Bull. Environ. Contam. Toxicol. (1986) 36:651–655

Environmental Contamination and Toxicology

Pesticide and Polychlorinated Biphenyl Residues in Human Adipose Tissue From Northeast Louisiana

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The persistent presence of organochlorine pesticides in the environment and their bioaccumulation in human adipose tissue has received much attention by researchers in recent years (Kilgore and Li 1973; Kutz et at. 1974, 1976a, b; Morgan and Roan 1971). This investigation is concerned with residue levels in human tissue in a heavily agricultural area such as the area of this study--northeast Louisiana. Earlier baseline studies in this locale were conducted and reported. Comparisons of that data to national averages led to the conclusion that pesticide residue levels in human tissue in a heavily agrarian environment were higher than the national average (Greer et at. 1980).

Pesticides examined in this study included 1,1,1 trichloro-2,2-bis(p-chlorophenyl)ethane (DDT) and its analogues, mirex, dieldrin, heptachlor epoxide, and beta hexachlorocyclohexane (BHC). In addition polychlorinated biphenyls (PCBs) were studied in the form of Aroclor 1260™. These organochlorine compounds were among those that were reported with the highest concentration and occurrence by the EPA National Human Monitoring Program and previous studies done at Northeast Louisiana University (Kutz et al. 1976, Greer et al. 1980).

MATERIALS AND METHODS

Tissue samples were obtained from Saint Francis Hospital in Monroe, Louisiana. Adipose tissue samples were taken during a pathological examination, placed in clean glass containers, and frozen until analysis. The size of tissue samples obtained ranged between 5 and 16 g. For each sample various physical characteristics of the sample donor, residence, and type of sample were obtained. These data are shown in Table 1. Tissue extraction and cleanup were performed basically according to accepted EPA methods. A 5 g sample was dry macerated with sand and Na_2SO_4, and the fat was extracted with three 50-mL portions of hexane. Pesticide residues were isolated by a liquid-liquid partitioning process from a 1 g sample of the oil obtained. The partitioning consisted of dissolving the weighed oil sample in 15 mL of hexane and extracting 4 times with 30 mL of acetonitrile saturated with hexane. The acetonitrile fractions

Table 1. Information of Human Tissue Donors and Location of Tissue in Body.

Sample #	Age	Sex	Location of Tissue	Parish (LA)	% Oil
			1980 STUDY		
1	65	F	leg	Ouachita	86.5
2	75	M	leg	Ouachita	81.9
3	48	F	breast	Richland	66.5
4	65	F	breast	Richland	67.8
5	45	F	omentum	Richland	31.0
6	53	F	abdomen	Richland	54.5
7	56	F	breast	Richland	88.9
8	56	M	arm	a	62.5
			1984 STUDY		
1	73	F	breast	Ouachita	81.0
2	48	F	breast	a	51.1
3	71	M	inguinal hernia	Ouachita	70.7
4	71	M	testicle	Ouachita	49.8
5	61	M	kidney	Union	68.3
6	68	F	colon	Ouachita	61.2
7	31	F	breast	Morehouse	71.7
8	78	M	inguinal hernia	Caldwell	71.6
9	73	M	colon	Ouachita	87.7
10	55	M	colon	Ouachita	74.4

[a] Information not available

were combined, and the pesticides were forced back into hexane by aqueous dilution (200 mL of hexane-extracted water and 50 mL of saturated sodium chloride solution) of the acetonitrile. The hexane fractions were then subjected to cleanup on a Florisil column using elufractions of 15 mL of hexane and 15 mL of 25% methylene chloride in hexane. These factors were concentrated to a suitable volume for gas-liquid chromatographic (GLC) analysis of organochlorine pesticides.

Five mL of the hexane fraction were oxidized with a chromic acid reagent (Trotter 1978). The oxidized sample was transferred to a silicia gel column and eluted with 35 mL of 0.5% benzene in hexane (Underwood 1979). This eluate's volume was concentrated to 5 mL for GLC analysis of PCBs.

All GLC analysis was performed on a Hewlett Packard Level 4 5880A gas chromatograph equipped with a ^{63}Ni electron-capture detector. Two 6' x 2 mm id glass columns containing either (1) 1.5% OV-17/1.95% OV-210 or (2) 5% 210 on 100-120 mesh Chromosorb W(HP) were used for identification and quantification of each residue

