Organohalogen Compounds, Volume 61, Pages 151-154 (2003)

CONCENTRATION OF POLYBROMINATED DIPHENYL ETHERS (PBDES) IN HUMAN SAMPLE IN JAPANESE

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Introduction

Polybrominated diphenyl ethers (PBDEs) are used for many plastics used in the car, textile, television, personal computer, etc. The amount of production has reached 40,000t in 1992. The environmental pollution of brominated flame retardants have been a serious problem in the recent years. However, research concerning human exposure is seldom performed.

The toxicity of PBDEs is reported to be an antagonist of thyroid-hormone (T4) [1, 2], and inhibition of aryl hydrocarbon (Ah) receptor, since PBDEs are structurally similar to PCBs and behave work as an antagonist like PCBs [3].

We presented the level of human exposure to PBDEs among Japanese in Dioxin 2002[4]. We reported PBDEs levels in the bile, blood and liver from autopsy cases.
In this study, we measured PBDEs in the additional autopsy cases to full fill the sex and age category.

The purpose of this study was to investigate human exposure and distribution of PBDEs in the human body among Japanese.

Materials and Methods

Chemicals

Authentic PBDEs and $^{13}C_{12}$-PBDEs were purchased from Cambridge Isotope Laboratories, Inc. (U.S.A.). All solvents and reagents used were of dioxin-analysis grade.

Samples

The bile from the gall bladder, cardiac blood and the liver tissue were obtained from 10 cadavers at autopsy with the permission of the bereaved families, and were stored at –80 until analysis.

Preparation of samples

1.Blood, Liver and Bile

The method reported by Hirai T. *et al.* [4] was applied.

2. Adipose tissue and Kidney

About 0.5-2 g of tissue was homogenized in the presence of the five fold of sodium sulfate and transferred to a 100 ml tube. Then, $^{13}C_{12}$-isomers were added. A lipid fraction was obtained by extracting with acetone / *n*-hexane (2:1) method [5].

Clean-up and HRGC / HRMS analysis

The method reported by Hirai T. *et al.* [4] was applied.

Results and Discussion

Level of PBDEs in the bile, blood, liver, adipose tissue and kidney

The level of PBDEs in the bile, blood, liver, adipose tissue and kidney are summarized in Table 1. The total pg / g lipid were almost the same among the bile, blood, liver, adipose tissue and kidney at 2953±2916, 3682±3395, 4001±3191, 5399±4826 and 4050±2849 respectively (Table 1). Among 25 congeners, the contribution of 2,2',4,4'-TetraBDE (#47) and 2,2',4,4',5,5'-HexaBDE (#153) were the most, accounting for more than 70% of the total amount in all these organs and fluids.

The characteristics of organ distribution of predominant PBDE congeners were determined (Table 2). Ratios of the pg / g lipid in the bile to the blood were between 1.1 and 2.2, indicating that distribution in these body fluids of each congeners was almost the same. The similar trends were obtained from the liver, blood, bile and adipose tissue. PBDE congeners was considered to equally distributed over the human body.

Relationship between PBDEs level and disease at death

Twelve of 20 cases died of malignant changes: three lung cancer, two liver cancer, one cancer in esphageal, rectun, bileduct, breast and uterus/ovary, one uterine sarcoma, one leukemia (Table 3). Total PBDEs level ranged from 0.8 to 5.9 ng / g lipid in blood. However, there was no association between cancer diagnosis and the level of PBDEs. In addition, there was no difference by sex , although there was a tendency to increase by age.

Accumulation rate of PBDEs in the bile, blood, liver and adipose tissue

We examined age accumulation rates of PBDEs in bile, blood, liver and adipose tissue, for total PBDEs level. Regression analysis between the total PBDEs level and age revealed that there is no statistically significant correlation in these organs and fluid, with correlation coefficients of below 0.2 (Fig. 1). Since the number of samples from younger age was small, and actually we did not examine samples from less than age 40, it is necessary to confirm this point.

Table 1. PBDEs levels in the bile, blood, liver, adipose tissue and kidney

	Mean ± S.D. (pg/g-lipid)				
	Bile (N=20)	Blood (N=20)	Liver (N=20)	Adipose tissue (N=20)	Kidney (N=5)
2,3',4',6-TetraBDE (#71)	127.5±236.8	88.6±176.0	121.9±118.8	98.7±158.4	113.0±127.2
2,2',4,4'-TetraBDE (#47)	703.4±827.8	1185.7±1868.8	1382.1±2215.1	1311.9±1292.6	913.4±616.6
2,2',4,4',6-PentaBDE (#100)	199.6±195.6	294.8±324.0	221.7±126.8	515.1±488.9	313.3±220.7
2,2',4,4',5-PentaBDE (#99)	141.0±151.6	217.0±245.6	180.3±163.5	243.9±244.8	203.3±107.9
2,2',4,4',5,5'-HexaBDE (#153)	1424.9±2151.7	1328.2±973.2	1554.8±2034.0	2441.4±3639.2	2001.7±1960.6
Total (25 congeners)	2952.6±2915.8	3682.4±3395.3	4001.0±3191.0	5399.3±4826.1	4049.7±2849.3

Table 2. Comparisons of PBDE congeners levels among the bile, blood, liver and adipose tissue

