Residues of DDT and its metabolites in human blood samples in Delhi, India

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Abstract

Blood samples from 182 people in Delhi, India, were examined for DDT residues. All except 8 contained DDT and its metabolites. The average total DDT concentration in the whole blood ranged from 0.177 to 0.683 mg/litre in males and from 0.166 to 0.329 mg/litre in females. The DDT metabolites detected were p,p'-*DDE,* p,p'-*DDD, and* o,p'-*DDT. DDE accounted for most of the total DDT.*

Residues of organochlorine insecticides have been detected in both human fat and blood from different parts of the world (*3*). By comparison with levels found in other parts of the world, very high levels of DDT and its metabolites have been reported in the body fat of people in India (*2, 7*). Since there is a definite relationship between amounts of DDT and its derivatives in blood and those present in human depot fat, blood can be used for assessing the total body burden of DDT in various populations (*1*). However, no studies appear to have been published on DDT residues in human blood from India (*3*). For this reason, we investigated residues of DDT and its metabolites in human blood.

Materials and methods

Blood samples from 182 people in various age groups were collected in Delhi in August 1975. The blood was haemolysed by adding an equal volume of double distilled water; 20 ml of hexane was added and the mixture was stirred for 30 min. The hexane fraction was removed after allowing the layers to separate. Hexane extraction was repeated at least twice. When the layers did not separate properly the samples were centrifuged to achieve this separation. The pooled hexane extract was reduced *in vacuo*. Clean up, detection, and quantitative estimation of DDT and its metabolites were carried out as described elsewhere (*8*).

Results and discussion

DDT and its metabolites were detected in all but 8 of the blood samples tested (2 from males, 6 from females) (see Table 1). In males, the range of total DDT was 0.005–8.40 mg/litre and the mean values were 0.177–0.683 mg/litre, the lowest being in the age group 71–86 years and highest in the age group 41–50 years. Especially in males, the total DDT content was comparatively smaller in the age groups 51 years and older. In one male aged 14 years the level of total DDT in blood was very high (8.40 mg/litre). In females, the range of total DDT was 0.02–1.80 mg/litre and the mean values ranged from 0.166 in the age group 61–70 years to 0.329 mg/litre in the age group 31–40 years.

The total DDT content of whole blood samples from the Delhi area is about 10 times higher than values generally reported from other countries (*1, 3*) but somewhat similar to DDT residue levels found in the blood of people connected with the manufacture of DDT (*5, 6*). Compared with males, females generally had lower amounts of total DDT, a result obtained in other studies also (*4*).

A higher concentration of DDT in the blood indicates a higher total body burden of DDT in the population (*1*). The present data agree closely with those reported by Ramachandran et al. (*7*) and Dale et al. (*2*), who found about 10 times more DDT in the body fat of people in India than in that of people from other countries, showing that data from blood samples give an indication of the total DDT content of the body.

Average concentrations of *p,p'*-DDT in blood varied from 0.020 to 0.350 mg/litre in males and from 0.003 to 0.110 mg/litre in females (Table 1). In addition to DDT the blood also contained

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Table 1. Concentrations of DDT and its metabolites in human whole blood samples from Delhi, India

Age group (years)	No. of samples	Range of concentrations and means ± standard error (mg/litre); in parentheses, No. of samples				
		p,p'-DDE	*o,p'*-DDT	*p,p'*-DDD	*p,p'*-DDT	Total DDT
				Males		
10–20	22	0.018–2.275 0.257 ± 0.118 (20)	0.002–0.600 0.073 ± 0.066 (9)	0.009–1.025 0.103 ± 0.090 (13)	0.003–4.500 0.255 ± 0.0479 (22)	0.008–8.400 0.590 ± 0.332 (22)
21–30	37	0.015–0.438 0.138 ± 0.017 (33)	0.001–0.033 0.006 ± 0.002 (18)	0.003–0.144 0.034 ± 0.033 (23)	0.002–0.155 0.039 ± 0.011 (32)	0.0225–0.6280 0.184 ± 0.028 (37)
31–40	27	0.018–0.640 0.193 ± 0.034 (22)	0.001–0.016 0.012 ± 0.002 (10)	0.004–0.063 0.027 ± 0.005 (17)	0.004–0.188 0.043 ± 0.031 (26)	0.005–0.638 0.221 ± 0.032 (26)
41–50	9	0.090–0.451 0.280 ± 0.059 (8)	0.004–0.112 0.030 ± 0.020 (6)	0.001–0.100 0.031 ± 0.021 (7)	0.028–2.500 0.354 ± 0.320 (8)	0.144–2.654 0.683 ± 0.239 (8)
51–60	3	0.026–0.469 0.235 ± 0.141 (3)	0.003–0.009 0.0064 ± 0.002 (3)	0.015–0.050 0.022 ± 0.020 (2)	0.015–0.244 0.106 ± 0.026 (3)	0.043–0.770 0.369 ± 0.212 (3)
61–70	1	0.134 (1)	0.012 (1)	0.028 (1)	0.020 (1)	0.194 (1)
71–86	4	0.040–0.360 0.167 ± 0.100 (3)	—	— 0.01 (1)	0.003–0.090 0.050 ± 0.025 (4)	0.031–0.430 0.177 ± 0.094 (4)
				Females		
10–20	16	0.017–0.420 0.211 ± 0.033 (14)	0.002–0.020 0.011 ± 0.003 (5)	0.001–0.132 0.049 ± 0.011 (11)	0.003–0.130 0.053 ± 0.0173 (15)	0.021–0.516 0.243 ± 0.032 (15)
21–30	29	0.015–0.363 0.114 ± 0.020 (28)	0.003–0.010 0.005 ± 0.004 (16)	0.008–0.110 0.029 ± 0.006 (20)	0.009–0.094 0.039 ± 0.004 (28)	0.047–0.506 0.188 ± 0.022 (28)
31–40	19	0.020–1.425 0.220 ± 0.085 (17)	0.002–0.022 0.006 ± 0.002 (10)	0.003–0.095 0.029 ± 0.002 (15)	0.004–0.466 0.086 ± 0.009 (17)	0.060–1.828 0.330 ± 0.095 (17)
41–50	8	0.035–0.800 0.191 ± 0.163 (7)	0.002–0.012 0.008 ± 0.005 (3)	0.007–0.028 0.015 ± 0.005 (4)	0.009–0.280 0.076 ± 0.017 (7)	0.076–0.850 0.265 ± 0.121 (7)
51–60	6	0.030–0.380 0.151 ± 0.071 (5)	0.001–0.009 0.005 ± 0.005 (2)	— 0.022 (2)	0.015–0.270 0.112 ± 0.051 (3)	0.030–0.470 0.287 ± 0.100 (5)
61–70	1	0.110 (1)	0.004 (1)	0.022 (1)	0.030 (1)	0.166 (1)
71–86	—	—	—	—	—	—

p,p'-DDE, *p,p'*-DDD, and *o,p'*-DDT. DDE was the major metabolite and was generally present in larger quantities than DDT, indicating that DDE is stored in the human body in preference to DDT or its other metabolites. A similar relationship is found in human adipose tissue (*3*) and in many animals (*8*, also unpublished observations of D. V. Yadav et al.).

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