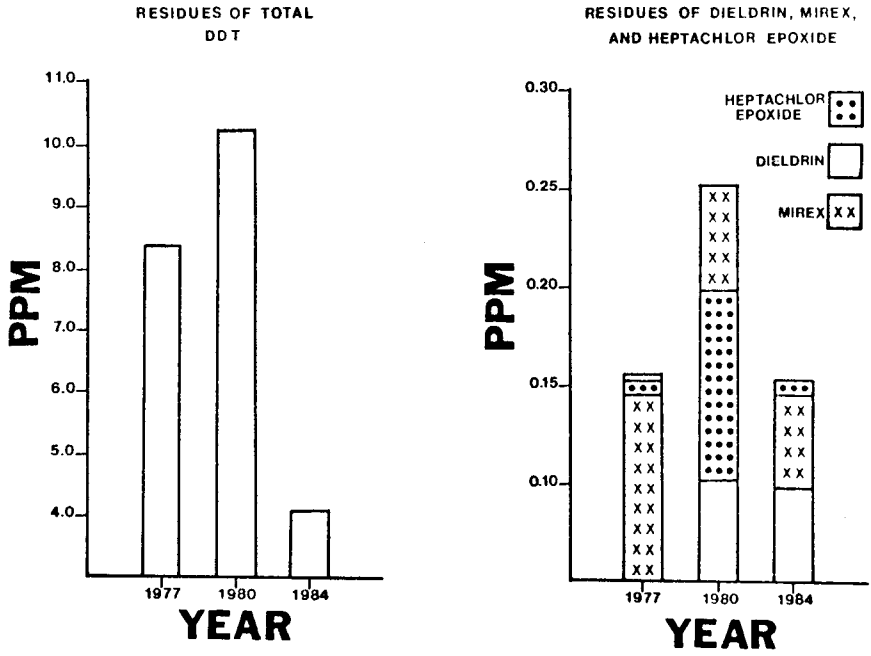

FIGURE 1. Comparison of the concentrations of organochlorine residues from northeast Louisiana. Concentrations are expressed in ppm of lipid basis. Graph represents the geometric mean of the values obtained. Values for 1977 were obtained from the survey done that year (Greer et al., 1980).

reported. The operating conditions were: N_2 flow rate of 35 mL/min; inlet temperature 200 °C; column temperature 175 °C; and detector temperature 300 °C. Pesticide standards used in this work were obtained from the U. S. Environmental Protection Agency, Health Effects Research Triangle Park, N.C. All solvents used were pesticide quality (Fisher Scientific).

RESULTS AND DISCUSSION

The concentration of the various organochlorine residues found in each tissue sample is shown in Table 2. Results of this work were compared with the baseline levels established in the earlier study and are shown in Figure 1 (Greer et al. 1980). No comparison was available for beta BHC or PCBs.

There was a 51% decrease in the total DDT present and a 50% decrease in dieldrin. Heptachlor epoxide had no significant change in its concentration level. Twenty of the 22 samples in 1977 had detectable amounts of mirex, all 10 collected in 1980, and only two of the 1984 samples. Beta BHC had an average concentration of 0.77 ppm in 1980 and 0.62 in 1984. The average residue level of PCBs increased from 1.04 ppm to 1.23 ppm. The increase in the

Table 2. Concentration of organochlorine compounds in individual tissue samples in oil (ppm).

Sample No.	p,p' DDE	p,p' DDD	p,p' DDT	mirex	dieldrin	heptachlor epoxide	beta BHC	PCB
				1980 Study				
1	4.80	NF[a]	NF	0.89	0.17	0.74	NF	1.00
2	5.89	NF	NF	0.86	0.16	0.79	0.63	0.89
3	16.22	1.36	1.80	0.20	0.34	0.02	2.31	2.33
4	7.44	NF	NF	0.26	0.06	0.04	NF	1.75
5	8.28	NF	NF	0.09	0.27	0.03	0.26	0.48
6	8.28	0.15	0.58	0.06	0.07	0.08	0.54	0.38
7	12.13	0.16	0.30	0.10	0.04	0.06	0.77	0.93
8	13.57	0.23	0.63	0.13	0.08	0.15	0.12	0.59
				1984 Study				
1	3.18	0.20	0.52	NF	0.11	0.11	0.59	0.65
2	3.79	0.24	0.53	NF	0.06	0.06	0.51	1.07
3	4.19	0.30	1.61	NF	0.09	0.21	0.71	1.44
4	4.16	0.27	0.70	NF	0.09	0.22	0.68	1.96
5	3.89	0.22	NF	NF	0.10	0.21	0.36	1.33
6	1.10	0.15	NF	NF	0.11	0.13	0.31	1.10
7	1.78	0.12	NF	0.17	0.04	0.06	0.33	1.34
8	7.72	0.29	0.81	NF	0.19	0.18	1.03	1.42
9	2.16	0.15	0.38	0.12	0.09	0.21	0.83	1.02
10	2.19	0.19	0.32	NF	0.09	0.20	0.83	0.93

[a] Not found

PCB concentration was not enough to warrant notice, but there was a leveling of the individual concentrations present in the 1984 samples toward the average. The variation from the average concentration in the 1980 samples was greater.

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Received May 22, 1985; accepted May 25, 1985.