Calcium absorption in reindeer: Effect of diet and vitamin D

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Calcium is an extremely important element with both structural and metabolic roles depending on tissue function. Therefore, Ca metabolism is well regulated. Ca absorption rate can change with metabolic requirement, and the process is actively regulated by vitamin D. However, there are few studies which describe these mechanisms in wild species in which both the Ca availability and requirements change seasonally. Previous studies indicated that there is a potentially high fecal loss of Ca when reindeer are fed a lichen based diet (Staaland *et al.*, 1984, White *et al.*, 1984) suggesting that Ca regulation may not always counter nutritional insufficiencies. How the absorption process has coevolved with dietary specialization is only poorly known in mammalian species.

This study was to determine the relative role of the rumen versus the small intestine as an absorption site and to test the degree to which absorption is modulated by the active form of vitamin D, 1,25-dihydroxyvitamin D_3 (1,25 D). It was hypothesized that the absolute amount of Ca absorbed would increase with Ca intake but the efficiency of absorption (equivalent to Ca digestibility) would increase as the dietary intake declined and that the role of 1,25 D would be maximal.

Three reindeer calves fitted with cannuli in the rumen and abomasum were kept in metabolism stalls for a 2-month period. In consecutive 2-week periods the animals were fed 1 kg Dry Matter/d of the following diets: lichens, lichens + RF-71 (1:1) and RF-71 (reindeer pellets concentrate and grass meal 3:1). Intakes of Ca on the three diets wee 22, 49 and 67 mmol/d. Ca absorption was measured after 10 d on each diet by deconvolution analyses of plasma radioactivity curves following injections of $^{47}CaCl_2$ into the abomasum, $^{45}CaCl_2$ into the rumen and $^{85}SrCl_2$ iv. 1,25 D (20 ug) was then given intraruminally to stimulate absorption. New measurements commenced 48 h later. The $^{45}CaCl_2$ was injected to determine the role of the rumen relative to the intestines as absorption sites.

Results of Ca absorption in relation to diet and stimulation by 1,25 - dihydroxyvitamin D_3 are: (Mean and s.e.m.)

Diet	^{47}Ca-absorption (% dose)		Net Ca-absorption (mmol/d)	
	Unstimulated	Stimulated	Unstimulated	Stimulated
Lichen	0.23±0.05	0.39±0.03	—3	0
Lichen+RF-71	0.27±0.06	0.50±0.08	1	16
RF-71	0.38±0.07	0.57±0.06	18	26

In spite of low Ca intake the efficiency of Ca absorption was low on the lichen diet. Therefore our hypotesis that fractional absorption would increase with declining intake is refused. Upon stimulation by 1,25 D Ca absorption increased but for lichens the stimulation was only to the level observed in unstimulated calves fed RF-71. Our results suggest that lichens possess Ca binding properties which may be of nutritional significance. In addition, analysis of the data where ^{45}Ca was injected into the rumen suggest that the ruminal route of absorption was relatively unimportant in reindeer.

References

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