

Table 4 (continued)

	Number detected	Concentration, ng/g lipid (age 20–39)				Number detected	Concentration, ng/g lipid (age 40–60)				Ratio older/younger	
		Mean	SD	Median	Max		Mean	SD	Median	Max		
HCB	53	18.6	10.7	18.1	43.5	23	37.0	17.9	33.6	13.9	84.7	2.0
β-BHC	42	17.5	13.4	18.0	40.6	33	27.9	16.1	25.8	5.5	78.4	1.6
	49	446	569	236	3456	23	910	976	670	151	4830	2.0
Heptachlor epoxide	35	183	129	134	600	33	903	922	618	79	4546	4.9
	47	4.4	3.9	3.2	21.7	22	5.8	3.3	5.1	1.5	13.4	1.3
Dieldrin	37	5.3	4.1	4.4	20.7	32	7.7	5.0	6.5	1.4	21.5	1.5
	52	9	5	8	31	23	13	10	9	3	45	1.5
<i>p,p'</i> -DDE	42	18	22	12	125	33	34	59	16	4	274	1.9
	52	307	197	262	858	22	373	166	390	92	619	1.2
<i>p,p'</i> -DDD	41	267	180	252	932	33	570	316	580	94	1598	2.1
	53	6.9	4.0	6.1	21.4	23	10.2	7.2	9.7	1.2	25.2	1.5
<i>p,p'</i> -DDT	42	7.9	5.1	6.8	25.3	33	14.9	10.1	11.8	2.2	39.6	1.9
	53	32	19	27	94	23	51	43	35	11	139	1.6
<i>t</i> -Chlordane	40	33	24	24	101	33	53	39	40	7	157	1.6
	49	1.3	1.1	1.1	6.6	22	1.0	0.8	0.8	0.2	3.8	0.8
<i>c</i> -Chlordane	40	1.1	0.7	0.9	2.8	29	1.5	1.1	1.1	0.3	4.8	1.3
	51	3.8	3.2	2.9	15.6	23	2.7	1.3	2.4	0.5	4.9	0.7
<i>t</i> -Nonachlor	36	3.9	2.5	3.4	10.5	31	4.7	3.1	3.8	0.1	12.3	1.2
	53	48	52	36	375	23	63	30	51	22	133	1.3
<i>c</i> -Nonachlor	42	62	47	50	221	33	133	114	98	27	566	2.1
	50	6.6	5.4	5.6	30.2	23	13.1	8.3	11.5	2.1	30.8	2.0
Oxychlordane	42	9.4	5.7	8.6	21.6	33	27.3	19.3	21.1	4.1	67.8	2.9
	44	10.5	7.8	7.7	33.2	23	13.3	7.9	12.4	2.5	34.3	1.3
Total pesticides	31	18.8	15.1	15.0	72.9	30	26.6	22.6	19.2	2.5	99.1	1.4
	53	851	705	667	4206	23	1477	1117	1313	411	5624	1.7
	42	582	335	493	1524	33	1800	1170	1651	280	5755	3.1

