

TISSUE LEAD LEVELS IN INDONESIAN LIVESTOCK

DARMONO and D.R. STOLTZ
Research Institute for Veterinary Science, Bogor

ABSTRACT

Lead was measured in liver and kidney of cattle, buffalo, sheep, goats and pigs collected at slaughterhouses in Bogor and Denpasar. Average liver and kidney lead levels ranged from 0.55 to 4.44 ppm (wet weight). Of the three species (cattle, goats, pigs) sampled at both sites, all species from the Bogor slaughterhouse had higher lead levels compared to animals from Denpasar. Reasons for this difference and the possible public health effects of consumption of lead-containing organs should be investigated.

INTRODUCTION

A survey of lead (Pb) in liver and kidney of cattle, buffalo, sheep, goats and pigs was undertaken to estimate background tissue Pb levels in slaughterhouse animals. Tissue Pb residues are of interest because little is known about the significance of Pb in veterinary toxicology and public health in Indonesia.

MATERIALS AND METHODS

Samples of kidney and liver were collected from each of 10 cattle, buffalo, sheep, goats and pigs at the slaughterhouse in Bogor, West Java, and from 30 cattle, 12 goats and 30 pigs at a slaughterhouse in Denpasar, Bali. These sites were initially selected to represent relatively non-industrialized (Denpasar) and industrialized (Bogor) areas. However, it was subsequently found that the majority of large ruminants slaughter in Bogor were trucked from East and Central Java. Samples were chilled for transport, then stored at -60°C prior to dry ashing and analysis by atomic absorption spectrophotometry (Solly *et al.*, 1981). Recovery of Pb from tissue spiked with 0.1–1 ppm was $\pm 90\%$.

RESULT AND DISCUSSION

Average liver and kidney Pb levels ranged from 0.55 to 4.44 ppm (wet weight) with sheep and goats

showing slightly higher levels than cattle, buffalo or pigs (Table 1). Of the three species (cattle, goats, pigs) sampled at both sites, all species from the Bogor slaughterhouse had significantly higher Pb levels in one or more tissues compared to animals from Denpasar. Two animals had levels above 10 ppm, suggesting lead poisoning (Blakley, 1984a).

Although Pb is a common cause of poisoning of livestock, especially cattle, in other parts of the world (Blakley, 1984b), poisoning by Pb has not yet been reported in Indonesia. Pb poisoning may be underreported due to still-developing diagnostic and analytical capabilities, or Pb poisoning may occur infrequently reflecting an effect of national development on the availability of sources of Pb. Some materials and farm machinery lubricants (Hammond, 1982), are rarely found on Indonesian farms. On the other hand, Pb in automobile emissions (Falahi-Ardakani, 1984) might be important in Indonesia because animals graze along roadsides and herbage bordering roads is cut for feed. Roadside plants in Jakarta have been reported to contain up to 160 ppm Pb on a dry weight basis (Surtipanti *et al.*, 1983). Grazing animals would also have access to Pb through infestation of soil, possibly an important source (Thornton and Abrahams, 1983).

The Pb levels observed in Indonesian livestock were generally higher than most values reported from other parts of the world (Solly *et al.*, 1981; Kramer

Table 1. Lead levels in animals from 2 slaughterhouses

| Species | ppm lead (mean \pm SD) | | | |
|---------|--------------------------|-------------------|-----------------|-------------------|
| | Liver | | Kidney | |
| | Denpasar | Bogor | Denpasar | Bogor |
| Cattle | 1.56 \pm 2.66 | 1.47 \pm 0.42* | 0.55 \pm 0.48 | 1.49 \pm 2.27** |
| Buffalo | — | 1.65 \pm 0.22 | — | 1.37 \pm 0.25 |
| Sheep | — | 4.44 \pm 4.11 | — | 3.92 \pm 1.56 |
| Goats | 1.42 \pm 0.14 | 3.23 \pm 2.10** | 1.27 \pm 0.23 | 2.94 \pm 1.42** |
| Pigs | 0.86 \pm 0.48 | 1.63 \pm 0.40** | 0.73 \pm 0.30 | 1.18 \pm 0.24** |

* $P < 0.05$ Students t-test, untransformed data, comparing locations

** $P < 0.01$

et al., 1983). The cause of these elevated levels warrants investigation. The apparent difference between the two sampling sites is difficult to interpret since many of the animals sampled in Bogor were actually raised in other parts of Java. Perhaps further study of animals at the farm level will indicate an association of lead levels with industrial activity, farming practices, traffic density or some other factor.

The public health significance of the Pb levels reported here might be considered low in a country with 4 kg annual per capita consumption of protein derived from meat (Sabrani and Knipscheer, 1982). However, certain local dietary habits may lead to high risk of Pb poisoning. In particular, the common practice of supplementing the daily diet of infants and children with liver should be examined, since the developing nervous system is sensitive to Pb toxicity (Roston, 1982).

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the contribution of Gunawan, R.B. Marshall and the Australian Development Assistance Bureau Project No. 5883 administered by James Cook University of North Queensland.

REFERENCES

- BLAKLEY, B.R. 1984a. A retrospective study of lead poisoning in cattle. *Vet. Hum. Toxicol.* 26: 505-507.
- BLAKLEY, B.R. 1984b. The incidence and seasonal characteristic of veterinary toxicoses in Saskatchewan. *Can. Vet. J.* 25: 17-20.
- FALAH-ARDAKANI, A. 1984. Contamination of environment with heavy metals emitted from automobiles. *Ecotox. Environ. Safety* 8: 152-161.
- HAMMOND, P.B. 1982. Inorganic lead in man's environment: sources and toxicological significance. *J. Appl. Toxicol.* 2: 68-74.
- KRAMER, H.L., J.W. STEINER and P.J. VALLEY. 1983. Trace element concentrations in the liver, kidney, and muscle of Queensland cattle. *Bull. Environ. Contam. Toxicol.* 30: 588-594.
- ROSTON, C. 1982. Are we at risk from lead? Part 1. *Fd. Chem Toxicol.* 20: 617-621.
- SABRANI, M., and H.C. KNIPSCHER. 1982. Small ruminants for small farmers. *Ind. Agric. Res. Dev. J.* 4: 86-90.
- SOLLY, S.R.B., K.J.A. REVFEIM and G.D. FINCH. 1981. Concentrations of cadmium, copper, selenium, zinc, and lead in tissues of New Zealand cattle, pigs and sheep. *N.Z.J. Sci.* 24: 81-87.
- SURTIPANTI, S., S. SUWIRMA, Y. SOFYAN and L. THAMZIL. 1983. Studi kandungan Pb dalam rumput di sepanjang jalan Jenderal Sudirman Jakarta. *Majalah Batan.* 16: 51-57.
- THORNTON, I., and P. ABRAHAMS. 1983. Soil ingestion - a major pathway of heavy metals into livestock grazing contaminated land. *Sci. Total Environ.* 28: 287-294.