

STORAGE OF PERSISTENT ORGANOCHLORINE INSECTICIDES IN ADIPOSE BREAST TISSUE OF POLISH WOMEN IN 1997-2001

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Introduction

Although manufacture and use of chlorinated insecticides was discontinued in Europe (including Poland) in the 1970s, the residues of these compounds are still detected in samples originating from all ecosystems. These insecticides, due to their resistancy to biotransformation, long half-lives, and lipophilic properties, have biomagnified up through the food chains. Their highest levels are, usually found in adipose tissue of beings at the top of the food chains, including humans^{1,2}. The presence of organochlorine pesticides, especially DDTs, HCHs, PCBs, and dioxins in the environment has generated public and scientific discussion about related toxicological implications for human health. In the last decade the debate has increased about concerning their potential role in disrupting the human endocrine system and related adverse health effects as they have been shown to exhibit estrogenic or antiestrogenic activity in biological tests³⁻⁵. Despite the ban of most of persistent organochlorine compounds in developed countries for almost 30 years, and slow but constant decline of their levels in the environment, the interest in human exposure to these compounds continues.

Methods and materials

The purpose of this study was to survey the current levels of selected organochlorine insecticides and their isomers and metabolites in women's breast adipose tissue which can be an indicator of body burden. A total of 67 samples of adipose tissue from women's breasts were assayed. The samples were taken from non-cancer patients undergoing plastic or benign breast disease surgery from 1997 to 2001 in two Warsaw's hospitals. The majority of donors lived in Warsaw or the Warsaw area, and were from 15 up to 74 years (average 43,7"13,6; see the age structure shown in Fig. 1). The adipose tissue samples were kept frozen at -20 °C until analysis. The identification and quantification of compounds analyzed (α -, β -, γ -, δ -HCH, oxy-chlordane, heptachlor, p,p'-DDT isomers and metabolites) was performed at the Department of Environmental Toxicology of National Institute of Hygiene in Warsaw. The analytical procedure⁶ included extraction with n-hexane, clean-up with concentrated sulphuric acid and analysis was by gas chromatography with electron capture detector with ion-trap mass spectrometric confirmation. To assure the quality of the results, the laboratory simultaneously used the same method in the international proficiency testing scheme (UK FAPAS). In addition, certified reference materials and own fortified samples were routinely analyzed as a part of international quality assurance procedure.

Results and discussion

In all the samples analyzed, p,p'-DDE, p,p'-DDT and β -HCH were present with p,p'-DDE, found to be dominant analyte. For this reason it is often used as a surrogate of past exposure to all sources of

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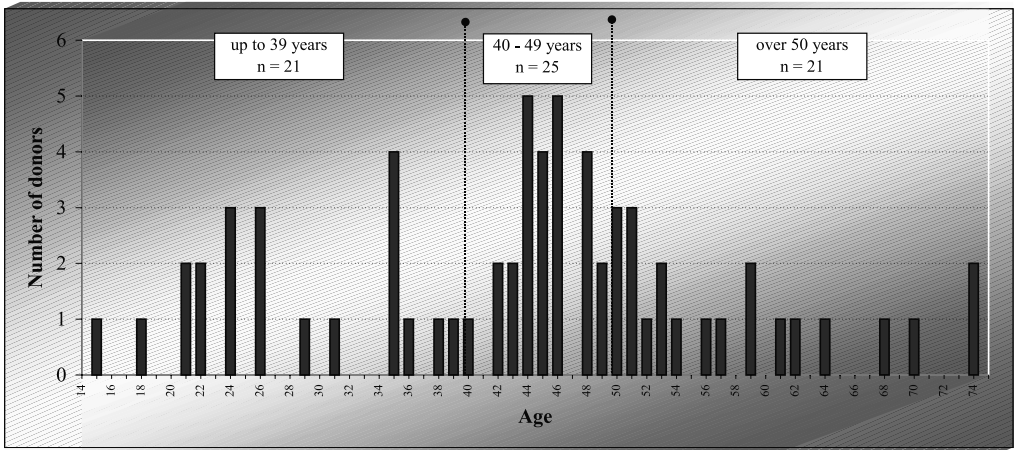


Figure 1. Age distribution among adipose tissue sample donors

DDT and DDE⁷. The levels of the remaining compounds: α -, γ -, δ -HCH, p,p'-DDD, oxy-chlordane, heptachlor and o,p'-DDTs were usually slightly beyond or below the method quantification limits (0,0025 – 0,0060 mg/kg of fat). The frequency of detection, expressed as a percentage of positive samples and the range of organochlorine insecticides levels determined, are presented in Table I. The results for DDTs and b-HCH are 3 to 6 times lower than the levels of these compounds in women's abdominal adipose tissue assayed roughly 10 years earlier in the same laboratory and using the same analytical procedure⁸.

