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MIN-AD®

Effect of MIN-AD Particle Size on Mg Bioavailability

Introduction

Over the past 40 years, MIN-AD has made two products available to the livestock industry: a Standard product with a broad particle size distribution for the dry feed industry, and a Fines product with most particles passing a 325 mesh for the liquid feed industry. Recently the feed industry has expressed interest in a granular product for inclusion in free-choice minerals. As a first step in the development of this potential product, it was necessary to verify the mineral availability of a narrow granular particle size distribution. It was decided to design a general trial to study the effect of MIN-AD particle size on serum Mg as the data would also be of use to current users of both the Standard and Fines products.

Methods and Materials

The trial was conducted at the Dairy Research Center at Kansas State University under the supervision of Dr. Barry Bradford. Prior to trial start, the cattle were on a diet that provided 0.25% Mg. Upon trial start, fifteen heifers averaging 847 lbs were grouped together and fed the basal diet shown in Table 1. This diet had a lower Mg level of 0.16%, but still met all of the nutrient requirements (NRC, 2001) including the Mg requirement of 0.11%. No supplemental Mg was supplied. After one week on the basal diet, the heifers were moved to individual stalls in a tie-stall barn. Heifers were randomly assigned to one of three MIN-AD particle size distributions with the MIN-AD top-dressed at the rate of 0.25 lbs per head per day, which resulted in a total Mg concentration in the diet of about 0.30%. Heifers were fed the basal diet *ad libitum*, and intake was recorded daily. Blood, urine, and fecal samples were collected on the day the heifers were moved onto the tie-stall barn and at weekly intervals.

Table 1. Composition of the basal diet[1].

Ingredient	%
Corn silage	42.6
Grass hay	43.6
Ground corn	6.8
Soybean meal (48%)	6.3
Limestone	0.4
Micronutrient premixes	0.3

[1]Values are expressed as a percentage of diet dry matter

Blood, urine, and fecal samples were analyzed for Mg content by atomic absorption spectroscopy with 0.1% lanthanum chloride as the diluent. Urinary creatinine concentrations were used to normalize urinary Mg concentrations for potential differences in water intake.

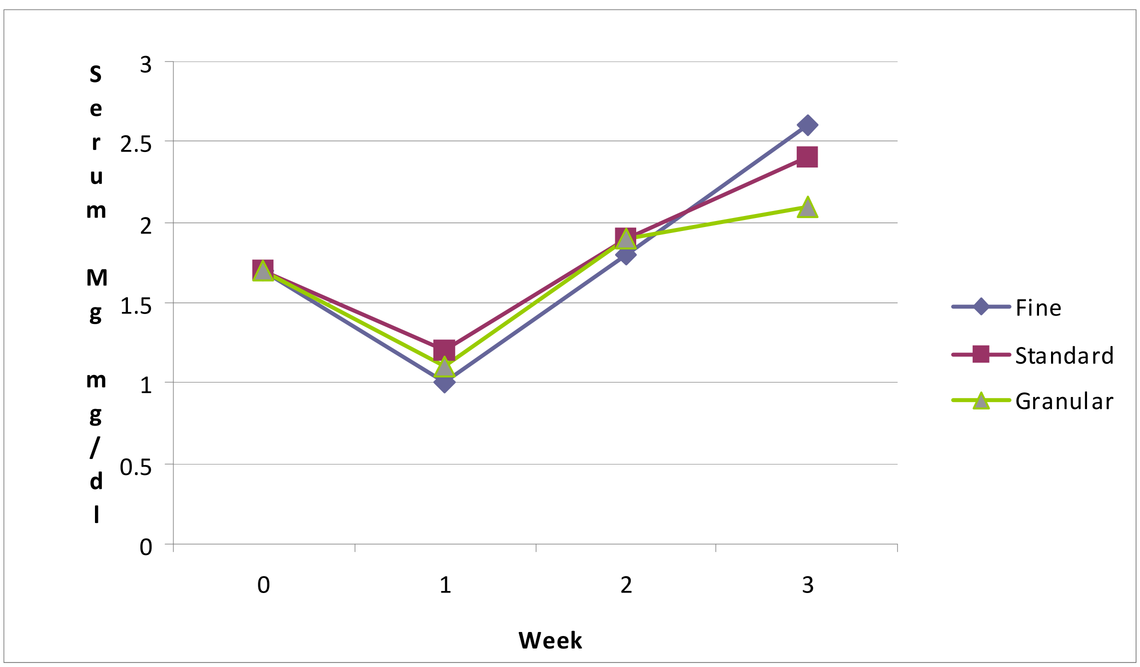
Results were analyzed by mixed model analysis including the fixed effects of treatment, time, and treatment by time interaction as well as the random effect of animal. Denominator degrees of freedom were calculated by the Kenward-Rogers method.

Results and Discussion

Analysis of the basal diet showed a final Mg concentration of 0.15%, very close to the targeted value of 0.16%. Dry matter intake was close to the model-predicted 17.6 lbs per day and was not affected by treatment.

