Seasonal hypomagnesemia in reindeer on Kautokeino winter pasture in Finnmark County, Norway

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Abstract: Hypomagnesemia was diagnosed in reindeer on Kautokeino winter pasture in Finnmark County, Norway. The affected animals were paretic or ataxic. Mean serum magnesium levels were 0.19 +/- 0.20 mm/L (n=6), compared to a serum Mg level of 0.82 +/- 0.17 mm/L for the reference group.

Key words: Reindeer, *Rangifer tarandus*, hypomagnesemia.

Rangifer, 13 (3): 133—136

Introduction

Subclinical hypomagnesemia in ruminants may occur in some animals for a long time, often for months (Simesen, 1977). When serum magnesium (Mg) approaches critically low levels, it may be accompanied by mild clinical signs such as nervousness and increased excitability. Certain conditions, such as fasting or reduced feed intake, may result in tetany or paresis.

«Slow-Onset» or «Winter Tetany» is a chronic Mg deficiency, often seen in beef cattle. The most prominent etiological factor is a subfeeding of Mg but a chronic energy deficiency is also common (Pehrson, 1985). As a rule animals that spend the winter outdoors are involved but it is also seen in stabled animals. Animals may also have very low blood Mg values for long periods without showing any clinical signs.

Latent hypomagnesemia may, however, change to a clinical manifest tetany at anytime. This often comes about when some moment of stress is added, for instance a change in weather, or when changing from indoor to outdoor feeding. (Pehrson, 1985).

Semi-domesticated-*Rangifer tarandus* L. are subjected to marked seasonal variation in nutritional and climatic conditions. In winter the diet of this species consists mainly of lichens, which are low in protein and minerals but abundant in complex carbohydrates (Nieminen and Heiskari, 1988).

Reindeer herders in northern Norway have reported that animals have died when grazing in part of Øvre-Anarjokka National park. This has been known for as long as reindeer herders have used this area as winter pasture for rein-

deer. Because of the increasing reindeer population it is difficult for reindeer herders to avoid this area. Apparently healthy animals die when exposed to physical activity. Both calves and adult animals have died. No abnormal behaviour has been seen in animals grazing quietly. We investigated aspects of the serum biochemistry of reindeer in Finnmark to determine the cause of death of animals here.

Materials and methods

Jugular blood samples were taken from 52 semi-domesticated reindeer of mixed gender. The animals consisted of three groups. The first group (G1) (n=6) were paretic and ataxic. Blood was sampled on February 24th, 1991 from this group, when the animals were gathered for slaughtering selection.

The animals in group 2 and 3 (G2 and G3) had no abnormal clinical symptoms and came from two different areas. These blood samples were taken March 7th, 1991 from G3 and April 24th 1991 from G2. All the animals were grazing on winter pasture, consisting predominantly of lichen. Twenty three of the animals were grazing 30 km west of Kautokeino. This was the same herd that had been on the problem pasture two months earlier. The other animals (G3) (n=23) were on winter pasture north of the problem area. (Figure 1). These animals had not been on the problem pasture at any time. The affected animals had been moved from the problem pasture just after they were sampled in late February. Two months later, on April 24th, the animals no longer revealed any clinical signs of weakness or tremors.

The animals were caught with lasso and blood samples were collected in heparin and serum vacutainer tubes within minutes of capture. Plasma samples were centrifuged and separated in the field. The serum samples were allowed to clot in a warming cabinet, centrifuged and separated within an hour. Plasma and serum samples were stored at -18°C until analysis. Biochemical profiles were measured on a Technicon RA 1000 Analyzer.

