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Organochlorine Pesticides in Human Adipose Tissue Collected in Ankara (Turkey) 1984–1985

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The accumulation of organochlorine (OC) pesticide residues in human tissues has been the subject of a number of studies reported during the past two decades. Most interest has centered on DDT and its metabolites and BHC isomers.

The national mean concentrations of OC pesticides which occur at low levels in human adipose tissue have been taken as an index of the average overall degree of exposure of the population to such substances (Abbott et al 1985).

Usage of OC pesticides started in Turkey in 1945. This paper reports the levels of OC pesticides in human adipose tissue in Ankara (1984/1985) and determines the possible trends of the dissappearance of OC pesticides whose use were restricted about 8 years ago. The amount of OC pesticides used in Turkey between 1976 to 1983 were 2219, 2947, 2336, 764, 744, 701, 840 and 487 tons respectively. We herein, compare the levels of some compounds (especially pp'DEE, pp'DDT and Σ DDT) with the previous study done in 1976 (Kayaalp et al. 1979).

MATERIALS AND METHODS

Human adipose tissue samples were taken during surgical operations in Hacettepe University Hospital from 48 patients living in Ankara at least 5 years. The ages of the sample donors varied from 18 to 72 yr, the mean age being 38. The adipose tissue samples were deep-frozen (-20°C) immediately until used in the analysis.

Standards of α-BHC, β-BHC, γ-BHC, pp'DDE and pp'DDT were obtained from Environmental Protection Agency (EPA). The pesticide standard mixture was supplied from Swedish National Food Administration.

100 mg samples were ground with anhydrous sodium sulphate by using a tissue grinder and extracted three times with 4 ml, 2 ml, 2 ml portions of n-hexane. The combined n-hexane extract was evaporated to dryness to determine extractable fat content (Smrek and Needham 1982). Using 8 ml n-hexane as the solvent and adding op'DDD as internal standard, the sample was cleaned up with

the aid of concentrated sulfuric acid (Murphy 1972, Wickström et al. 1983). The extracts were concentrated to appropriate volumes and injected to ECD-GC glass columns packed with 1.5 % OV-17 + 1.95 % OV-202 on Chromosorb WHP (80-100 mesh) for the quantification of the OC levels. The residue levels of OC were calculated by measuring peak heights. Confirmation was routinely carried out using different column, (4 % SE-30 + 6 % OV-210 on Chromosorb WHP).

RESULTS AND DISCUSSION

The means of OC pesticide residues in adipose tissue of Ankara citizens are presented in Table 1.

Table 1. Organochlorine pesticide residues in human adipose tissue in Ankara 1984-1985 (mean ∓ S.D ppm on extractable fat basis).

Total n:48	α-BHC	β-BHC	Σ BHC	pp'DDE	pp'DDT	Σ DDT
$\bar{x}$	0.19	1.52	1.72	5.83	0.62	7.12
S.D	0.20	0.79	0.83	3.31	0.50	4.10
Min.	0.04	0.48	0.54	1.25	n.d.	1.69
Max.	1.02	5.67	5.78	19.20	3.01	24.42

n.d. -not determined

Compared to a previous study (Kayaalp et al. 1979) the average levels of pp'DDE, pp'DDT and Σ DDT are lower as indicated in Table 2.

Table 2. Comparison of OC pesticide residues in human adipose tissue in Ankara

Compound	mg/kg extractable fat	
	Kayaalp et al n:41	Present study n:48
pp'DDE	10.2	5.83
pp'DDT	3.2	0.62
Σ DDT	14.6	7.12
DDE/DDT	3.19	9.40

In addition to the reduced mean levels of OC pesticides (during 1976-1985) it should be noted that the DDE/DDT ratio was increased from 3.19 to 9.40. It is interesting that the ratio of DDE/DDT increases in restricted countries and it is low at places, like India where it is still used (Table 3).

The residue levels of OC pesticides in human adipose tissue by age are shown in Table 4.

Table 3. DDE/DDT ratios in human adipose tissues collected in different countries

Country	Year	pp'DDE	pp'DDT	DDE/DDT	Reference
United States	1955	12.5	7.4	1.69	Hayes et al (1956)
	1961-62	8.6	4.0	1.95	Quinby et al (1965)
	1964	5.1	2.5	1.97	Zavon et al (1965)
	1978	5.91	0.81	7.30	Barquet et al (1981)
Canada	1959-60	3.3	1.6	2.07	Read and McKinley (1961)
	1973	3.23	0.90	3.57	Ritcey et al (1973)
	1976	1.72	0.31	5.53	Mes et al (1982)
	1979-81	3.26	0.16	20.3	Williams et al (1984)
India	1964	11.6	13.5	0.85	Dale et al (1965)
	1982	9.39	9.66	0.97	Ramachandran et al (1984)
United Kingdom	1963-64	2.0	1.1	1.82	Egan et al (1965)
	1965-67	2.0	0.78	2.56	Abbott et al (1968)
	1969-71	1.8	0.52	3.46	Abbott et al (1972)
	1976-77	2.1	0.21	10.0	Abbott et al (1981)
	1982-83	1.3	0.11	11.81	Abbott et al (1985)
Yugoslavia	1976	6.02	0.92	6.54	Jan and Zelenko (1978)
Turkey	1976	10.2	3.2	3.19	Kayaalp et al (1979)
	1984-85	5.83	0.62	9.40	Present Study

Table 4. The residue levels of OC pesticides in human adipose tissue by age

Age Groups (years)		Residue levels (mg/kg) mean ± S.D					
		α-BHC	β-BHC	Σ BHC	pp'DDE	pp'DDT	Σ DDT
20-30 n:6	$\bar{x}$	0.08	0.80	0.87	3.26	0.28	3.91
	S.D	0.02	0.29	0.30	1.59	0.08	1.82
31-40 n:19	$\bar{x}$	0.19	1.53	1.71	5.67	0.62	6.94
	S.D	0.23	0.57	0.60	2.59	0.79	3.15
41 + n:17	$\bar{x}$	0.27	1.78	2.05	6.77	0.72	8.27
	S.D	0.20	1.06	1.06	4.26	0.71	5.36

All OC compound concentrations in adipose tissue increased with age. Except α-BHC levels, there were significant differences in the levels of OC pesticide residues between the 20-30 year and 31-40 year age groups respectively ($P < 0.05$). But there were no significant differences in the levels of OC pesticide residues between the 31-40 year age and 41 + year age groups. This may be explained by the fact that, considering the usage of OC pesticides starting from 1945, there was no significant difference in the exposure period between the latter two age groups.

In conclusion, OC pesticides still have risk potential in terms of environmental pollution although the levels of these compounds have been reduced by restrictions in Turkey.

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