# Lead exposure in an urban population of free-ranging kaka (*Nestor meridionalis septentrionalis*)

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# Abstract

Anthropogenic lead use has resulted in widespread environmental lead contamination known to affect wildlife populations worldwide. Lead is a highly toxic, non-essential heavy metal recognised as a cause of morbidity and mortality in birds. Ecotoxicological investigations in wild birds have thus far prioritised waterfowl and raptor species and primarily addressed contamination in natural ecosystems. Urban areas are increasingly associated with high levels of heavy metal contamination, however the risk of lead exposure in urban wildlife is less well known.

This study aimed to identify the significance of lead exposure in a well-established urban population of kaka (*Nestor meridionalis septentrionalis*). Blood lead concentrations were assessed in adult and nestling birds to quantify exposure prevalence and magnitude. The impact of lead exposure on physiological and neurological function was assessed using behavioural and physiological parameters. Finally, lead stable isotope analysis was employed to identify the primary sources of lead in the urban environment.

Lead exposure is prevalent in this kaka population, with 43.2% of adults and 36.7% of nestlings with detectable blood lead concentrations. Blood lead concentrations in nestlings ranged from <3.3 to 42.9ug/dL, with no detectable neurological or physiological deficits. The pattern of exposure in chicks is suggestive of parental feeding of lead, however detection of lead in some eggshells suggests that maternal transfer is another route of exposure in this species. Blood lead concentrations in adult birds ranged between 3.4 to 50.7ug/dL. Although no acute clinical signs of toxicity were observed, lead exposure was associated with reduced body condition in adults. Behavioural changes were present in one individual with the highest recorded blood lead concentration. Lead isotope ratios in kaka blood samples overlap with isotope values of roof-collected rainwater, suggesting this to be an important source of exposure in this population.

The prevalence of lead exposure observed in this study suggests that lead is a threat to kaka interacting with urban areas. Wildlife intoxications largely result from anthropogenic lead sources and this study identifies a previously undescribed urban source of lead in wildlife. The well-described subclinical and persistent effects of lead highlight the need for abatement strategies to reduce lead exposure and its effects in this population.

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