Susceptibility of yak (Bos grunniens) to copper deficiency

Clauss, M; Dierenfeld, E S

Postprint available at:
http://www.zora.uzh.ch

Posted at the Zurich Open Repository and Archive, University of Zurich.
http://www.zora.uzh.ch

Originally published at:
Susceptibility of yak (Bos grunniens) to copper deficiency

M. clawss, E. S. Dierenfeld

SEVERAL cases of copper deficiency in captive wild animals have been described (Senf 1974, Senf and Zacheihe 1978, Ashton and others 1979, Zwart and others 1985, Gillespie and others 1995). For one species, the blebbo (Damauliscus dorcas phillipsi), a state of deficiency has been demonstrated both in captivity (Jones 1978) and in the wild (Turkstra and others 1978), and this may reflect an unusually high requirement for the element (Dierenfeld and others 1988). The evidence and possibility of genetic differences in the absorption of copper was reviewed by Wiener (1987).

Specific clinical signs which responded to copper supplementation have been noted in yak (Bos grunniens) in two zoological collections. At Whipnade Wild Animal Park (formerly Whipnade Zoo), low serum copper concentrations were observed in yak by Ashton and others (1979), who described a range of clinical signs which responded to oral supplementation with the element, including debility, weight loss, oedema, diarrhoea, hindleg ataxia, alopecia, loss of coat colour including typical white spectacles around the eyes, poor reproductive rate, frequent stillbirths and low neonatal survival (Ashton and others 1979, Hawkey and others 1983). Haematological changes in these yak included microcytic anaemia, neutrophilia and eosinophilia, possibly due to persistent parasitic infections despite regular anthelmintic treatment (Hawkey and others 1983). Pasture analyses revealed slightly low copper concentrations without high molybdenum concentrations (Whipsnade veterinary records 1998), but bacterial clover (Coracias lactiscus) and Pire David's deer (Elaphurus davidianus) sharing the same pasture have never displayed clinical signs of deficiency. The yak's concentrate ration has been supplemented with copper for many years, which has resulted in alleviation of the problems and cases recur only sporadically.

In a yak group kept at the New York Zoological Society (Bronx Zoo) until 1987, low blood copper levels, loss of coat colour, hair loss and hyperkeratosis skin lesions on the neck, shoulders and withers, were successfully treated with a special copper-supplemented diet (E. S. Dierenfeld, personal observation). A dietary mineral supplement with an excessively high iron content was found to be part of the problem, but the final cause could not be identified.

It was postulated that yak might be especially susceptible to copper deficiency, and questionnaires were sent to other collections keeping the species to determine whether a deficiency was recognised more widely.

In 1986, six other zoological collections in the USA which kept yak groups were contacted (C. R. Rice, unpublished observations). No general herd problem with low blood copper levels or with skin lesions was reported, but there was one single case of hyperkeratosis of unknown cause on the neck and forequarters.

In 1998, 12 European facilities returned a questionnaire on the subject. In 11 collections, a copper deficiency problem in yak had neither been suspected or identified, nor had similar clinical signs ever been observed. In one collection, however, hyperkeratosis of the neck and rump, and a bad hair condition, both of unknown origin, had been experienced. The absence of copper-related herd health problems seems to contradict the idea that yak have special copper requirements, notwithstanding the lack of detailed knowledge about the different institutes dietary regimes. Alternatively, the report of hyperkeratotic skin lesions, albeit sporadic, may suggest a species peculiarity, not in the requirement for copper, but in the response to copper deprivation.

Reports on yak diseases (Pal 1993, Ranga Rao and others 1994, Liu and others 1995, Lensch 1996) have not mentioned copper deficiency problems except for the Whipsnade case reported by Li and Wiener (1995). Whitehead (1950) described a syndrome similar to enzootic ataxia in yak at Woburn Zoo in the UK, but no diagnostic investigations were recorded.

