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Organochlorine Residues in Human Blood from Nainital (U.P.), India

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Exposure to organochlorine insecticides HCH and DDT occurs in the environment and enter into the human system through food and other environmental media. They remain in the human system for many years due to their chemical nature (Ahmed et al. 1988). Higher than expected occurrences of these compounds in remote regions are recorded due to long range transport in the atmosphere, precipitation and cold condensation (Blais et al. 1998; Simonich et al.1995). A recent study has shown that five lakes situated in Nainital (altitude 1934 m MSL) U.P. of India are contaminated with high levels of HCH and DDT residues (Dua et al. 1998) despite the fact that these insecticides were not used for public health programme in the past. Present study reports the contamination of HCH and DDT residues in human blood from population residing in Nainital, India.

MATERIALS AND METHODS

Nainital is situated at an altitude of 1934 m (MSL) at southern extremity of lesser Himalaya in Kumaun region of U.P. state. It is located at 29.23° North latitude and 79.3° East latitude. HCH and DDT were not used in the past for vector control programme and their uses in agriculture are also officially banned.

Human whole blood samples spiked on filter papers were collected and processed as described earlier (Dua et al. 1996) during the months of March, July and November. All samples were analysed for HCH isomers and DDT metabolites on Hewlett-Packard 5890 gas chromatograph fitted with Ni^{63} electron capture detector on fused silica capillary TM^5 column PTE (length 30 m, 0.25 mm id) Supelco Corp. USA. Nitrogen was used as a carrier gas @ 2 ml /min (split ratio 1:100). The injector, oven and detector temperatures were set at 210, 190 and 220°C respectively. Level of detection for DDT was 0.1 ng while for HCH was 0.2 ng. Below this value was termed as N.D. (not detected).

RESULTS AND DISCUSSION

The average extraction recoveries of HCH isomers and DDT metabolites from whole blood spiked on filter papers varied from 87 to 92%. The number of human blood samples collected during March , July and November were 35, 37

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and 39 respectively.

Mean concentrations of HCH and DDT in human blood are given in Table 1. July samples contained maximum HCH and DDT residues ranged from 0.73-7.85 mg/L and 1.95-15.54 mg/L respectively.

Table 1. HCH and DDT concentrations in human blood from Nainital

Insecticide	Mean concentration (mg/L)		
	March	July	November
α-HCH	0.59 (0.03-4.65)[a]	0.54 (0.05-1.97)	0.18 (0.05-0.58)
β-HCH	1.51 (0.05-4.57)	1.89 (0.18-4.96)	0 .94 (0.11-6.85)
γ-HCH	0.04 (ND – 0.24)	0.69 (ND – 3.26)	0.20 (0.03-1.03)
Σ-HCH	2.14 (0.19-8.03)	3.12 (0.73-7.85)	1.32 (0.25-7.49)
p,p'-DDE	1.33 (0.1 - 4.21)	1.55 (0.14 - 4.10)	1.37 (0.12 - 4.65)
o,p'-DDT	ND	0.01 (ND-0.150)	ND
p,p'-DDT	1.03 (ND - 4.88)	4.46 (0.78 - 14.29)	2.58 (0.39 - 10.0)
p,p'-DDD	0.37 (ND - 1.75)	0.91 (ND - 2.82)	0.64 (ND - 2.67)
Σ-DDT	2.73 (0.17 - 7.67)	6.92 (1.95 - 15.54)	4.59 (1.04 - 12.62)

ND = not detected. a) values in the parenthesis denotes range.

The difference of HCH and DDT contamination in whole blood between male and female was found nonsignificant while significant seasonal variation was recorded between the samples collected in March, July and November.

β-HCH contributed maximum to the total HCH residue present in all blood samples from three seasons collection with 71.5, 71.26 and 60.9% in March, November and July respectively. β–HCH has been reported to be most persistent (Jensen 1983) and accumulate 10 to 30 times more in fatty tissues than Lindane (Hansen 1980). Moreover α-and γ-HCH are known to isomerize into β-HCH in living organisms (Jensen 1983).

Maximum DDT level was recorded in July month while March samples contained minimum DDT residue. p,p'-DDT was also found maximum in July (64.34%).

p,p'-DDE was found maximum in March (48.06%) followed by samples collected in November (29.6%). High value of p,p'-DDT in July revealed recent exposure while higher p,p'-DDE in March indicated old exposure of DDT (Mehrotra 1985). Traces of o,p'-DDT was also detected in some blood samples collected in July month. Ramesh et al. (1992) observed that the ability of organisms to metabolize DDT into DDE results persistence of DDE in biological system.

Nainital is situated in hilly area with an average temperature ranged from 0- 30°C which is much lower than the adjoining plain areas of India. Therefore, this area behaves as subtropical area with longer organochlorine half-life than other parts of India. Agnihotri (1983) have found a half life of 3-9 months for HCH and DDT from the plains of India. Thus high concentrations of HCH and DDT in human blood from Nainital as compared to reported earlier (Dua et al. 1996; Ramachandran et al. 1984; Saxena et al. 1987; Agarwal et al. 1976) are because of longer half-life of these residues in subtropical climate. It may be noted that HCH and DDT was never used for public health programme in Nainital. Therefore presence of these residues in human blood is due to intake through contaminated food and water besides respiratory route of exposure.

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