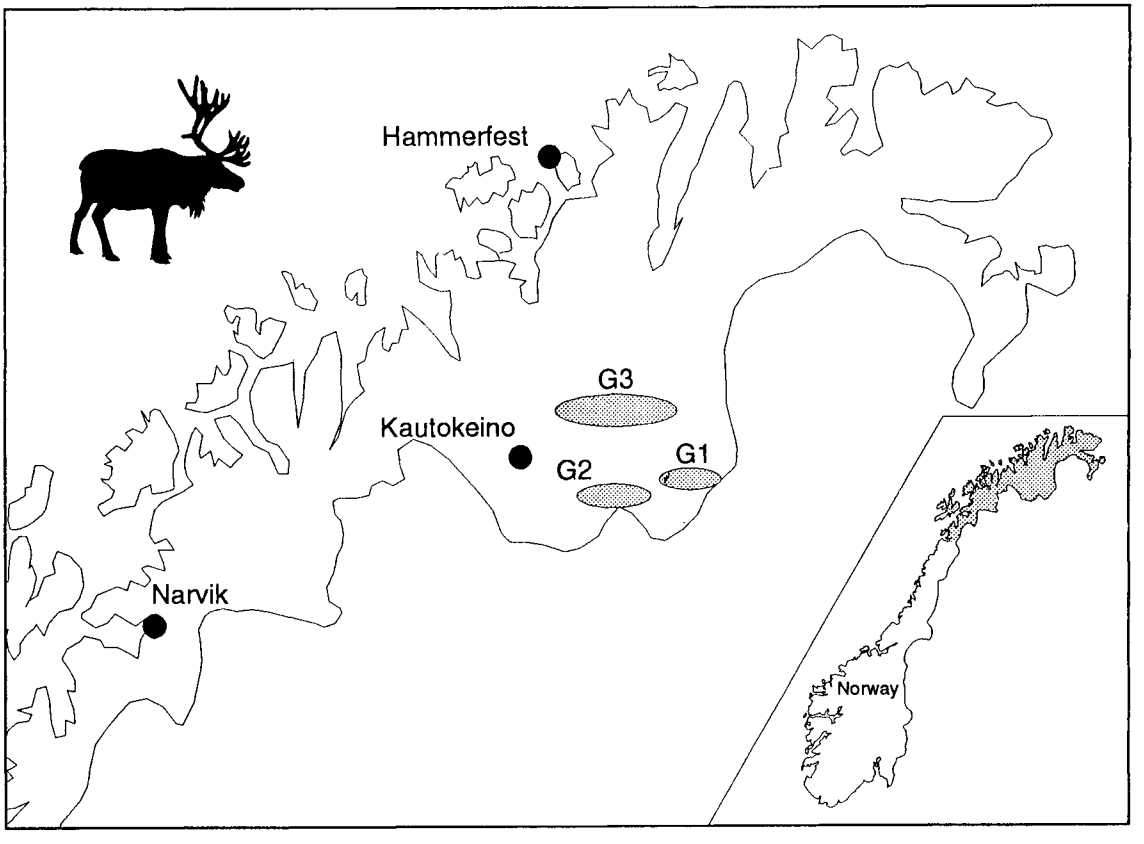

Fig. 1. Location of the studied reindeer groups.

Table 1. Mean and standard deviations on serum biochemistry profile values for adult reindeer. All animals were free-grazing reindeer from Finnmark district, Norway.

Parameter	Unit	Finnmark 1 Day 0 n=6	Finnmark 2 Day 60 n=23	Finnmark 3 Reference n=23
Calcium	mmol/L	2.03±0.27	2.37±0.12	2.13±0.18
Phosphorus	mmol/L	1.68±0.12	1.60±0.26	1.25±0.40
Calcium/Phosphorus		1.21±0.02	1.48±0.02	1.85±0.02
Magnesium	mmol/L	0.19±0.18	0.95±0.19	0.82±0.17
Asparate aminotransferase	U/L	2502±567	56±14	95±18
Creatine kinase	U/L	59307±8743	151±76	289±213
Lactate dehydrogenase	U/L	3335±2147	608±98	1019±242
Total protein	g/L	60.67±7.50	59.43±7.76	60.17±4.98
Albumin	g/L	31.83±1.47	32.48±3.87	36.87±2.87
Globulin	g/L	28.82±2.55	26.95±3.81	23.30±3.93
Albumin/Globulin		1.10±0.13	1.21±0.10	1.58±0.12
Urea	mmol/L	4.7±3.2	1.6±1.5	2.1±0.9
Creatinine	mmol/L	210±30	204±28	225±21
Glucose	mmol/L	8.8±3.9	5.6±1.1	7.6±2.0
Sodium	mmol/L	148±1	144±3	152±2
Potassium	mmol/L	3.4±0.4	4.3±0.6	3.3±0.3
β-Hydroxybutyrate	mmol/L	0.82±0.23	0.75±0.41	0.64±0.16
Copper	μmol/L	9.0±0.9	—	7.7±1.0
Zinc	μmol/L	6.7±1.5	—	6.7±1.0

