DISTRIBUTION OF SELECTED HEAVY METALS IN BLOOD OF ASIAN ELEPHANT

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The biological impact of increases of heavy metals in the environment has become a major concern in recent years. The uptake, general distribution in tissues, metabolism and the effects of various heavy metals in many terrestrial species have been well studied (Sharma *et al.*, 1979 Jayasekera *et al.*, 1986, Jayasekera *et al.*, 1992). Although, they do occur in trace amounts, some metals (i.e. copper, zinc and magnesium) play important role as co-factors or components of enzyme systems involved in the metabolism in human and animal tissues, others (cadmium and lead) do not have any biogical role and are considered undesirable toxic elements (Lynch *et al.*, 1976, Sharma *et al.*, 1979). Trace metals that are essential can also exert toxic action if the physiologic threshold limits are imbalanced.

Apart from the published reports on plasma, serum norms and blood chemistry of Asian elephants (Niemuller *et al.*, 1990, Silva and Kuruwita, 1993a) there is little information available on the distribution of metals in the blood of Asian elephan (*Elephas maximus*). The study reported here investigated the occurrence and the distribution of cadmium, copper, lead, magnesium and zinc in whole blood of the Asian elephant to broaden the present knowledge of its blood chemistry. An attempt was made to compare the distribution of the selected metals between domesticated and free ranging elephants.

The test group consisted of 15 elephants from 4 to 20 years of age. Of this group, 8 were domesticated and 7 were free-ranging elephants. There were 6 male and 9 female elephants in the test group. The blood samples from the free-ranging animals were collected in duplicates when translocating them to national parks after chemical immobilization. Blood samples were collected into acid washed, heparnized test tubes from the ear vein of the animals. The samples were stored in the refrigerator and a 200 microlitre portion was digested in 2 millitres of concentrated nitric acid overnight at 70° C in a water bath. The preparation was then diluted with deionized water as appropriate prior to analysis. The metal content in the acid digested samples were analysed using an atomic absorption spectrophotomtre according to estabilished methods (Perkin-Elmer, 1976)

The mean concentration of cadmium, copper, lead, magnesium and zinc in whole blood of domesticated and wild elephants are presented in Table 1. Of the 5 metals tested, the cadmium content in blood was about 3.5 nm/1 and there was no significant difference between the values of domesticated and free-ranging elephants. While excess of cadmium is not compatible with normal physiological processes it has been observed in almost all living tissues. Statistically significant differences in copper and lead concentrations were noted in both domesticated and free- ranging elephants. It is apparent that, both copper and lead levels are significantly higher ($p \leq 0.05$) in domesticated elephants compared to those levels found in free-ranging animals. However, the concentration of copper noted in domesticated elephants in this study is about 34 percent of the value (165 micro moles/ 1) which has been reported by Debbie and Clausen (1975) for the African elephant *(Loxodonta africana)*. The reason for this discrepancy cannot percisely be explained at this point but may be related to the diet.

Elevated levels of lead in blood of cattle have been reported following outbreaks of acute poisoning and are usually associated with discrete sources of lead or contaminated feed (McEvoy and McCoy 1993) or it may be from an unlikely source. While the exact source and the form of elevated levels of lead in domesticated elephants have not been estabilished in the present study, it was noted that, the higher levels were found in elephants living in the urban environment. Nonetheless, the animals did not show any lead associated clinical manisfestations. Although an outbreak of flaccid trunk paralysis, suspected to be associated with lead has recently been reported (Oryx, 1993) the said report did not indicate the levels of lead in blood of affected elephants and suggested that, the sources of lead as water contaminated with petrol, batteries, discarded oil filters and most importantly automobile exhausts. The higher levels of lead in domesticated elephants reported in the present study may be related to the similar sources, which are usually the results of increased human activities in the urban environment. The whole blood magnesium concentration reported in this study is slightly higher than the levels which have been observed in serum (1.13 mmol/1) of the Asian elephants by Niemuller *et al*., (1990). There was no significant difference in the magnesium content between the two groups of elephants. The zinc content was slightly higher in domesticated elephants, but the mean values were not statistically different.

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Table 1. Metal concentration in blood of domesticated and free ranging elephants *

Group	Number of animals	Cadmium μ mol/l	Copper μ mol/l	Magnesium milli mol/l	Lead μ mol/l	Zinc μ mol/l
Domesticated	08	3.55 ± 1.10	55.20 ± 9.90	1.82 ± 0.28	24.13 ± 13.3	87.20 ± 12.54
Free ranging	07	3.50 ± 1.0	24.86 ± 12 90	1.80 ± 0.12	7.20 ± 2.80	72.50 ± 16.82

* Mean Concentration ± S.D.

† Significantly different from the values within the column ($P < 0.05$)