Table I. Percentage of positive samples, mean and standard deviation, median and range of organochlorine residue levels determined in women's adipose tissue samples (mg/kg of fat)

Compound	Quantification limit	%	Mean \pm SD	Median	Range
α -HCH	0,0025	1,5	0,0027 \pm 0,0014	0,0025	0,0025 – 0,0141
β -HCH	0,0025	100	0,0635 \pm 0,0473	0,0498	0,0026 – 0,2302
γ -HCH	0,0025	28,4	0,0070 \pm 0,0086	0,0025	0,0025 – 0,0336
δ -HCH	0,0025	0	-	-	-
oxy-chlordane	0,0050	25,4	0,0070 \pm 0,0039	0,0050	0,0050 – 0,0215
Heptachlor	0,0025	43,3	0,0098 \pm 0,0141	0,0025	0,0025 – 0,0799
p,p'-DDT	0,0060	100,0	0,0720 \pm 0,0460	0,0569	0,0140 – 0,2702
o,p'-DDT	0,0060	16,4	0,0097 \pm 0,0091	0,0060	0,0060 – 0,0409
p,p'-DDD	0,0050	83,6	0,0182 \pm 0,0167	0,0135	0,0050 – 0,0954
o,p'-DDD	0,0050	0	-	-	-
p,p'-DDE	0,0025	100,0	0,7700 \pm 0,6317	0,5375	0,0322 – 2,9402
o,p'-DDE	0,0050	13,4	0,0061 \pm 0,0033	0,0050	0,0050 – 0,0225

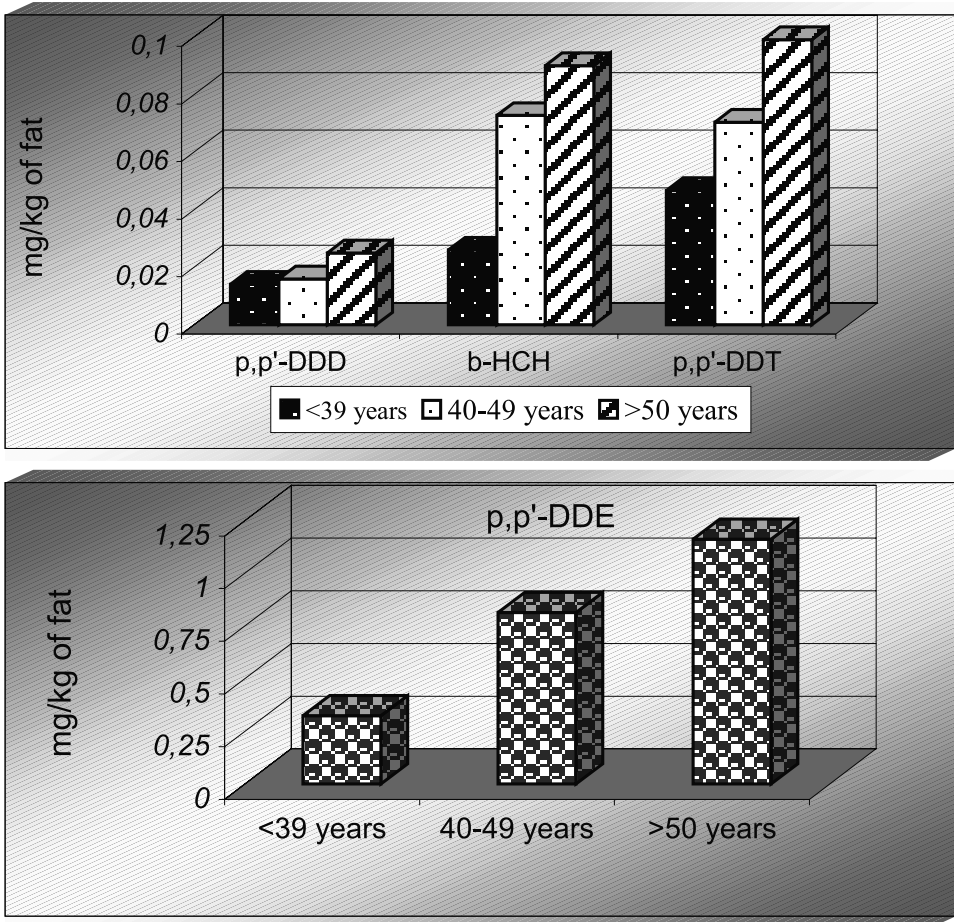


Figure 2. Concentration of selected organochlorine compounds in different age groups

It is known from other studies that there is a positive association between age and organochlorine compounds levels⁸⁻¹⁰. Present results confirm this observation (Fig. 2). After dividing donors into three age groups: below 39 years, 40 – 49 years, and beyond 50 years the influence of age on OCP levels is clearly visible. In the case of compounds present in all samples, the results for the oldest group were 2,1 to 3,6 times higher than the youngest group (premenopausal, still in reproductive age). The comparison is as follows: for β -HCH – 0,0901 “ 0,0498 vs. 0,0260 “ 0,0164, for p,p'-DDE – 1,1629 “ 0,6352 vs. 0,3248 “ 0,2311, and for p,p'-DDT – 0,0991 “ 0,0562 vs. 0,0467 “ 0,0205. All of this differences were statistically significant ($p \neq 0,05$).

The results obtained in the study presented here are similar to levels of organochlorine insecticides reported in mammary and abdominal adipose tissue in other European countries and in the USA¹¹⁻¹⁴. The positive association of age and organochlorine compounds evident in these studies, seem to be a

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direct effect of time of exposure to these compounds used worldwide in large quantities until the 1970s. It is worth noting that relatively high levels of insecticide residues (and their metabolites) have been detected in donors who were born even 10 – 15 years after most countries introduced severe restrictions or banned the use of organochlorine insecticides in agriculture. This may be cause for anxiety due to potential of these compounds to promote toxic effects in the breast epithelial cells, which give rise to breast tumours.

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