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Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) in Human Serum Collected from the General Population from Zagreb (1985–1990)

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The blood reflects the level of absorption of organochlorine pesticides and polychlorinated biphenyls (PCB) in the human body; these compounds are present in much higher concentrations in serum or plasma than in erythrocytes. The results of a five-year monitoring study (1985-1990) on levels of the DDT-complex, HCH-group of isomers, hexachlorobenzene (HCB) and PCB in human sera are presented in this paper. Samples were collected in Zagreb, an industrialized continental town in the Republic of Croatia. The results of the present study are compared with those obtained and published earlier for the same area and for two other areas of Croatia over the period 1975-1990.

MATERIALS AND METHODS

Blood was sampled by venipuncture, and the serum was kept frozen until analysis. Serum samples were extracted with hexane and the extract was purified with sulphuric acid using the same procedure as described previously; the gas chromatographic determination was done under the same conditions as described earlier (Krauthacker 1991). The total PCB were determined using Aroclor 1260 as standard.
The recoveries were from 40 to 89 % depending on the compound determined. All results were corrected for recoveries. Determination limits were 0.5 ug/L for HCB, HCH-isomers or DDT complex, and 1 ug/L for PCB.

RESULTS AND DISCUSSION

Samples were collected from four groups of persons living in the capital of Croatia, which is also a city with the largest number of industries in the Republic. The total number of samples was 97. The year of sampling, number of samples, and age of donors are given

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in Table 1. Two groups from whom samples were taken in 1985 and in 1987/88 were persons who were not occupationally or accidentally exposed to organochlorine pesticides and PCB. The samples collected in 1989/1990 were collected from male electrical workers with occupational exposure to PCB but not to organochlorine pesticides.

Table 1. Concentrations (ug/L) of organochlorine compounds in serum determined in four population groups from Zagreb.

Year	1985	1987/88	1989/90	1990
N	15	24	26	32
F/M	4/11	18/6	0/26	19/13
Age(yr)	17-53	23-47	22-55	24-56
HCB				
-Median	1	0.9	1	0
-Range	0-4	0-3	0-7	0-4
-n	12	15	25	8
alpha-HCH				
-Median	0	0	0	0
-Range	0-0.5	-	-	0-1
-n	6	0	0	1
beta-HCH				
-Median	0	0	0	0
-Range	0-4	0-3	0-1	-
-n	1	11	1	0
gamma-HCH				
-Median	0	3	0	0.5
-Range	0-4	0-26	0-7	0-9
-n	7	22	6	19
p,p'-DDE				
-Median	7	4	8	2
-Range	2-48	2-9	2-24	0-28
-n	15	24	26	30
PCB				
-Median	4	3	8*	8
-Range	3-30	0-26	4-210*	3-36
-n	15	22	26*	32

0=below detection limit, N=number of analysed samples, n=number of positive samples, F/M=female/male.
Results are corrected for recoveries.
* Published in Krauthacker (1990)

The fourth group from whom samples were collected in 1990 were workers employed in the distribution and packing of seeds treated with different pesticides. It was expected that this group absorbed organochlorine compounds over the levels of the general population.

All samples were analysed for HCB, alpha-, beta- and gamma-HCH, p,p′-DDE, p,p′-DDD, p,p′-DDT and PCB. The results are given in Table 1. Concentrations are expressed per volume of serum. All concentrations are given as medians and ranges. None of the analysed samples contained p,p′-DDD and p,p′-DDT. p,p′-DDE and PCB were found in all but two analysed samples. HCB was present in approximately half of the analysed samples depending on the group. The presence of alpha- and beta-HCH was established in only 20 analysed samples. Predominantly, the concentrations of HCB and HCH isomers were close to the detection limit; the exception was a sample with 26 ug/L of gamma-HCH. p,p′-DDE and PCB concentrations were slightly higher. In the samples collected in 1989/90 a wide range of PCB was found probably due to occupational exposure (the highest value was 210 ug/L). The group of workers employed in packing and distribution of treated seeds had the same level of organochlorine pesticides as the other three groups, indicating that no recent exposure to organochlorine pesticides had occurred. The small differences in medians and the overlapping ranges in the five-year follow-up did not demonstrate any marked trend. However, a downward trend was evident when the present results were compared with our earlier results which were recalculated from geometric means to medians (Table 2).

Table 2. Median concentration (ug/L) of organochlorine compounds in human serum collected from general population during 1975-1990

Site	Year/N	HCB	Alpha -HCH	Beta -HCH	Gamma -HCH	p,p′ DDE	p,p′ DDD	p,p′ DDT	PCB
Zagreb*	1975/147	NA	<1	NA	<1	31	<5	<5	NA
*	'76-7/11	NA	<1	NA	<1	33	<2	<2	NA
*	'77-9/35	NA	<1	NA	<1	18	<2	<2	NA
	1985/15	1	<0.5	<0.5	<0.5	7	<0.5	<0.5	4
	'87-8/24	0.9	<0.5	<0.5	3	4	<0.5	<0.5	3
	'89-90/26	1	<0.5	<0.5	<0.5	8	<0.5	<0.5	8
	1990/32	<0.5	<0.5	<0.5	0.5	2	<0.5	<0.5	8
Krk*	1977/44	NA	<1	NA	<1	18	<2	<2	NA
Labin#	1989/10	2	2	18	<0.5	6	<0.5	<0.5	7
Klakar*	1979/41	NA	<1	NA	<1	7	<2	<2	NA

N=number of analysed samples, NA = not analysed
* Krauthacker et al. (1980) (recalculated data)
# Krauthacker (1991)

For the same Zagreb city area the median concentration of p,p′-DDE dropped about ten times. The downward trend was also evident for the same compound in the northern

Adriatic area when two groups of samples from the island of Krk and the town Labin were compared. The serum samples collected in 1979 from residents of Klakar (a village in central Croatia) also had lower concentrations of compounds than those from our urban population, but were at about the same level as those found in urban populations ten years later. For other compounds the trend was not clear, because the concentrations were below the detection limit which was higher at the beginning of the fifteen-year study period than at present. The occurrence of compounds was, however, more frequent earlier than today. PCB were found in all, but two, analysed samples. In the present five-year follow-up study median PCB values were lower in two groups analysed before 1989 than in three groups (including the group from Labin) analysed in 1989 and 1990. In all analysed groups the ranges were overlapping. A downward trend in concentrations of organochlorine pesticides and their metabolites was expected because of restrictions in their use introduced almost twenty years ago. PCB are still in use and increasing blood concentrations might therefore be expected.

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