Brief communications

DDT and its metabolites in human body fat in India *

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Abstract

DDE and the o,p′ *and* p,p′ *isomers of DDT were assayed in 94 human biopsy fat samples from hospitals in Delhi by gas chromatography. DDT was present in all except 2 samples at concentrations from 0.17 to 176.5 mg per kg of body fat. The average total DDT content was 21.8±2.9 mg/kg, of which 45.9% was DDE. The average value reported in a similar study in 1965 (24.3 mg/kg, of which DDE constituted 39.7%) was not significantly different from the present value, indicating that the DDT storage status has not since undergone any significant change.*

Because of its low cost, ready procurability, and stability DDT was used in the National Malaria Eradication Programme for nearly two decades in India, with spectacular success. On account of DDT's extreme stability and persistence and its probable indiscriminate use in grain preservation and agriculture, DDT residues have found their way into the food chain and ultimately into the human system, where they are stored in body fat after partial metabolism. The various aspects of DDT storage in human populations and the significance and role of DDT residues in food have recently been discussed in two reports (1, 2). The storage of DDT, its metabolites and dieldrin were studied by Dale et al. (3) in 104 human fat samples from India. It was found that the level of DDT was much higher than in samples from the USA, although the Indians were not specifically exposed to the insecticide. However, no adverse clinical or pathological effects have thus far been reported in human volunteers to whom DDT has been administered over a long period (4, 5). Because of its ease of handling, DDT, if used judiciously and with caution, would still be of use in vector control. As 8 years had elapsed since the previous report (3) on Indian subjects, it was thought that measurement of the current levels of DDT in samples of human fat drawn from the same geographical zone might be useful.

Materials and methods

Ninety-four human biopsy fat samples were collected in 1973 from 3 state hospitals in Delhi, placed in 10% formalin solution and stored at 4°C until assay. The extraction of the samples for DDT was carried out according to the method of de Faubert Maunder et al. (6). Weighed 1–2-g samples of the fat were ground with washed sand in a mortar and repeatedly extracted with hexane. Dimethylformamide was used as an extractant in the clean-up process. After clean-up the hexane extract was passed through a Florisil column (activated at 120°C for 3 hours) about 25 cm long and topped with 2–3 g of sodium sulfate. The column was washed 3–4 times with small quantities of hexane, the combined extracts were evaporated to dryness, and the residue was redissolved in 0.5 ml of hexane. Samples of 5 μl of the final extract were used in the gas-liquid chromatographic analysis. A Packard gas chromatograph[a] equipped with an electron capture detector and 1-mV strip chart recorder was used in the estimations. Quantitative analysis of DDT isomers and DDE in each sample was effected by comparing the peak heights with those obtained from a chromatogram of a mixed insecticide standard of known concentration.

Results and discussion

The DDT values for the body fat of 94 subjects are given in Table 1. The group consisted of 45 males and 49 females, and included 8 children below the age of 5 years. All except 2 samples contained DDE, *o,p′*-DDT and *p,p′*-DDT in varying quantities, total DDT amounting to 0.17–176.5 mg per kg of body fat. As Table 1 shows, there was no significant difference in the DDT content between the sexes. Average total DDT content, calculated after converting the two iso-

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Table 1. Concentration of DDT and its metabolites in the body fat of Indians (mg per kg of body fat), Delhi area, 1973

Group	Age	Statistical value	DDE	*o,p'*-DDT	*p,p'*-DDT	Total as DDT	DDE as DDT(%)
male	7 months–75 years	range	0.16–46.15	0.11–30.50	0.07–47.96	0.17–99.35	8.99–100.00
		mean±SE	10.1 ± 1.6	4.0 ± 1.1	6.8 ± 1.6	21.3 ± 3.9	
		N	45	45	45	45	
female	15 years–65 years	range	0.87–28.06	0.11–43.98	0.16–106.60	2.54–176.54	13.58–95.13
		mean±SE	8.1 ± 0.8	4.2 ± 1.0	9.2 ± 2.5	22.3 ± 4.2	
		N	49	49	49	49	
total	7 months–75 years	range	0.16–46.15	0.11–43.98	0.07–106.60	0.17–176.54	8.99–100.00
		mean±SE	9.1 ± 0.9	4.1 ± 0.7	8.0 ± 1.5	21.8 ± 2.9	
		N	94	94	94	94	

mers and DDE to DDT, was 21.8±2.9 mg per kg of body fat. DDE accounted for 45.9% of this total. In 1965 Dale et al. (3) reported an average total DDT content of 24.3 mg/kg, of which DDE accounted for 39.7%, in 35 Indian samples examined by a similar method. As those figures are not significantly different from the present figures, it appears that there has been no significant change in the storage levels of DDT or its metabolites during the intervening period.

Attempts to correlate epidemiological data on, for example, exposure to DDT through the spraying of residences or particular dietary habits with the DDT content of body fat did not yield positive results. The likely source of the DDT is the food consumed by the subjects. The constancy of the storage levels over a period of 8 years may be attributable to an equilibrium between intake and excretion and an increase in the concentration of the detoxifying microsomal enzyme system. The collection of data on the storage level of DDT among the general population of different states in India should clarify the situation; such a study is contemplated in the near future.

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