Li and Wiener (1995) recorded a seasonal variation in the red blood cell haemoglobin content in yak in China, with a low before and a peak directly after the grazing season; similar results were reported from Siberia. As copper is an important element for red blood cell production, it may be possible that this variation was due to a marginal copper supply in the winter period. Liu and others (1995) revealed very low liver copper levels from apparently healthy yak, with no reports of copper deficiency in yak or other domestic species in the region.

Winter and others (1992) described severe losses of free-ranging domestic yak due to pyrolozidine alkaloid poisoning, and the suspected toxic plants were later identified as Senecio raphanoides, Senecio biligularis, Ligularia mortoni, Ligularia amplexicaulis and a then unknown. Ligularia species corresponding to alkaloid poisoning in other species, skin lesions were a consistent and even pathognomonic symptom, although such lesions have not been described in cases of alkaloid poisoning in other animals. The lesions occurred on the nose, the dorsal part of the body and the legs, and symptoms included hair loss. No parasitic or bacterial cause could
be demonstrated. The anaemia found in the diseased yak was a more severe and consistent feature than normally reported for alkaloid poisoning. Swick and others (1982) demonstrated that pyrrolizidine alkaloid poisoning causes an increase in liver copper concentration in rats, and they hypothesised that this was due to a mobilisation of copper from other tissues resulting in an accumulation in the liver. Therefore, if the yak were marginally copper deficient, the compartmentalisation of copper in the liver, triggered by alkaloid poisoning, may have led to a copper deficiency state with corresponding changes in red blood cell count, and with skin lesions seemingly typical for copper-deficient yaks.

In general, the reproductive rate of free-ranging yak is low under normal grazing and rearing conditions (Li and Wiener 1995). Females are most likely to calve every two years, and many will have only one annual oestrus, with much of the relatively low productivity being directly attributed to malnutrition in winter and early spring (Li and Wiener 1995). Mineral deficiency may also be part of this general low nutritional status. The experiences from Whispnade suggest that copper supplementation may have a beneficial influence on fertility. Senf and Zschelke (1978) reported that the addition of a copper supplement to the diet of a zoo in a copper-deficient area resulted in improved fertility, fewer stillbirths, fewer births of immature offspring, intensified rutting behaviour in males, and an overall improved condition in several ungulate groups; similar results are also reported by Wiener and Sales (1976). A long-term copper response trial should be undertaken with free-ranging yak, for example, as described by Wilks and others (1992), and probably with slow release intramural devices. Li and Wiener (1995) suggest that the role of specific minerals should be investigated as possible factors limiting health and production in yak; copper seems a good choice with which to start.

ACKNOWLEDGEMENTS

The authors thank E. J. Flach for information and support in the writing of this article. The authors would also like to thank the responding personnel from the zoological collections of: Magdeburg, Augsburg, Halle, Leipzig and Nürnberg (Germany); Givskud Zoo and Ebeltoft Famillepark (Denmark); Ouwehand Zoo (Netherlands); Blackpool (UK); Paris Zoo and Monde Sauvage Safari (France); Boras (Sweden); Brookfield, Kansas City, Knoxville, Utica, Turtleback and Denver (USA). Thanks also to Dr G. Wiener for comments on the manuscript.

References


ABSTRACT

Free skin grafting for treatment of distal limb skin defects in cats

The use of free skin grafts for treating distal limb skin defects in cats has been described only indirectly in papers relating to dogs. This paper describes the procedures used for 17 grafts in 16 cats; first to prepare the recipient site, secondly to collect the graft from an area on the lower thorax or abdominal wall lateral to the mammary glands, thirdly to place the graft, and finally to bandage and care for the graft. The grafts were successful in 13 of the cats. One failed as a result of a plasma cell tumour, and two failed partially, in one case as a result of the bandage slipping, and in the other because the bandage was applied too tightly.


The Veterinary Record, October 9, 1999 437