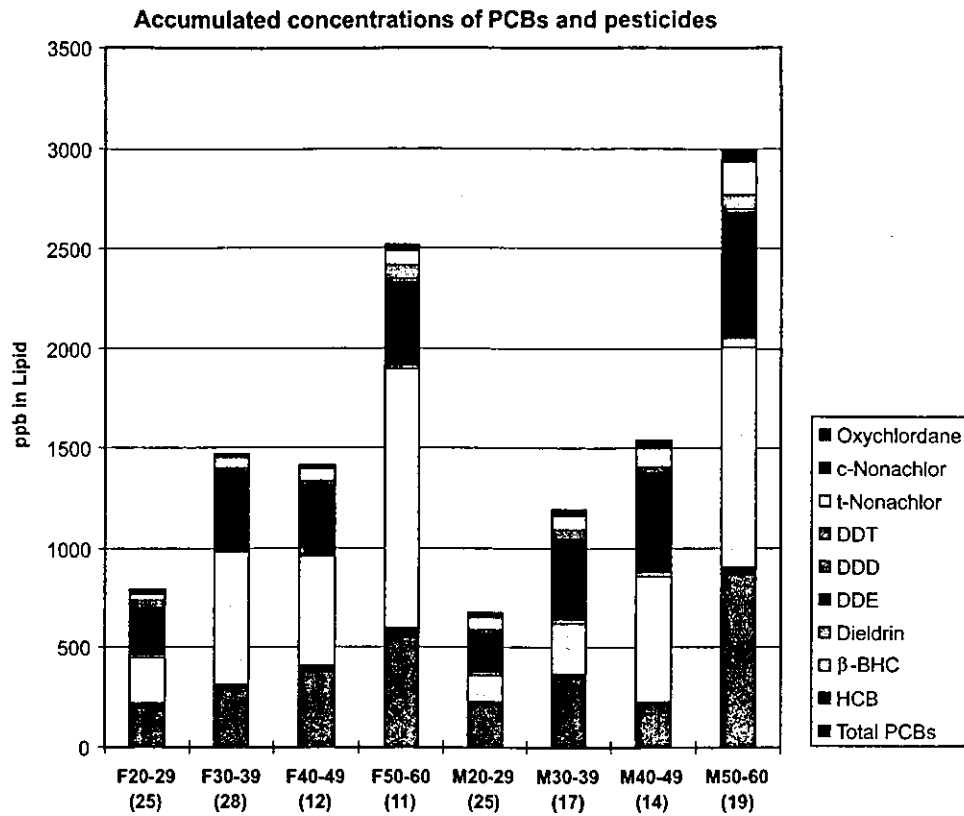


Fig. 2. Accumulated concentrations of total PCBs and chlorinated pesticides in the blood of 151 residents in Fukuoka. F: female, M: male, range of ages, and number in parentheses.

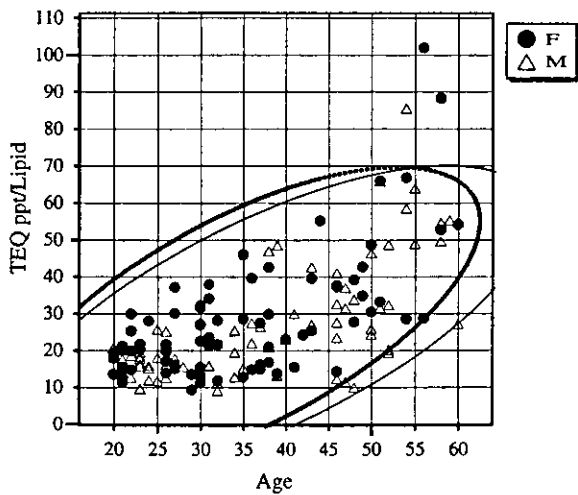
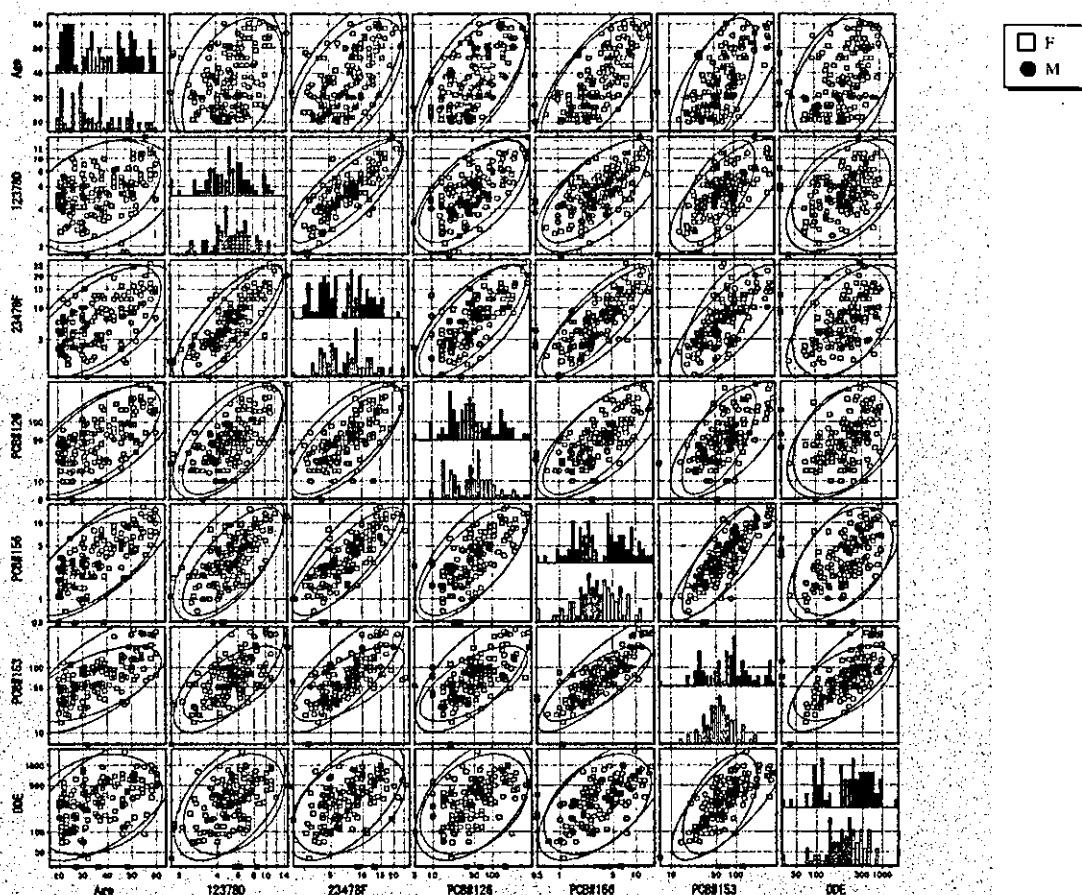


