Elucidation of environmental metal pollution in humans and animals in Africa and development of countermeasures

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To date, with the aim of assessing the impact of metal contamination on humans and inhabiting animals, I have been investigating in 10 African countries (Zambia, Ghana, South Africa, Kenya, Uganda, Cameroon, Nigeria, Ethiopia, Egypt and Namibia). The biological samples, including livestock, wildlife and human blood/urine/fecal samples have been collected in the aquatic and terrestrial environment. Comprehensive environmental pollution surveys have been carried out covering the aquatic and terrestrial spheres, covering biological samples including livestock and wildlife. In collaboration with government agencies such as the University of Zambia, Zambia Ministry of Health, Ministry of Livestock and Fisheries, Ministry of Mines and Environmental Protection Authority, the study reported high concentrations of lead (Pb) accumulation in edible parts of livestock and poultry in the Kabwe mining area in Zambia, which threatens food safety. Furthermore, blood lead levels were measured in 300 children, 440 mother-child pairs (880 people) and 500 households (approximately 1250 people) in the area, and revealed a serious contamination situation in the vicinity of the mine, with 100% of the subjects exceeding the standard values. In addition to higher blood Pb concentrations in children compared to adults, the study also showed that blood Pb concentrations were higher in the vicinity of the mine, especially in the western area, downwind of the wind direction, indicating that not only distance from the mine as a source of contamination, but also direction and age are determining factors in Pb concentration. The livestock/poultry such as cattle, goat, pig, chickens, and wild rat, wild lizard, as well as dogs have been used as indicator (sentinel) animals to elucidate the situation of environmental metal pollution. Interestingly, Pb concentrations of blood, liver and kidneys of wild rats were higher in dry season compared to rainy season, suggesting that the small particles of Pb containing dust from the mine are main exposure pathway. This is also supported by the study using the wild lizard. Habitat types were categorized based on vegetation data obtained from satellite images and Pb concentrations in lizards living in bare fields were higher than expected based on the distance from the contaminant source, while those in lizards living in green fields were lower than expected. The locations of the dogs and their ages were related to their Pb and metal exposures. The trends of the exposures of dogs were shown to be largely similar to those previously reported for humans. These results suggest that these animals could be useful as sentinel animals for Pb exposure of human.

Currently, we try to develop new Pb reduction methods from soil/vegetable to animals/humans. This further aims not only to reduce the accumulation levels of Pb in animals/humans, but also to reduce possible toxicological effects.

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