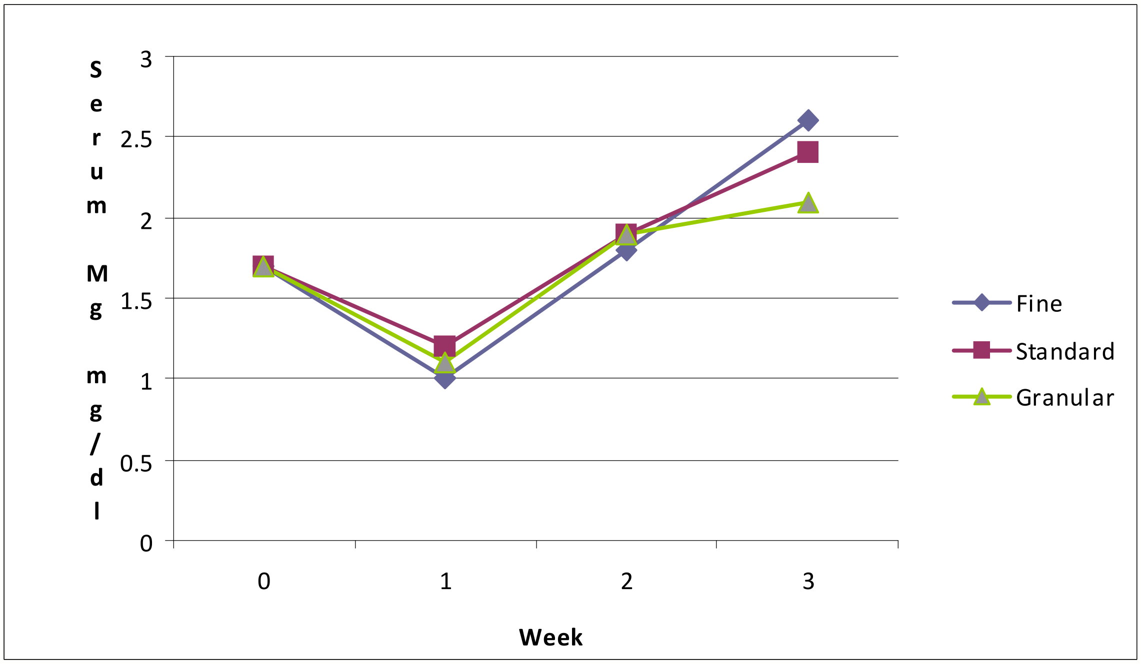
Serum Mg concentration appeared to respond to supplementation with MIN-AD, but there appeared to be a lag period (Figure 1). Serum levels were not different among the treatments (P=0.84). However, the numerical trends were what one would expect, namely, that the Fines product would have the highest Mg availability, followed by the Standard product and then the granular distribution. The lag period may have resulted from the elimination of supplemental Mg in the basal diet. The basal diet had about 50% less Mg than the pre-trial diet in order to bring serum Mg down.

Figure 1. Serum Mg response to MIN-AD particle size.



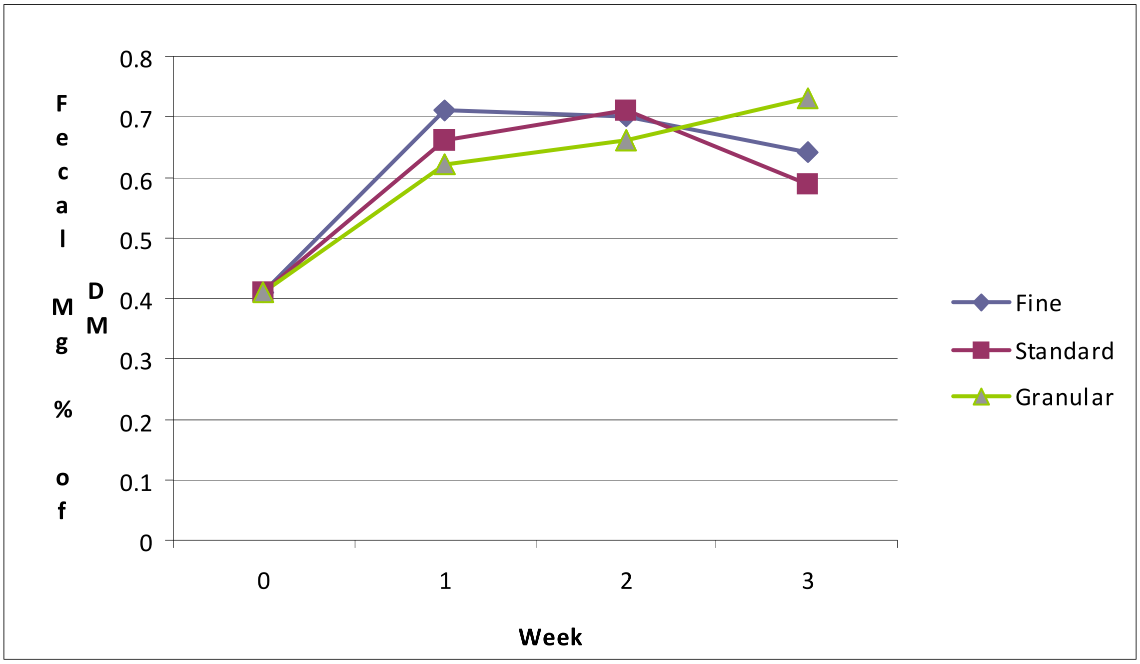
Particle size affected urinary Mg concentrations with higher levels (P=0.03) in the heifers receiving the Standard particle size compared to the other particle sizes which were not different (Figure 2). This result is difficult to explain since the intermediate particle size resulted in higher levels when one would have expected urine levels in relation to the particle size as was shown for serum levels.

Figure 2. Urine Mg response to MIN-AD particle size.



Fecal Mg levels increased as would be expected with the addition of supplemental Mg. The increase was not affected (P=0.96) by particle size (Figure 3), but there was a slight numerical tendency for higher Mg excretion with the granular product.

Figure 3. Fecal Mg response to MIN-AD particle size.



Conclusions

The addition of MIN-AD as the sole source of supplemental Mg resulted in an increase in serum Mg levels, which is a good indicator of bioavailability. There does not appear to be any significant difference in the Mg bioavailability of the three different MIN-AD particle size distributions. Furthermore, the granular particle size should be a bioavailable source of Mg in free-choice minerals.