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DDT Residues in Human Milk Samples from Delhi, India

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The widespread use of DDT in India has resulted in increased level of the insecticide in ecosystem and, therefore, the potentiality of the possible health hazards has been voiced. DDT-residues excreted in milk have been reported from different parts of the world as reviewed by Jensen (1983); however, very few reports did appear from India (Kalra and Chawla 1981; Slorach and Vaz 1983; Ramakrishnan et al.1985). In fact, there is no report on DDT-content in human milk from Delhi area where higher levels of DDT and BHC in human adipose tissues and blood have already been reported by us (Ramachandran et al.1974, 1984) and others (Dale et al.1965; Agarwal et al.1976). DDT residues in various food commodities from the different parts of India have been reviewed by Dikshith (1978).Higher bioaccumulation of DDT might reflect the higher excretion of residues in milk. We have, therefore, attempted a systematic study to monitor DDT-residues in human milk samples collected from various hospitals of Delhi (India).

MATERIALS AND METHODS

DDT and its metabolites(DDE and op'DDT) were purchased from Aldrich Chemical Co., Milwaukee, Wisconsin. These compounds were recrystallised in 95% ethanol to yield a pure substance. The purity of each compound was judged by Packard Gas Chromatograph equipped with electron capture detector where each substance yielded a single peak. Chromosorb WHP (80/100 mesh) coated with 1.5% OV 17 + 1.95% OV 202 was purchased from Packard Instrument BV, Netherlands. Solvents used for extraction were of AR grade and pre-distilled. Glasswares used in the study were free of residues contamination.

Sixty milk samples (10-15 mL) over 5 mL of benzene were collected from lactating mothers admitted to various hospitals of Delhi.The samples were frozen until analysis which was done within a week. Samples were brought to the room temperature prior to the extraction and clean-up which was done essentially according to the procedure described by Kalra and Chawla (1981). Fat content of milk samples was determined by the method of Polishuk et al. (1977). Residues were finally dissolved in

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0.5 mL hexane and 2 µL was injected into gas chromatograph. Residues were quantitated according to our recently published procedure (Zaidi 1987). Conditions were: Stationary phase,Chromosorb WHP coated with 1.5% OV 17+1.95% OV 202; carrier gas, N_2 (120 mL/min); temperature of detector and column, 195°C each; injection port, 220°C, and outlet, 200°C. Quantitative analysis of DDT and its metabolites were effected by comparing the peak height with those obtained from a chromatogram of standard mixture of pp'DDE, op'DDT, and pp'DDT with a known concentration.

RESULTS AND DISCUSSION

Apart from the excretion of DDT and its metabolites through bile (Paschal et al.1974) and urine (Gold et al.1982; Zaidi et al.1984), milk represents an alternate route of elimination in lactating animals including humans. Sixty milk samples were analysed by GC and the results are shown in Table 1. pp'DDE, op'DDT and pp'DDT were detected in 55 samples in varying proportions; whereas 5 samples showed either none or trace amount of residues. The levels of pp'DDE, op'DDT and pp'DDT in whole milk ranges from 0-2.245, 0-0.683, and 0-2.560 ppm with a mean±SD 0.176±0.382, 0.046±0.011, and 0.122±0.434 ppm, respectively. These values were found considerably lower than those reported earlier from Punjab, India (Kalra and Chawla 1981). Such variation might be expected due to certain factors, viz. magnitude and frequency of application, efficiency of absorption and excretion, age, and nutritional and socio-economic status.

Values calculated for pp'DDE, op'DDT, and pp'DDT on the basis of milk fat were in the range of 0-154.90, 0-10.68, and 0-39.56 mg/kg fat with a mean±SD 7.280±23.240, 1.428±2.697, and 1.597±5.936 mg/kg fat, respectively. As indicated in Table 1, a large variation in individual values was observed.

Table 1. Levels of DDT-residues in human milk samples (1985-86)[a]

Residue		Whole milk (ppm)	Milk fat[b] (mg/kg fat)
pp'DDE	Mean±SD	0.176±0.382	7.280±23.240
	Range	(0-2.245)	(0-154.90)
op'DDT	Mean±SD	0.046±0.011	1.428±2.697
	Range	(0-0.683)	(0-10.68)
pp'DDT	Mean±SD	0.122±0.434	1.597±5.936
	Range	(0-2.560)	(0-39.56)

a: Sixty milk samples were collected from lactating women (age group 20-30 yr) within one week after delivery and analysed by GC.

b: Fat content of milk samples ranges from 1.26 to 7.09% with a mean of 3.66

Results of the present study compared on the basis of milk fat have shown an increased trend in the level of pp'DDE and pp'DDT (1.34 and 1.33 times higher respectively) than those reported from Ahmedabad, India (Slorach and Vaz 1983). This seems obvious due to the continued use of DDT in India and its ultimate translocation to human beings through food chain. The highest level of DDT-content in human milk was ever reported from Guatemala (Olszyna-Marzys et al.1973). During the present study it was observed that pp'DDE account for the major metabolite of DDT excreted in milk and the results are in accordance with earlier reports (Kalra and Chawla 1981; Hayes 1982).

The average daily intake of total DDT determined during this study was about 0.062 mg/kg body wt assuming an intake of 0.6 L milk per day by infant of average wt 3.36 kg which was nearly 12 times higher than the acceptable daily intake (0.005 mg/kg/day) of total DDT prescribed by FAO/WHO (1978). Though these values are several times higher than the acceptable daily intake of DDT, no harmful effects have ever been reported so far to produce injury to the infants who receive mother's milk solely as diet. The toxicological implication of the present level of DDT in milk during this study could not be assessed, however, preventive measures should be adopted to reduce the body burden of DDT to avoid any forthcoming danger due to residues.

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