

## LEAD IN GRIFFON AND CINEREOUS VULTURES IN CENTRAL SPAIN: CORRELATIONS BETWEEN CLINICAL SIGNS AND BLOOD LEAD LEVELS

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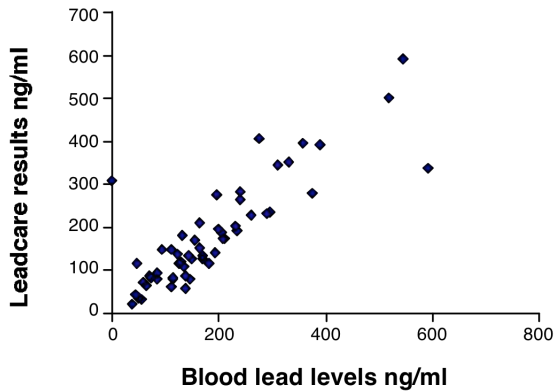
EXTENDED ABSTRACT.—As in other regions, vultures in Spain are often exposed to spent lead ammunition from carcasses of small and large game. This exposure may have increased after the ban on abandoning carcasses of domestic ruminants in the field due to the bovine spongiform encephalitis (BSE) crisis, both because the vultures consume hunting bag residues more frequently and because malnutrition may lead to mobilisation of lead stores (Iñigo and Atienza 2007). Although cases of clinical intoxication have been reported in numerous species including Griffon Vultures (*Gyps fulvus*) and Cinereous Vultures (*Aegypius monachus*) (Mateo et al. 1997, Mateo et al. 2003, Hernandez and Margalida 2008), little information on the potential correlation of blood lead levels and clinical signs and on potential subclinical effects of lead in vultures is available. Although other sources of lead may exist, in a study of live-trapped Griffon Vultures in southern Spain in which high blood lead levels were detected, the authors concluded that the ingestion of spent lead ammunition alone was responsible for the exposure (Garcia-Fernandez et al. 2005). An experimental study in Turkey Vultures (*Cathartes aura*) showed that there was great individual variation in susceptibility to lead, and that weakness and lack of coordination were present in most of the intoxicated birds, while only very high levels of lead produced lead toxicosis (Carpenter et al. 2003).

In this study, we analysed samples from vultures admitted to rehabilitation centers in South-central

Spain, comparing blood lead levels, clinical signs, and hematological data in order to determine any clinical/subclinical effect of exposure to high lead levels and the degree of exposure to which it might be related. In addition, our aim was to compare the blood lead levels obtained with the LeadCare® blood lead testing system (ESA Biosciences, Inc. Chelmsford, MA, USA), the system used in our rehabilitation center network for the rapid confirmation of clinical lead intoxications, with results obtained by standard laboratory methods.

Blood samples were taken from 56 Griffon, 13 Cinereous, and one Egyptian Vulture (*Neophron percnopterus*) upon admission to four different rehabilitation centers in central Spain throughout the years 2006 and 2007. Blood lead levels were measured with the LeadCare® device that uses anodic stripping voltammetry (ASV), and standard laboratory methods (ICP-inductively coupled plasma atomic emission spectrometry). Clinical signs suggestive of potential lead toxicosis included disorientation, ataxia and impaired landing, posterior paresis, and hematology ranged from a slightly increased polychromatic index to a severe hypochromic anemia.

A good correlation was observed between the results for blood lead levels obtained with the LeadCare® device and standard laboratory methods (Figure 1). One Griffon Vulture and the Egyptian Vulture were confirmed to have clinical lead intoxications.



**Figure 1.** Correlation of blood lead levels obtained using the LeadCare® device and standard laboratory (ICP) methods.

While the Griffon Vulture also had severe traumatic lesions and was euthanized, the Egyptian Vulture was treated with oral and parenteral Calcium-EDTA, and recovered. Mean blood lead levels among the other birds were 144.41 ng/ml, with a range from 0.37 to 591.98 ng/ml in Eurasian Grif-

fon Vultures, and mean of 70.07 ng/ml with a range from 0.75 to 512.16 ng/ml in Cinereous Vultures. Approximately 35% of the Griffon Vultures and 23% of the Cinereous Vultures tested had blood lead levels above 200 ng/ml. Using nonparametric statistics we were not able to detect any correlation between clinical signs, hematological values, body condition, and blood lead levels in either of the species. Griffon Vultures appeared to be somewhat more exposed to lead than Cinereous Vultures, although this trend was not significant. In general, lead levels appeared to be higher in individuals admitted to the rehabilitation centers between mid-August and mid-February, coinciding with the large and small game hunting seasons, suggesting that spent lead ammunition alone is responsible for the uptake. To the best of the author's knowledge the lead intoxication in the Egyptian Vulture is the first description of lead intoxication in this species. Received 19 June 2008, accepted 27 October 2008.

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Key words: Ammunition, blood lead, clinical signs, hunting, lead, toxicosis, vultures.

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