	Mean ± S.D.					
	Bile / Blood	Liver / Blood	Adipose tissue / Blood	Liver / Bile	Adipose tissue / Bile	Liver / Adipose tissue
2,3',4',6-TetraBDE (#71)	1.1 ± 0.6	1.5 ± 0.6	1.4 ± 0.8	2.7 ± 3.1	2.3 ± 1.8	1.2 ± 0.7
2,2',4,4'-TetraBDE (#47)	1.6 ± 1.5	1.2 ± 0.4	1.6 ± 0.7	3.3 ± 3.6	4.3 ± 5.9	1.0 ± 1.2
2,2',4,4',6-PentaBDE (#100)	1.6 ± 1.5	1.1 ± 0.4	1.7 ± 0.7	2.3 ± 2.3	3.9 ± 3.8	0.7 ± 0.5
2,2',4,4',5-PentaBDE (#99)	2.2 ± 2.6	1.3 ± 0.6	1.6 ± 0.7	3.4 ± 3.0	4.6 ± 4.6	0.9 ± 0.9
2,2',4,4',5,5'-HexaBDE (#153)	1.5 ± 1.3	1.1 ± 0.5	1.8 ± 1.1	2.3 ± 2.2	4.2 ± 5.9	0.7 ± 0.4
Total (25 congeners)	1.3 ± 1.0	1.2 ± 0.4	1.7 ± 0.9	2.4 ± 2.4	3.8 ± 5.1	0.8 ± 0.6

Table 3. Total PBDEs levels and diagnoses at death

Total PBDEs levels (25 congeners) [ng/g-lipid]					Age	Sex	Disease
Blood	Liver	Bile	Adipose tissue	Kidney			
1.5	1.5	3.5	3.4	8.8	49	M	Liver cancer
0.77	1.4	0.37	1.9	1.5	54	M	Renal insufficiency
14	4.6	7.3	13.5	4.3	50	M	Spesis
1.4	1.9	1.5	2.6	3.1	73	M	Esphageal cancer
1.6	1.5	0.61	2.4	2.1	90	M	Aneurysma
2.9	3.3	1.4	4.3	-	58	M	Multiple organ insufficiency
4.8	8.7	8.7	20	-	76	M	Rectum cancer
1.4	1.9	0.73	2.4	-	65	M	Lung cancer
5.7	5.7	7.6	13	-	64	M	Lung cancer
1.2	1.3	0.71	2.0	-	63	M	Cerebral hemorrhage
3.0	3.4	2.2	4.7	-	58	M	Liver cancer
2.2	4.2	2.7	4.1	-	77	F	Uterus/Ovary cancer
9.6	11	3.2	3.4	-	85	F	Cerebral hemorrhase
1.9	2.5	0.21	5.1	-	86	F	Bileduct cancer
4.0	1.9	1.3	4.3	-	49	F	Vena cava thrombosis
6.0	5.7	2.6	7.8	-	68	F	Breast cancer
1.8	1.7	0.75	3.2	-	55	F	Uterine sarcoma
2.3	3.5	1.6	5.9	-	53	F	Athsma
0.92	1.1	0.31	1.4	-	59	F	Lung cancer
0.88	1.1	0.62	2.1	-	44	F	Leukemia

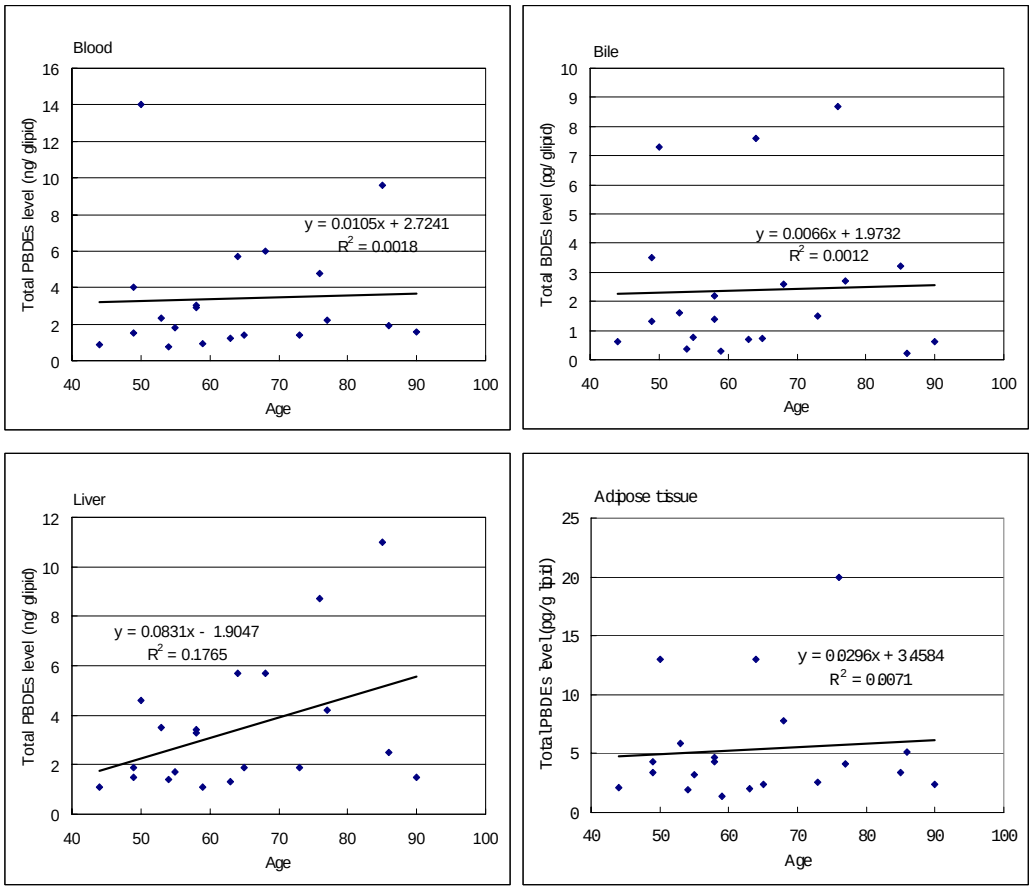

Fig. 1. Relationship between age and total PBDEs levels in the bile, blood, liver and adipose tissue

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