to a main effects ANOVA with main effects being treatment, period and block. Statistical analyses were done with the aid of Statistica version 10. Differences between treatment means were determined with t-tests and significance was declared at $P<0.05$.

RESULTS AND DISCUSSION

Plasma magnesium values are presented in Table 1 and Figures 1 and 2. The “Before” and “After” values were average values per treatment of all the pre- and post-treatment days.

Table 1 The effect of MgO and two levels of Marine Mg on plasma Mg concentrations of dairy cows, following a period of feeding a Mg free premix

Item	Treatment			Significance	
	MgO	Low MMg	High MMg	SEM	P
Before supplementing Mg (mmol/L)	0.98	0.97	0.97	0.010	0.392
After supplementing Mg (mmol/L)	1.05	1.01	1.05	0.021	0.400
Before-after contrasts	P=0.011	P=0.013	P=0.009		

[1]MgO = conventional MgO supplemented to cows at 36g/d; Low MMg = marine Mg supplemented at 9 g/d; High MMg = marine Mg supplemented at 18 g/d.

The plasma Mg levels did not reach deficient values during the adaptation period. The basal diets contained some Mg that resulted in plasma Mg values that were just above deficient. The values (Table 1) were similar for all treatments before the Mg supplementation period started. After feeding the different Mg premixes, plasma Mg levels increased significantly for all treatments and were not different between treatments. Although the average increase in plasma Mg level was 4.1% for the Low MMg Treatment vs. 7.1% and 8.1% for the MgO and High MMg Treatments, respectively, the post-treatment plasma concentrations were not significantly different between treatments.

It is of interest to note that the response was quite rapid in all the treatments, and significantly increased values were already observed the day after feeding the supplements (Figure 1).

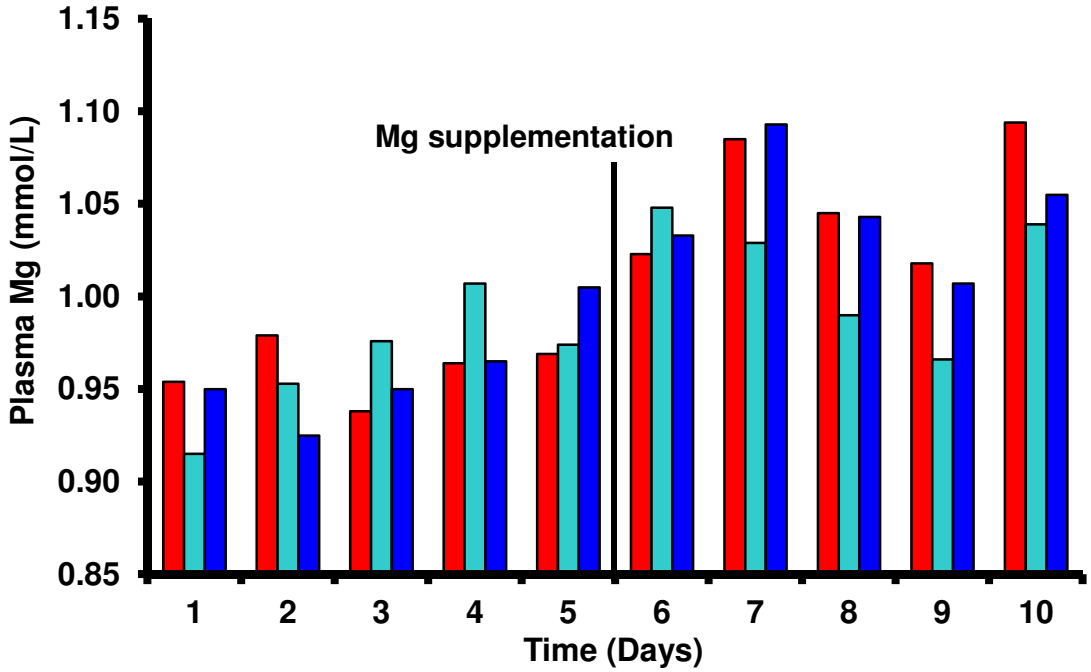

Figure 1. The effect of different Mg sources on plasma Mg levels in dairy cows.
Legend: Red = Conventional MgO supplemented to cows at 36g/d; Turquoise = Marine Mg supplemented at 9 g/d; Blue = Marine Mg supplemented at 18 g/d.

