Tissue Storage in Cadmium Treated Pigs. (21925)

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During an investigation of the ascaricidal activity of cadmium added to the feed of pigs (1,2), cadmium analyses of various tissues were made. The purpose was to determine the extent to which ingested cadmium was retained and to locate the tissues where greatest storage occurred. Although the above authors reported no evidence of toxicity with the dosage of cadmium used, it was considered desirable to see if tissue levels reached concentrations approaching those previously reported in animals showing definite signs of poisoning.

Method. Pigs, varying in weight from 25 to 150 lb, were fed Aska-Rid* in the diet for 72 hours. They were bathed prior to and following treatment and just before autopsy to prevent contamination of tissue samples. They were fed *ad libitum* during the experiment, and no reduction in food intake was noted for the treatment period. With the type ration used for administering cadmium, a 50-lb pig will eat about 2.5 lb per day(2). Thus, the cadmium oxide intake for 3 days would be 510 mg at the 68 mg per lb concentration. The first group received 68 mg cadmium oxide per lb of feed and were sacrificed at intervals of 14 and 30 days following treatment. This is the cadmium concentration recommended for worming pigs when used in a 3-day feeding program. The second group received 91 mg cadmium oxide per lb of feed and were sacrificed at intervals of 1, 3, 7, 14, 60, and 90 days following treatment. The third group received 68 mg cadmium oxide per lb of feed for 3 days. At the end of 6 weeks, they were again treated with feed containing 68 mg cadmium oxide per lb for 3 days. They were sacrificed 30 days after the second cadmium feeding. The fourth group received no cadmium and served as controls. Cadmium determinations were made in duplicate by the dithiozone method of Church(3).

Results. The highest concentration reported (Table) was 1.30 mg of cadmium oxide per 100 g of fresh tissue. This was from the spleen of a pig fed exclusively on 91 mg cadmium oxide per lb feed for 3 days and autopsied one day later.

Cadmium levels in the various tissues drop rapidly with only the kidney and spleen still showing significant increases as long as 14 days after the feeding experiment. Therefore, in subsequent determinations (30, 60, and 90 days after cadmium feeding), only these 2 tissues and the liver were analyzed. The liver was included, as others had reported high levels in this organ(3,4). When 2 feedings are made at a 6-weeks' interval, cadmium storage is greater than on a single feeding, but in no tissue was it as high as 1 mg per 100 g of fresh tissues 30 days after the second feeding.

Most studies reported on cadmium concentration in tissues are following administration by inhalation. Under such circumstances, the highest concentration is usually in the lungs. In fatal or near-fatal doses, this may be as high as 10 mg per g of dried lung tissue in the rat(4). On the other hand, cadmium oxide inhalation experiments in dogs(5) resulted in concentrations of cadmium oxide as high as 13.3 mg per 100 g of fresh kidney tissue. The highest in the liver was 3.9 mg. In these animals, toxicity was not noted nor were definite pathologic changes seen at autopsy. Prodan(6) fed 10 mg of cadmium per day to cats for 2 months. Emesis occurred occasionally during the first few days and ceased. Near the end of the experiment all animals manifested a decreased appetite. Tissue cadmium was 5.62 mg per 100 g of tissue for the liver, 4.65 mg for the kidney, and 1.11 mg for the spleen. Tipton(7) has recently assembled some very revealing data on cadmium con-

* Aska-Rid is the tradename for Pitman-Moore Co. brand of anthelmintic powder containing 1.5% cadmium oxide in an inert diluent.

TABLE I. Distribution of Cadmium in mg %.

Tissue	Untreated pigs	Treated pigs*								Repeat treatment† with 68 mg/lb CdO
		91 mg/lb CdO						68 mg/lb CdO		
		Days following treatment								
		1	3	7	14	60	90	14	30	30
Liver	.05(3)‡	.22	.12	.16	.16	.36(2)	.28(2)	.02(2)	.41(2)	.92(4)
Kidney	.03(3)	1.05	1.04	.53	.41	.23(2)	.16(2)	.38(2)	.27(2)	.65(4)
Spleen	.05(3)	1.30	.84	.91	.35	.46(2)	.24(2)	.05(2)	.53(2)	.92(4)
Blood	.02	.19	.25	.36	.13			.16(3)		
Brain	—	.97	.39	.09	.06			.02(2)		
Heart	—	.59	.25	.07	.00			.04(2)		
Muscle	—	.25	.17	.02	.04			.02(2)		
Stomach tissue	—	.12	.00	.53	.00			.16(2)		
" contents	—	.48	.06	.09	.00			.06(2)		
Ileum	—	1.10	—	—	—			—		
Cecum	—	1.23	.06	—	—			—		
Mid-jejunum	—	.80	.18	.26	.06			.32(2)		
Colon contents	—	—	—	—	—			.02(2)		
Rib bone	—	—	—	.10	.03			.04(2)		
Subcut. fat	.02	—	—	—	—			.11		
Abdominal fat	.02	—	—	—	—			.16		

* All received food containing indicated concentration of CdO for 3 days.
† Same dose repeated 6 wk after first; pigs sacrificed 30 days after second dose.
‡ No. in parentheses indicates No. of pigs from which average obtained. No number in parentheses indicates only tissue from one pig analyzed.

tent of human kidneys obtained at autopsy. On a fresh tissue basis, the average was 3.31 mg of cadmium per 100 g for kidneys and 0.36 mg for liver. There was no known exposure to cadmium in any of these subjects.

Summary. Feeding cadmium oxide-containing food for 3 days at concentrations of 68 mg and 91 mg per lb of food results in cadmium retention in the liver, spleen, and kidneys. The increase is significant when compared to controls but is very low when compared to cadmium levels others have reported by inhalation or feeding. Humans with no known exposure to cadmium have higher cadmium levels in the kidneys than pigs fed cadmium as described above.

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