Bull. Environm. Contam. Toxicol. 24,606-610 (1980)

In Vivo Study on the Storage of Fenitrothion in Chicken Tissues after Long-Term Exposure to Small Doses

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It has been demonstrated that orally administered ^{32}P- or ^{14}C-labeled fenitrothion is readily absorbed from the gastrointestinal tract and rapidly metabolized (MIYAMOTO et al. 1963, MIYAMOTO 1977a). In the blood and brain of guinea pigs and white rats, the radioactivity reached its maximum 1-3 h after treatment and gradually decreased after 12 h (MIYAMOTO et al. 1963). In rats, guinea pigs, dogs, mice and rabbits, the excretion of radioactive metabolites was complete within a few days post-treatment (MIYAMOTO et al. 1963, MIYAMOTO 1977a, ANONYMOUS 1978) and similar results were obtained with Jersey cows and goats (ANONYMOUS 1978, MIYAMOTO et al. 1967, JOHNSON and BOWMAN 1972). Preliminary studies with female Japanese quails indicated that after oral administration, the avian metabolism of fenitrothion is more or less similar to mammalian (MIYAMOTO 1977b). Thus far, no study has been carried out in birds in order to determine whether long-term exposure to small doses of fenitrothion could lead to its storage, thereby representing a potential hazard.

MATERIALS AND METHODS

Male Hubbert chicken (B. King Farm, Moncton, N.B., Can.) weighing about 500 g at the beginning of the experiment were intubated with ^{3}H ring-methyl fenitrothion (spec. act. 19.33 mCi/mmole, NEN Canada) into the stomach at a dose of 10 mg/kg body weight. Intubations were performed twice (at two day intervals) every other week for 2 to 8 weeks. The amount of radioactivity given was about 0.3 mCi per animal per intubation for the first six intubations and about 1.5 mCi for the last one (radioactivity was omitted for the seventh intubation). ^{3}H-Fenitrothion used was diluted with the required amount of technical grade fenitrothion (Chemagro Corp., Kansas City, Mo.) to give a final concentration of 2 mg/mL, then mixed with 20 mM Na^{+} taurocholate and sonicated for 15 min prior to administration (TROTTIER and JANKOWSKA 1979).

0007-4861/80/0024-0606 $01.00

Animals were divided into four lots each consisting of 1 control and 3 experimentals except for lot 1. Controls received 20 mM Na^+ taurocholate only. Lots 1 to 3 (0.5, 1 and 2 month treatment) were sacrificed by decapitation eight days and lot 4 (2 month treatment), 16 days after the last intubation, respectively. Upon sacrifice, tissue aliquots (whole blood, liver, brain and abdominal adipose tissue) were dissolved in Protosol (NEN Canada), decolorized, neutralized and counted in a β-Mate II liquid scintillation counter using Biofluor or Econofluor scintillation fluids (NEN Canada). Radioactivity was corrected for background and quench using tritiated H_2O (NEN Canada) as internal standard. Detection limit was defined as µg equivalents of ^{3}H-fenitrothion per gram (or mL) of tissue corresponding to the background value above chemilumescence, both expressed in cpm.

RESULTS AND DISCUSSION

Table 1 gives the experimental conditions and counting efficiencies for the selected tissues. Table 2 shows the amount of radioactivity found in the various tissues expressed as µg equivalents of ^{3}H-fenitrothion per gram of tissue (wet weight) or mL of blood. The results show that eight days after the last intubation, measurable amounts of radioactivity are found in all tissues examined, except brain. However, there is no evidence of bioaccumulation of radioactivity in these tissues during such a repeated administration of small doses of ^{3}H-fenitrothion.

The results also show a sharp decrease in the radioactivity content of all tissues upon allowing one more week for recovery since the average values then fall to the detection limits in brain and liver; however during the same recovery period, the average decrease in abdominal fat and blood is higher than 40 and 75%, respectively.

The above findings suggest that chicken tissues retain no significant amount of fenitrothion or its metabolites even after a long-term exposure to small doses of this insecticide. The results are thus consistent with Miyamoto's observation where tissue analyses of animals exposed to fenitrothion for prolonged period of time showed no tendency to bioaccumulation (MIYAMOTO 1977b).

TABLE 1. Experimental conditions and counting efficiencies of ^{3}H-fenitrothion for the individual biological media

	Tissue			
	Blood	Liver	Brain	Adipose
Amount of tissue (mL or mg)	0.2	~50	~50	~75
Acetic acid glacial (mL)	-	0.1	0.1	0.1
HCl, 0.5N (mL)	0.5	-	-	-
H_2O_2, (30%) (mL)	0.5	0.1	-	-
Protosol (mL)	1.0*	1.0	1.0	1.0
Econofluor (mL)	-	-	-	10
Biofluor (mL)	15	10	10	-
Total volume (mL)	17.2	11.2	11.2	11.2
% counting efficiency	22.5	30.0	32.0	36.5

* Protosol/ethanol 1:2

TABLE 2. Radioactivity content of chicken tissues after 2 to 8 week treatment with ^{3}H-Fenitrothion and followed by 8 or 16 day recovery period.

Animal	Duration of treatment (months)	Total number of intubations	Time elapsed between last intubation and sacrifice (days)	µg equiv. of ^{3}H-Fenitrothion per g of tissue			µg equiv. of ^{3}H-fenitrothion per mL of blood
				Brain	Liver	Abdominal fat	
1	0.5	2	8	0.033[a]	0.037[a]	0.040[d]	0.044[g]
2				0.019[a]	0.016[a]	0.058[d]	0.030[g]
3	1	4	8	0.031[b]	0.028[b]	0.071[e]	0.060[h]
4				< det.lim.	0.025[b]	0.050[e]	0.026[h]
5				< det.lim.	0.030[b]	0.058[e]	0.027[h]
6	2	8	8	0.058[c]	0.047[c]	0.043[f]	0.057[i]
7				0.068[c]	0.060[c]	0.053[f]	0.086[i]
8				0.037[c]	0.033[c]	0.035[f]	0.044[i]
9	2	8	16	< det.lim.	< det.lim.	0.018[f]	0.005[i]
10				0.010[c]	0.012[c]	0.031[f]	0.011[i]
11				< det.lim.	< det.lim.	0.023[f]	0.004[i]

Detection limits (in ppm): a: 0.011; b: 0.022; c: 0.010; d: 0.007; e: 0.013
f: 0.006; g: 0.004; h: 0.008; i: 0.003

ACKNOWLEDGMENTS

Study was supported by the Conseil de recherches de l'Université de Moncton and Forest Protection Limited, Fredericton, N.B., Canada.

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