The temporary decrease in plasma Mg levels that occurred for all treatments on days 8 and 9 cannot be readily explained, but values increased again on day 10. The mean plasma Mg concentration of the five days after supplementation was, however, significantly higher than the mean of the five days before supplementation, as indicated in Figure 2.

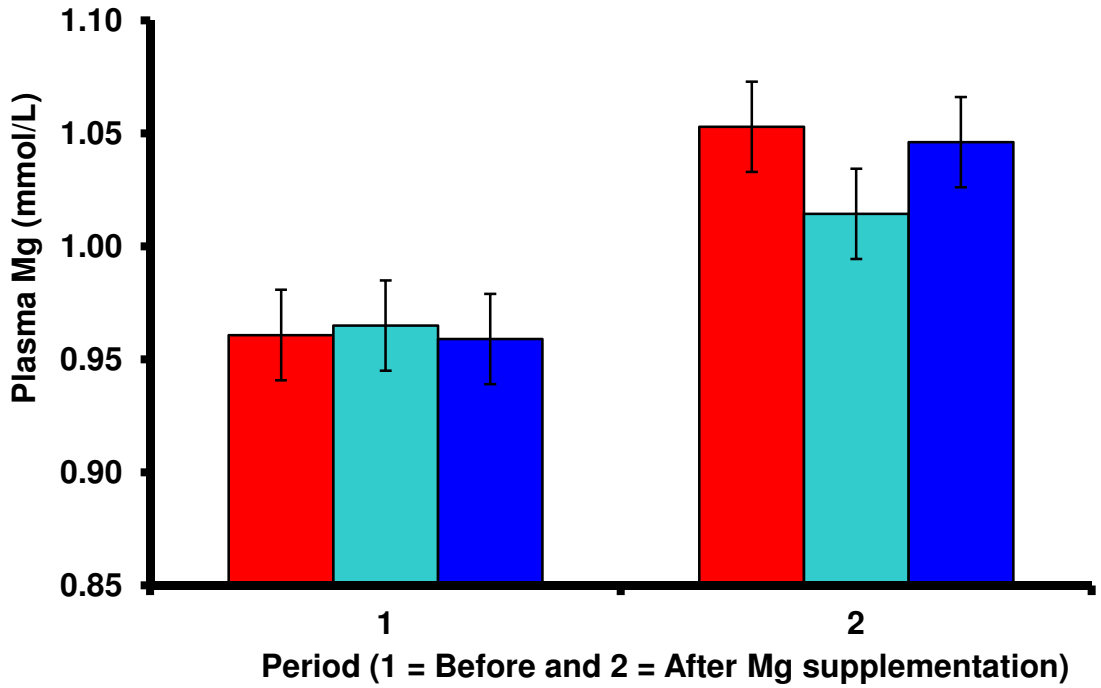

Figure 2. The effect of different Mg sources on plasma Mg levels in dairy cows.
Legend: Red = Conventional MgO supplemented to cows at 36g/d; Turquoise = Marine Mg supplemented at 9 g/d; Blue = Marine Mg supplemented at 18 g/d.

The effect of the respective treatments on milk Mg levels is presented in Table 2.

Table 2 The effect of MgO and two levels of Marine Mg on milk Mg concentrations of dairy cows, five days after feeding the respective Mg premixes

Item	Treatment[1]			Significance	
	MgO	Low MMg	High MMg	SEM	P
Milk Mg (mg/L)	84.1[ab]	75.9[a]	89.2[b]	3.917	0.079

[1]MgO = conventional MgO supplemented to cows at 36g/d; Low MMg = marine Mg supplemented at 9 g/d; High MMg = marine Mg supplemented at 18 g/d.

Milk Mg values tended (P=0.08) to be different between the low and the high marine Mg treatments, but neither differed from the MgO treatment. It would appear that the low marine Mg treatment is somewhat insufficient to maintain optimal milk Mg levels.

CONCLUSION

Marine Mg, supplemented to cows at a level of 18 g/d (50% of the conventional MgO dose) is able to increase and maintain plasma and milk Mg levels to the same extent as traditional MgO supplemented at 36 g/d. A supplementation level of 9 g/d of marine Mg appears to be somewhat low to ensure optimal plasma and milk Mg levels. It is possible that the optimal supplementation dose of marine Mg may be somewhere between 25 and 50% of that of conventional MgO.