INTRODUCTION

Lead is ubiquitous in the environment as a result of mining and industrialization. This metal has no known physiologic value and children are the most sensitive population with high health risks.

In Uruguay, manufacturing emissions and solid wastes as well as the leaded gasoline for cars have been the principal known sources of lead pollution.

There is not a relevant surveillance screening program for lead polluted areas in order to determine the children's risk of lead exposure although from 2001 up to now, this subject has been taken into account by the health and environment Uruguayan authorities.

Blood lead level (B-Pb) is the biological marker to environmental lead exposure and our research group at the Dept. of Toxicology and Environmental Hygiene has a 15-year research experience on lead monitoring on different Uruguayan populations.

One of the aims of this presentation is to assess the risk of environmental lead pollution by biological monitoring on dogs as sentinels considering that those animals are more susceptible than children at similar conditions of exposure.

Then, we are able to work up a scientific basis for a blood lead levels dog screening program as a lower cost methodology that can be used in those countries, like ours, which do not have a systematic environmental evaluation and control for lead pollution to prevent health effects in children.

MATERIALS & METHODS

We studied the following dog and children populations: A preliminary group of stray captured dogs (n=48) and the main group composed by both stray dogs (n=49) and pet dogs (n=151) selected on a random basis were blood sampled by veterinary physicians.

At the same time, we did a blood lead levels screening on Uruguayan children populations with a preliminary group (n=34) and the main group (n=134) also randomly selected. Those data were used to compare blood lead levels in animal (dogs) vs. human (children) population.

We also sampled 12 volunteer families from a lead polluted area to analyse the blood lead levels of children and dogs living together to compare linked data.

We collect individual data in questionnaires both dogs and children sampling campaigns to get the variables of interest for this study such as age, sex, zone, traffic intensity, etc.

Blood analysis were done by flame atomic spectrometry (FAAS) after adding complexing agent and extraction (λ=283 nm) and GFAAS for low detection values (<5µg/dL). The statistical analysis (Mann Whitney; Kruskall Wallis, etc. with p-value < 0.05) was performed to evaluate correlations and associations comparing groups and between B-Pb and single variables. All the described studies included internal and external quality controls for the analytical methods and data processing.
Our data were compared with the reference value of blood lead level of 10 µg/dL considered as an excessive absorption for infant population by the US Center for Disease Control Atlanta, (CDC 1991)

RESULTS

Our data showed higher blood lead levels for dogs (mean 16.3 µg/dL) than blood lead levels of children (mean 9.7 µg/dL) with a p<0.005. Those results on blood lead levels on dogs were significantly associated with age (p<0.001), size (p<0.0001), zone of residence (p<0.01) and lead related symptoms (p<0.0001) with a cut off value of 38 µg<dL.

The blood lead levels of children levels also showed significant correlations with age (p=0,001), sex(p=0,023), area of residence (p=0,0098), traffic intensity at home (p=0,02) and border line with parent smoking habits (p=0,08)

In the 12 environmental lead exposed families the difference between blood lead levels of dogs and children in the same family were significant (p< 0,01) with higher values for the pets.

DISCUSSION

Dogs are very useful as sentinels for environmental lead pollution since they have significant higher B-Pb than those of children’s population. They also have statistically significant early symptoms associated with lead intoxication with lower blood lead levels than those from little children.

In our developing countries, this is a good risk assessment tool, so as to compare blood lead levels in a more sensitive animal population than humans to easily have background environmental data.

We considered that also, this is a relevant proposal, to be taken into account by the health and environment authorities in poor countries too, as a first step in lead pollution diagnosis and control.

CONCLUSIONS

We conclude that a systematic surveillance on blood lead levels in dogs can be a reliable method to assess and prevent lead risk for children when environmental data are not available.

This kind of lead bio monitoring has lower cost for quick environmental screening programs with the advantage that dogs only “measure” biologically active lead.

Finally, ethic aspects have been considered as an advantage of this proposal.

REFERENCES


CDC (Centers for Disease Control and prevention) (1998) Analytical Methods for blood lead measurements: 50th National Meeting of the American Association for Clinical Chemistry Workshop # 2215 Chicago, IL (USA)


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