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Authors: NEWMAN, JAMES R., and YU, MING-HO

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FLUOROSIS IN BLACK-TAILED DEER

JAMES R. NEWMAN and MING-HO YU, Huxley College of Environmental Studies, Bellingham, Washington 98225, USA.

Abstract: Marked dental disfigurement and abnormal tooth wear patterns were observed in black-tailed deer (*Odocoileus hemionus columbianus*) taken from an area near an industrial fluoride source in northwestern Washington. Fluoride levels in the bones of these deer were from 10 to 35 times higher than levels in the bones of normal animals. These levels are similar to those associated with fluorosis of cattle.

INTRODUCTION

Fluorosis in domestic animals has been known for a long time.[5] In cattle, fluorosis can take the form of intermittent lameness and stiffness and lesions of the bones and teeth.[1] Fluorosis induces osteosclerosis, osteoporosis, osteomalacia, osteophytosis and hyperotosis.[6] In addition to locomotor damage and bone structure alteration, animals on an elevated fluoride diet showed varying degrees of dental disfigurement, including browning and blackening of teeth, hypoplasia, hypocalcification, pitting and excessive wear.[1]

Fluorosis is caused from the ingestion for extended periods of time of forage or water containing elevated levels of fluoride. The sources of fluoride can be natural, such as water-borne fluoride from mineral deposits or geysers, or technological such as industrial activities like phosphate fertilizer production, or aluminum reduction processes.[4]

Information on the effect of industrial-borne fluoride on wildlife is lacking.[4] The only published study on the effect of fluoride on wildlife is by Karstad[2] who found that white-tailed deer (*Odocoileus virginianus*) living near a technological fluoride source had dental disfigurement similar to that reported to occur in fluoride-intoxicated cattle. This paper reports signs of fluorosis in black-tailed deer.

CASE REPORT

History

During 1971-72 a male and a female black-tailed deer were obtained from an area adjacent to an aluminum plant in northwestern Washington. The female, approximately 15 to 18 months old, had been dead about two months. The cause of death was unknown. The male, of the same age, was shot illegally. Both deer were obtained from the Washington State Department of Game.

Examination

Chemical analysis for fluoride of ribs, metatarsals and digits was performed by the method of Singer and Armstrong.[7] Teeth and bones were examined for lesions of fluorosis. Skulls and leg bones of two male black-tailed deer obtained from local hunters were analyzed similarly and considered as controls.

The bones of deer from the vicinity of the fluoride source contained 10 to 35 times more fluoride than control deer (Table 1). Both contaminated animals had extensive dental disfigurement and excessive tooth wear. The doe had extensively damaged incisors and upper and lower second molars. The erupting third molars were pitted and blackened. The

TABLE 1. Comparison of Fluoride Content of Bone Tissues from Black-tailed Deer.

Bone	Fluoride concentration (ppm)[a]			
	Control[b]		F-contaminated[c]	
	(1)	(2)	(1)	(2)
Rib	157	465	2820	6809
Metatarsal	89	442	2475	4760
Digit	54	—	2048	—

[a] on fat-free bone basis.

[b] (1) male 2½ years; (2) male, 15-18 mos.

[c] (1) female 15-18 mos; (2) male, 15-18 mos.

second molar was excessively worn. The F-contaminated buck also had pitted and discolored incisors, severely worn, pitted and chipped second molars and blackened and pitted erupting third molars. Using the tooth damage classification system developed for fluoride-intoxicated cattle,[1] where damage is rated from normal to excessive on a scale of zero to five, the incisors and molars of both the contaminated doe and buck were rated four and five, indicating "marked to excessive effect" of fluoride. Controls showed no damage and were rated zero or "normal." A thickening of the mandible over the erupting molars was observed in the doe.

An indication of softening of teeth by fluoride is revealed by comparing molars of contaminated animals with control animals. Under normal conditions the greatest wear in young black-tailed deer is always seen more on the first molar than on the adjacent fourth pre-molar and second molar.[3] This pattern was observed in the control animals. However, in both contaminated deer the second molar showed the greatest amount of tooth wear when compared to the first molar.

DISCUSSION

The effects of fluorides on black-tailed deer are similar to those reported in cattle[1] and white-tailed deer.[2] In normal white-tailed deer, fluoride levels ranged from 160 to 560 ppm in mandibles and 134 to 152 ppm in antlers. White-tailed deer collected in the vicinity of the fluoride source had levels as high as 7125 ppm in mandibles. Extensive pitting, mottling, broken and excessive tooth wear were noted in these deer. Some of the white-tailed deer showed jaw fracturing and thickening of the mandible over the erupting molars. No jaw fracturing was observed in this study.

In 1971 the Washington State Department of Game killed an approximately 6-year-old black-tailed deer from the same area in northwestern Washington. The mandible contained 1504 ppm fluoride and was characterized as mild dental fluorosis (pers. comm., J. C. Adkins, Washington Department of Game, Mount Vernon, Washington).

These observations suggest deer are susceptible to fluoride intoxication and some of the signs are similar to those found in bovine fluorosis. Studies are needed to determine possible debilitating effects.

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