Fig. 3. Ellipse of constant distance (95%) between TEQ level and age in Fukuoka residents (152). Female (77): black circle and dotted line, Male (75): triangle and solid line. Regression line: Male and female (152)  $Y(\text{TEQ}) = -6.561 + 0.947X(\text{age})$ ,  $r = 0.6526$ ,  $p < 0.001$ . Female (77)  $Y(\text{TEQ}) = -6.232 + 0.983X(\text{age})$ ,  $r = 0.6334$ ,  $p < 0.001$ . Male (75):  $Y(\text{TEQ}) = -8.208 + 0.948X(\text{age})$ ,  $r = 0.6873$ ,  $p < 0.001$ .

females, because the lipid base TEQ concentrations in breast milk and blood are similar levels in human (Iida et al., 1999c; Fürst and Pöpke, 2002). The regression line of TEQ level on age in the breast milk data is within the range of TEQ levels of present study (Fig. 5). The Japanese environment was presumed to be heavily polluted with TEQ in 1970s. These pollutants exposed to human at that time still remain in the persons aged from 40 to 60 for about 25 years. The survey of breast milk of Osaka residents indicated that DDE and PCB levels at 3.0 and 1.3 ppb in lipid in 1972–1976 decreased to 0.25 and 0.2 ppb in lipid, respectively, in 1995–1998 (Konishi et al., 2001). American body concentrations of dioxins were estimated from the dioxin analysis of carbon-dated sediment cores of lakes and rivers, and it was predicted that TEQ levels ranged from 50 to 80 ppt in lipid in the 1970s were decreased to 10–20 ppt in lipid in 1990s (Lorber, 2002). This prediction is applicable to young persons aged below 30s who had not ingested the polluted foods at their growing period, but older persons aged above 40s who had already grown with polluted foods probably retained high levels of the pollutants in the body.



**Correlation coefficients in males 75 (Upper) and females 76 (Lower)**

	Age	12378D	23478F	PCB#126	PCB#156	PCB#153	DDE
Age	1.0000						
12378D	0.2952	1.0000					
23478F	<b>0.6218</b>	<b>0.7559</b>	1.0000				
PCB#126	<b>0.6709</b>	<b>0.5781</b>	<b>0.6873</b>	1.0000			
PCB#156	<b>0.7505</b>	<b>0.6125</b>	<b>0.8219</b>	<b>0.7014</b>	1.0000		
PCB#153	<b>0.6965</b>	<b>0.7073</b>	<b>0.7882</b>	<b>0.6893</b>	<b>0.8568</b>	1.0000	
DDE	<b>0.5811</b>	<b>0.5276</b>	<b>0.5957</b>	<b>0.4922</b>	<b>0.6321</b>	<b>0.7633</b>	1.0000

11 point boldface >0.37 p < 0.001; 9 point >0.23 p < 0.05

Fig. 4. Ellipse of constant distance (95%) in female: circle and dotted line, and in male: black circle and solid line, and correlation coefficients between age and levels of 1,2,3,7,8-penta-CDD (12378D), 2,3,4,7,8-penta-CDF (23478F), 3,3',4,4',5-penta-CB (PCB#126), 2,3,3',4,4',5-hexa-CB (PCB#156), 2,2',4,4',5,5'-hexa-CB (PCB#153) and DDE in the blood of Fukuoka residents (151). Histograms in squares of diagonal; upper: males 75; lower: females 76 (ppt or ppb in lipid).

Table 5  
Sample correlation coefficients between age and concentrations of TEQ, PCBs and seven pesticides in the blood of Fukuoka Residents in 1999

