SUSPECTED VITAMIN D_3 TOXICITY IN A GROUP OF BLACK RHINOCEROS (*DICEROS BICORNIS*)

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Abstract

Three black rhinoceros (two males, one female, *Diceros bicornis*) in a group of 10 black rhinoceros, (two male and two female long-term wild-caught adults and six male captive-born juveniles) began to show hypercalcemia and partial anorexia over a 5-mo time frame. These signs were more pronounced in the adult rhinoceros, serum sampling in the juveniles were inconsistent due to behavioural conditioning problems. During this period the three black rhinoceros died. Clinical signs were similar in all three: weight loss (15-20%), weakness, stiffness in hind legs, hypercalcemia (13-18 mg/dl, normal 12.4 mg/dl), and normophosphotemia. All three rhinoceros that died had elevated BUN and creatinine (near death, within 24 hr). These three rhinoceros were unable to stand with progressive weakness starting in the hind quarters and moving forward. Necropsy on the two adult rhinoceros revealed a varying degree of mineralization of the major vessels, heart valves, heart muscle, stomach, lungs, and kidneys consistent with vitamin D_3 toxicity.[2] The youngest rhinoceros (3-yr-old) did not have gross mineralization of soft tissue and had no other abnormalities. Shortly after the first death, vitamin D_3 concentrations were determined on tissue, feed (two pelleted diets), and serum samples. In the original pelleted diet A, vitamin D_3 was formulated at 250 IU/kg of feed, however follow-up routine testing for vitamin D_3 is not standard. A total of four pelleted lots were tested, two during the crisis and two after the crisis. Rhinoceros are fed approximately 8-9 kg of pelleted diet A, two flakes of alfalfa hay, four flakes of timothy hay, two apples, two carrots, 6.8 kg of browse and 30 ml of vitamin E oil daily in two feedings. Most food was eaten with the exception of 20-30% of timothy hay. Pelleted diet B was originally fed and was used as a comparison. Other portions of the diet were not tested as samples of the original hay and browse were not available.

Concentrations of vitamin D_3 in pelleted diet A were 9500 IU/kg, and pelleted diet B 3282 IU/kg feed (as–fed basis). Toxic concentrations in horses are above 2200 IU/kg of feed and recommended feeding concentrations are 500 IU/kg of feed.[3] Serum samples from the first two rhinoceros that died were submitted and 25-hydroxy vitamin D_3 concentrations were mildly elevated, 138 nmol/L and 203 nmol/L, when compared to concentrations of 25-hydroxy vitamin D_3 in wild black rhinoceros at 139 nmol/L.[1] Tissue concentrations of 25-hydroxy vitamin D_3 of the liver of the first rhinoceros to die were elevated at 515 ng/g (normal in sheep 3.4-10 ng/g)[2] and the second and third rhinoceros to die had normal liver concentrations of 16 and 14 nmol/L, respectively. Additional serum and tissue samples from a female black rhinoceros that died 1 yr previously were submitted for analysis. This female rhinoceros also had soft tissue mineralization of the major vessels, stomach and lungs. Additionally the female was

normocalcemic, had an elevated serum 25-hydroxy vitamin D_3 of 544 nmol/L, and normal liver concentration of 25-hydroxy vitamin D_3 of 35 nmol/L. Normal concentrations of 25-hydroxy vitamin D_3 in black rhinoceros tissue have not been established, however this concentration appears normal when compared to concentrations in domestic animals.[2] Additional samples of serum 25-hydroxy vitamin D_3 in other black rhinoceros and white rhinoceros (*Ceratotherium simum*) were elevated concurrently at the same time that the feed concentrations of 25-hydroxy vitamin D_3 were elevated. Once the same pelleted diet was obtained from a different feed mill, vitamin D_3 concentrations have decreased and clinical signs are now abating.

It is unclear if the vitamin D3 was toxic enough to cause death, however clinical signs of vitamin D_3 toxicity and elevated serum calcium concentration and soft-tissue mineralization were present. Weight loss may have been exacerbated by two factors: removing the pelleted feed from the diet for a period of 1 mo, and unusually cold weather (many nights below freezing). It is recommended that both feed and serum concentrations of 25-hydroxy vitamin D_3 are tested on a routine basis in addition to serum parathyroid hormone (PTH), calcium and phosphorus (Table 1).

LITERATURE CITED

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3. National Research Council. 1989. Nutrient Requirement of the Horse. 5th rev. ed. National Academy Press. Washington, D.C. Pp. 21-22.

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Table 1. Information for feed and serum testing.

Conversion Factor
From ng/ml to nmol/L: ng/ml × 2.496 = nmol/L
Tissue and Serum Samples
Animal Health Diagnostic Laboratory
629 West Fee Hall B
Michigan State University
East Lansing, MI
48824-1315
(517)355-0281 (tissue samples)
(517)353-0621 (serum samples)
Feed Samples
Woodson-Tenent Laboratories, Inc.
PO Box 1292
3507 Delaware Ave
Des Moines, IA
50305
(515)265-1461