POLYCHLORINATED BIPHENYLS (PCB) IN HUMAN FAT TISSUE

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Abstract:

Human fat tissue was examined for the contamination with PCBs including the six PCB indicator congeners established by the German Guidelines for Maximal Quantities of Contaminants as well as PCB No. 49 and the mixed-inducers, PCB Nos. 156, 170 and 189.
The material examined was primarily contaminated with higher-chlorinated biphenyls. Low-chlorinated biphenyls that were detected, included PCB No. 49, 52 and 101. The percentage of mixed inducers Nos. 138, 156, 170 and 189 amounted to 40% of the total contamination with PCB congeners. A positive correlation was seen between increasing age and PCB contamination in fat tissue.

Introduction:

At present, only older studies are available on contamination of human fat tissue with PCB congeners in the Federal Republic of Germany [1]. The aim of the present study was to obtain up-to-date data on the contamination of human fat tissue with the six indicator congeners listed in the German Guidelines for Maximal Quantities of Contaminants [2]. Additionally, three PCBs of the mixed-inducer type [3,4] and 2,2',4,5'-tetrachlorobiphenyl were included in this study. The latter congener has demonstrated tumour-initiating properties in in vivo experiments [5].

Experimental Part:

Fat tissue samples (post-mortem material from 1987, n = 75) were prepared for testing of PCB Nos. 28, 49, 52, 101, 138, 153, 156, 170, 180 and 189 by Soxhlet extraction. The extracts were purified on basic aluminium oxide and silica gel, then subjected to capillary gas chromatography on two 30m capillary columns of differing polarities. In order to test the reliability of the results, random samples were examined by mass spectrometry [6].

Results and Discussion:

Table 1 shows the concentration of the PCB congeners tested in human fat samples:

Table 1. PCB congeners in human fat (Post-mortem material from 1987, n=75) μg/kg fat

PCB No.	28	52	49	101	138	153	156	170	180	189	Total[§]
x	0	0	0	10	560	707	86	215	588	6	2172
min	0	0	0	0	71	86	11	0	55	0	223
q1	0	0	0	7	269	375	47	55	315	4	1072
x	0	0	0	10	427	547	65	155	455	5	1664
q3	0	0	0	12	671	906	102	320	723	7	2741
max	0	14	18	27	3649	3703	334	833	3398	19	11995

[§] Total of all the PCB congeners measured
0 represents <1μg/kg fat

The results shown in Table 1 demonstrate that human fat tissue is principally contaminated with high-chlorinated biphenyls as well as with PCB No. 101 and in a few cases, Nos. 49 and 52. This confirms the results of other authors who showed the presence of low-chlorinated biphenyls in fat tissue of deceased persons who had not been subjected to exceptional exposure [7]. The concentration of mixed-inducer PCBs (Nos. 138, 156, 170 and 189) made up 40% of the total PCB contamination (based on median values).

Table 2 presents the contents of the PCB congeners examined in relation to the age of the deceased person:

Table 2. Contents of polychlorinated biphenyls in human fat tissue according to age (Median value, μg/kg fat)

	PCB No.							
Age group	101	138	153	156	170	180	189	n
to 30 years	7	161	204	32	63	135	0	5
to 50 years	9	246	386	50	125	330	4	11
to 60 years	9	431	552	77	55	478	6	18
to 70 years	10	412	618	71	251	515	6	20
> 70 years	10	605	768	92	222	538	6	21

0 represents < 1μg/kg fat

The concentration of PCB congeners in fat tissue is clearly dependent upon age, as seen in Table 2. Similar results have been shown by other authors for total PCB concentration [7,8].

The results of this study show that human fat tissue is contaminated with high- as well as with low-chlorinated biphenyls (PCB Nos. 49, 52, 101 - Table 1). Of special importance in this regard is the presence of mixed inducers detected in the fat tissue. These PCBs are less toxic than 2,3,7,8-TCDD and its related Ah-receptor-binding dioxins [3,4], however, they occur in much higher concentrations and can therefore be considered of similar importance.

References

1. Senatskommission zur Prüfung von Rückständen in Lebensmitteln der Deutschen Forschungsgemeinschaft (1988): Mitteilung XIII. Polychlorierte Biphenyle. Deutsche Forschungsgemeinschaft (Hrsg.). VCH Verlagsgesellschaft mbH, Weinheim.

2. VDLUFA Schriftenreihe (1985): Heft 12 Rahmenkonzept für die Routineanalytik von polychlorierten Biphenylen. VDLUFA Verlag, Darmstadt

3. S. Safe (1984): CRC Crit. Rev. Toxicol. 13, 319 - 395

4. L.G. Hansen (1987): In: Safe, S., Hutzinger, O. (eds) Environmental toxin series, 1. Polychlorinated Biphenyls (PCBs): Mammalian and environmental toxicology. Springer Verlag, Berlin Heidelberg New York, pp 15 - 48

5. R.J. Laib, N. Rose, H. Brunn (1990): This volume.

6. H Brunn, S. Georgii, V. Stojanovic, R. Flemmig, R. Thalacker (1989): Dtsch. Lebensm. Rdsch. 85, 239 - 246

7. Y. Mori, M. Kikuta, E. Okinaga, T. Okura (1983): Bull. Environ. Contam. Toxicol. 30, 74 - 79

8. J. Mes, D.J. Davies, D. Turton (1982): Bull. Environ. Contam. Toxicol., 28, 97 - 104