		Male									
		Age	TEQ	PCBs	HCB	$\beta$ -HCH	Dieldrin	DDE	DDT	<i>t</i> -Nonachlor	<i>c</i> -Nonachlor
Number		75	75	75	75	75	75	75	75	75	75
Age	1.0000										
TEQ	<b>0.6510</b>	1.0000									
PCBs	<b>0.7244</b>	<b>0.8784</b>	1.0000								
HCB	<b>0.4929</b>	<b>0.5540</b>	<b>0.5684</b>	1.0000							
$\beta$ -HCH	<b>0.6998</b>	<b>0.7419</b>	<b>0.7679</b>	<b>0.4622</b>	1.0000						
Dieldrin	0.2496	<b>0.4084</b>	<b>0.4447</b>	0.3305	0.3690	1.0000					
DDE	<b>0.6026</b>	<b>0.6596</b>	<b>0.7787</b>	<b>0.3737</b>	<b>0.6518</b>	<b>0.3896</b>	1.0000				
DDT	<b>0.4330</b>	<b>0.6575</b>	<b>0.6710</b>	<b>0.5131</b>	<b>0.5436</b>	<b>0.4894</b>	<b>0.6043</b>	1.0000			
<i>t</i> -Nonachlor	<b>0.4971</b>	<b>0.6149</b>	<b>0.7127</b>	<b>0.5462</b>	<b>0.5862</b>	<b>0.3735</b>	<b>0.5399</b>	<b>0.4374</b>	1.0000		
<i>c</i> -Nonachlor	<b>0.6239</b>	<b>0.7741</b>	<b>0.8475</b>	<b>0.5463</b>	<b>0.6963</b>	<b>0.5034</b>	<b>0.6210</b>	<b>0.5479</b>	<b>0.8374</b>	1.0000	
		Female									
		Age	TEQ	PCBs	HCB	$\beta$ -HCH	Dieldrin	DDE	DDT	<i>t</i> -Nonachlor	<i>c</i> -Nonachlor
Number		77	77	76	76	76	76	76	76	76	76
Age	1.0000										
TEQ	<b>0.5757</b>	1.0000									
PCBs			1.0000								
HCB			<b>0.5066</b>	1.0000							
$\beta$ -HCH			<b>0.5860</b>	0.3504	1.0000						
Dieldrin			0.2306	0.2348	<b>0.5197</b>	1.0000					
DDE			<b>0.6034</b>	0.2705	<b>0.3958</b>	<u>0.0374</u>	1.0000				
DDT			<b>0.3971</b>	<b>0.5353</b>	<u>0.1600</u>	0.2562	0.3513	1.0000			
<i>t</i> -Nonachlor			<b>0.6032</b>	<b>0.4958</b>	<b>0.5338</b>	0.3191	<b>0.4678</b>	0.2724	1.0000		
<i>c</i> -Nonachlor			<b>0.6160</b>	<b>0.4278</b>	<b>0.4273</b>	<b>0.3870</b>	<b>0.4741</b>	<b>0.3858</b>	<b>0.6626</b>	1.0000	

Bold >0.37,  $p < 0.001$ ; nonbold >0.23,  $p < 0.05$ ; underline <0.23 not significant.

Table 6  
Relation between TEQ level and age in the Japanese dioxin studies

Where (number), when	Average TEQ level, ppt in lipid					Regression line TEQ ( $Y$ ), age ( $X$ )	Correlation coefficient	Reference
	PCDD	PCDF	Non-ortho PCB	Mono-ortho PCB	Total TEQ			
Fukuoka (152), 1999	10.28	5.56	7.75	4.57	28.15	$Y = 0.95X - 6.59$	0.653	This report
Nose (32), 1998 include polluted area	13.18	9.37	7.12	5.93	35.50	$Y = 1.17X - 27.6$	0.540	Environment Agency (1999b)
Saitama (31), 1998	9.03	6.7	6.05	3.91	25.70			
Six areas <sup>a</sup> in Japan (234), 1998	7.6	4.3	4.0	7.3	19.0	$Y = 0.37X + 1.90$	0.525	Environment Agency (1999c)
Fifteen areas <sup>b</sup> in Japan (470), 1998–2000	10.1	7.1	9.5	–	25.5	$Y = 0.35X + 10.8$	–	Watanabe et al. (2001)

<sup>a</sup> Regular environment.

<sup>b</sup> Miyagi, Niigata, Yokohama, Saku, Shimane, Osaka, Nagasaki, Okinawa.

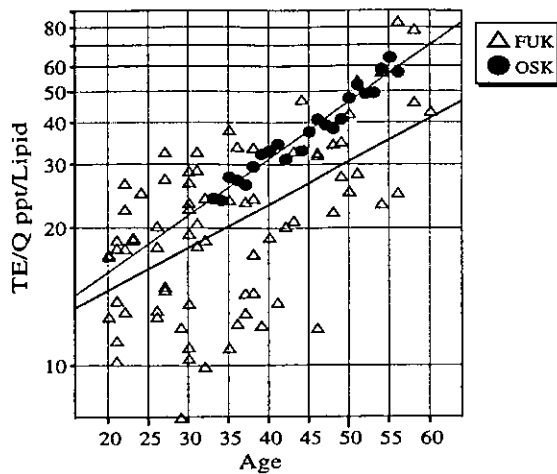


Fig. 5. Comparison of TEQ levels between the women of Osaka in 1973–1996 (black circle) and Fukuoka in 1999 (triangle). Time trend of TEQ concentrations in breast milk from 58 ppt in 1973 to 23 ppt in 1996 were converted to from 56 to 33 of age in 1999, supposing the ages of milk donors were 30 years old.

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