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Letter to the Editor

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Copper responsive wasting and diarrhoea in captive European bison (*Bison bonasus*) in UK

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Severe diarrhoea, wasting and death were reported in a ten year old entire bull European bison in a wildlife park in England. Over two to three weeks its faeces had been become progressively more fluid and gradual weight loss had been noted. No pathogens were identified on faecal parasitology or bacterial culture, so more fibre was added to the diet, as this was thought to be beneficial. The bull would only eat browse (leaves from woody plants). This is unusual, as a report on range herbivores from Lyons *et al*. (2012) indicates the closely related American bison (*Bison bison*) usually eat mainly grass (81%), forbs (wildflowers, weeds, etc.) (12%) and browse only (7%). The bull then became acutely anorexic and died. An in situ necropsy was carried out by the private vet but there were no gross or subsequent histological findings of significance.

The bison enclosure is four acres and contained another European bison bull that had been bought in seven years previously with the affected animal from the same premises. The pasture is low lying with permanent grass, marsh grass and reeds and it is susceptible to poaching in the winter. The pasture has not changed over the last seven years. The bison had ad lib access to hay in a hay rack and were offered daily seasonal fresh leafy browse, in addition to daily hard feed (Monarch deer cubes).

Three months after the death of the affected bison, the remaining bison developed the same clinical signs. This animal was sedated to allow collection of samples including faeces, and a range of blood samples. There was no evidence from faecal examination of parasitic gastroenteritis, coccidiosis, liver fluke, salmonella infection or Johne's infection by PCR. In addition, PCR testing of blood samples was negative for Bovine viral diarrhoea virus (BVDV) and Malignant Catarrhal Fever Virus (MCFV) antigen. The serum copper level was 11.07 umol/l and the reference range for plasma copper in domestic ruminants (cattle, sheep, goats and deer) is 9-19 umol/l with the Animal and Plant Health Agency (APHA) guide for clinical copper deficiency at levels below 6umol/l. Puls (1994) indicates that the serum reference range should be 17 to 24% less than the plasma reference range. The results do not indicate any direct copper deficiency. However, consultations with staff at other British wildlife parks, which keep European bison, revealed anecdotal evidence that these clinical signs might be due to a copper responsive disease. Foster *et al*. (2011) also reported a similar case of rapid weight loss and death in farmed American bison (*Bison bison*) where copper deficiency was diagnosed. On the basis of this information copper responsive disease could not be ruled out.

Copper treatment by intramuscular dart of 5ml Veticop (20mg/ml copper methionate, Bimeda) was given and an improvement was seen within 12 hours. The bison looked more alert and had an improved appetite (see before and after pictures). This improvement continued dramatically. No liver tissue was available from this animal but a sample had been collected from the first case for histopathology. Unfortunately the formalin fixed liver had by now been discarded and the histological wax block sample was all that remained. Bischoff *et al*. (2008) had previously carried out a limited study to show comparative trace element, including copper, analysis figures using formalin fixed and crucially wax embedded liver to fresh bovine liver studies. The wax block liver sample was therefore analysed for tissue copper levels. This gave a copper result of 11.85 mg/kg DM, which is equivalent to 186umol/kg DM. The APHA guide for copper deficiency is liver levels ≤300umol/kg DM. This supports a diagnosis of copper deficiency in the first case and response to copper treatment in the second cases suggested copper deficiency was also involved. However as these bison had been on the same pasture for seven years it is not obvious what factors precipitated the clinical changes at this time.

Recent work by Durkalec *et al*. (2018) checking trace elements in livers of captive and free-ranging European bison in Poland suggested copper deficiency occurred in 85% of free-ranging animals and in 88% of the captive ones. This is important to consider as European bison have recently been re-introduced in some areas of Continental Europe

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such as the Southern Carpathians in Romania. Also they are being considered for re-wilding projects in Great Britain as well as for conservation grazing. Copper responsive disease may be a limiting factor in these schemes. However, the level of copper supplementation would need to be suited to each scheme, to prevent over supplementation that might lead to copper toxicosis. Soil and pasture biochemical analysis would be a useful guide in helping prevent over or under supplementation.

Fig. 1. Before copper treatment.

Fig. 2. 13 days later.

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