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Levels of Organochlorine Insecticides in Human Blood from Ahmedabad (Rural), India

V. K. Bhatnagar, J. S. Patel, M. R. Variya, K. Venkaiah, M. P. Shah, and S. K. Kashyap

National Institute of Occupational Health, Meghani Nagar, Ahmedabad-380016, Gujarat, India

Assessment of human exposure to persistent organochlorine insecticides (OCI) through biological monitoring offers a profound criteria to evaluate the magnitude of potential health risk, if any, due to use of these chemicals. Residues of these chemicals especially DDT and HCH have been identified and reviewed in man and his environment from different parts of the world (Hayes 1982; Jensen 1983), however, by comparison very high levels of DDT and its metabolites have been reported in human body fat, blood and milk samples in India (Kaphalia and Seth 1983; Ramachandran et al. 1984; Zaidi et al. 1989). Since there is a definite relationship between the amount of DDT and its residues in blood and those present in human fat depot, blood can be easily be used for assessing the total body burden of persistent OCI in various populations (Brown and Chow 1975). In view of fragmentary reports on the levels of DDT and HCH in human blood samples from India which categorically pertain to the general population of urban areas like Delhi (Agarwal et al. 1976; Ramachandran et al. 1984) and Lucknow (Kaphalia and Seth 1983), we attempted to provide a database on residues of DDT and HCH including other cyclodiene compounds, e.g. heptachlor, heptachlor epoxide, aldrin, oxychlordane, HCB and dieldrin in blood samples collected from general population of Ahmedabad (rural) area.

MATERIALS AND METHODS

DDT and its metabolites (pp'-DDT, op'-DDT, pp'-DDE, pp'-DDD), HCH (α-HCH, β-HCH, γ-HCH), heptachlor, heptachlor epoxide, aldrin, oxychlordane, HCB and dieldrin were obtained as gift from U.S.E.P.A., Analytical Chemistry Branch, Research Triangle Park, N.C. 27711, U.S.A. All solvents of analytical grade were predistilled and checked for any pesticide contamination. Glasswares used in the study were free from residue contamination.

Blood samples (4-6 mL) from 31 male healthy subjects of Ahmedabad (rural) area during 1989-90 were collected by

Send reprint requests to Dr.V.K. Bhatnagar

venipuncture and the serum was separated. Serum samples were stored at 4°C until analysis. These subjects aged between 18-57 yr (mean 28.38 yr), were not occupationally exposed to organochlorine insecticides. Blood serum (0.5 mL) was extracted with 6 mL hexane in round bottom tube for 2 hr on slow speed rotating machine according to the procedure as described by Dale et al. (1966). 5 mL aliquot of hexane layer was quantitatively transferred to an evaporative concentrator tube to which was affixed modified micro-snyder column. The extract was concentrated in a waterbath and the final volume was adjusted to correspond to the expected concentration of the pesticide residue.

A suitable aliquot was injected into Gas Chromatograph (GC, Perkin Elmer 8700) equipped with ^{63}Ni electron capture detector. The assay conditions were: Perkin Elmer, VIT silica capillary column containing 25 QCZ/OV 1701, length-25m, id-0.2mm; carrier gas, argon/methane (90/10) at 15 PSIG; injection port temp 220°C; detector temp 275°C; column temp 215°C; chart speed, 2 cm/min. Quantitative analysis of these chemicals were effected by comparing the peak height/area of unknown concentration to that of external standards of known concentration (Gaul 1966). The minimum detection limits for HCB, α-HCH, γ-HCH, heptachlor, aldrin, β-HCH, oxychlordane, heptachlor epoxide, pp'-DDE, dieldrin, op'-DDT, pp'-DDD and pp'-DDT according to respective retention time were 0.5, 1.25, 1.75, 2.0, 1.8, 10.0, 2.8, 3.0, 5.0, 6.8, 16.0, 8.0 and 60.0 pg/uL respectively.

RESULTS AND DISCUSSION

Standard chromatogram with major peaks of different OCI as per their retention time is shown in Figure 1. Thirtyone serum samples were analysed by GC for OCI and the results are shown in Table 1. Serum level of pp'-DDE, op'-DDT, pp'-DDD and pp'-DDT ranged from 8.642-137.263, 0-3.254, 0-3.134 and 0-27.84 µg/L with a mean of 37.25, 0.335, 1.33 and 8.828 µg/L respectively. However, the total DDT (equivalent sum of pp'-DDE, op'-DDT, pp'-DDD and pp'-DDT) content in serum samples had a mean of 47.745 µg/L in range of 10.348-164.209 µg/L. pp'-DDE was the major metabolite and it alone contributed about 78% of total DDT. All serum samples were contaminated by HCH (equivalent sum of α-HCH, γ-HCH, β-HCH) with an average of 147.935 µg/L which ranged from 34.664-231.474 µg/L. The data on total DDT and HCH is lower than earlier reports from Delhi's population (Agarwal et al. 1976; Ramachandran et al. 1984) but comparable to the data on Lucknow's population (Kaphalia and Seth 1983) and other countries (Hayes 1975). This could be explained either as a descending trend in the bio-accumulation of DDT and HCH in the body or might be a regional variation.

Thirty serum samples were contaminated by heptachlor which ranged from 0-1.936 µg/L with an average of 0.819 µg/L. Heptachlor is readily absorbed via all routes of exposure and