Results

Mean values for serum parameters are given in Table 1. Very low magnesium and moderately decreased calcium were found in the affected animals (day 0). Creatine kinase, aspartate aminotransferase, lactate dehydrogenase and glucose levels were significantly elevated in the affected animals (G1) compared to the reference group. The reference group (G3), came from another herd in the same general area, but away from the affected pasture. No animals had ever been noted with clinical signs in this area.

Discussion

The winter conditions encountered by the affected group in Øvre-Anarjokka had a pronounced effect on the mineral status of the animals. The animals in this group had low magnesium (Mg) and calcium (Ca) compared to animals described by Hyvärinen (Hyvärinen *et al.*, 1977) and the values reported by Halse (Halse *et al.*, 1976). The very low Mg value, (0.19 +/- 0.18 mmol/L), for the animals in the affected group is significantly (p>than 0.01) lower than the value for the earlier mentioned groups, 0.67 and 0.60 mmol/L respectively. The animals described by Hyvärinen and Halse revealed no abnormal clinical signs. Earlier studies (Staaland *et al.*, 1985) from reindeer grazing in an area in southern Norway revealed hypomagnesemia in reindeer calves. Staaland reported a seasonal variation in plasma Mg levels, with the lowest value of 0.4 +/- 0.1 mmol/L in December. Åhman *et al.*, (1985) correlated the condition of the reindeer in February/March with the Mg levels, and found that weak animals has significantly lower serum Mg.

Our findings were similar to the findings of Åhman *et al.* (1985) and may explain the weakness of the animals in the affected group. The mean serum Mg level in our study was >.19 +/- 0.2 mmol/L (n=6), compared to a serum Mg level of 0.43 units for the weak animals in Åhman's report.

The animals in the affected group have most likely experienced the same winter grazing conditions as reindeer in the reference group although there is a significantly lower level of

Mg in the animals grazing in the problem area. This would indicate a need for a further investigation of the forage composition, or at least a closer investigation of the seasonal variation of the mineral content of the most grazed winter diet, lichen (*Cladonia* sp.).

The highest losses of animals usually occurs in the period from late January to early March, after the animals have been grazing the problem area for a period of one month. The animals show few clinical signs when grazing quietly, but it would appear that any type of physical stress accentuates the clinical signs of the affected animals. In this terminal stage affected animals often walk with difficulty, often appearing uncoordinated and ataxic. Sick animals lie down and they are unable to rise. The low serum magnesium and calcium levels would indicate a possible disturbance in the mineral metabolism, likely of the type seen in winter tetany in beef cattle. The most prominent abnormal biochemical parameter, is the very low serum magnesium. Low calcium levels have been found to accompany low magnesium levels (Smith 1972). The low calcium levels could also be expected with innapitance and lack of calcium absorption by the gut. Further studies with therapy would be necessary to verify the influence of the low serum mineral.

The very high muscle enzymes (AST and CK), in the hypomagnesemia group, could indicate that seizures have occurred. It is also possible that a nutritional myopathy is present. This should be investigated on future animals with selenium and glutathione peroxidase levels.

The increased globulin levels in the affected animals, without increased albumin, could indicate chronic antigenic stimulation due to parasitism (Poppe, 1980).

Increased serum urea in the affected animals may be due to prerenal retention of nitrogenous wastes due to dehydration, shock or protein catabolism associated with starvation (Kaneko, 1989). Reindeer are among the ruminant species which are able to minimize their urinary urea loss, and thus increase the availability of nitrogen for the synthetic process in the rumen during periods of low protein intake (Hove & Jacobsen, 1975). This explains the low urea levels in the reference animals, but not the increased levels in the affected animals.

The increased mean level of serum glucose (8.8 mmol/L) in the affected animals is most likely the effect of chronic stress and endogenous adrenal cortical hormones (Kaneko, 1989).

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Manuscript accepted 25 June, 1993