

DIFFERENT EFFECTS OF ORGANOCHLORINE COMPOUNDS IN CONCENTRATIONS ON WHOLE AND LIPID WEIGHT BASES ON HUMAN HEALTH

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Introduction

Recently, we have found that quantitative and reproducible lipid extraction from biological samples such as the blood and breast milk is quite difficult, based upon the results of our several studies^{1,2}. In this study, in order to show the importance of quantitative and reproducible lipid extraction from the breast milk on the risk evaluation of dioxins, PCBs and organochlorine pesticides, we compared their effects on the immune response and thyroid hormone systems of Japanese infants and mothers by using the concentrations of whole and lipid weight bases.

Materials and Methods

In this study, 124 mothers volunteered to participate in all. Only babies born at term without congenital anomalies or diseases were included. Breast milk, sampled 2 to 4 months after childbirth, was used to determine concentrations of organochlorine pesticides and PCBs by ECD gas chromatographic method³ and dioxins (PCDDs, PCDFs and DL-PCBs) by HRGC/HRMS method³. TCDD TEQ concentrations of dioxins were calculated by using 1998 WHO TCDD TEF values⁴.

At around 10 months after birth, peripheral blood samples were individually obtained from 100 infants and mothers. These blood samples were employed to measure lymphocyte subsets by indirect immunofluorescence using monoclonal mouse anti-human antibodies⁵. Then the relative population densities of the lymphocyte subsets were calculated. These blood samples were also used to determine the serum concentrations of T₃, T₄ and TSH by radioimmunoassay methods using commercially available kits⁶. The percentages of the lymphocyte subsets, as well as CD4+/CD8+ ratio, and the serum concentrations of thyroid related chemicals were categorized into two groups; namely, the measurements which were less than the mean and equal to or over the 75th percentile point in each year were set by 0 and 1, respectively. Then, Fisher's exact test was applied to the resulted fourfold tables and odds ratios were computed from the tables by logistic regression to evaluate the relative risks. In this study, less than 10 percent of *p*-value was considered as statistically significant.

Results and Discussion

In Tables 1 and 2, effects of exposure to dioxins, PCBs and the organochlorine pesticides on lymphocyte subsets are shown in Japanese infants and their mothers, respectively. In Table 1, with the exception of effects of HCH on lymphocyte subsets of HLA-DR+ and HCE on lymphocyte subsets of CD8+ and CD20+, in which they showed almost same effects in the concentrations on both whole and lipid weight bases, we observed their different effects in all other cases. For example, chlordane decreased the lymphocyte subset of CD8+ in the concentration on wet weight

basis and increased in the concentrations on lipid weight basis. This is also the case in their effects on lymphocyte subset of Japanese mothers, as indicated in Table 2.

Table 1. Effects of the organochlorine compounds on lymphocyte subsets of Japanese infants by whole or lipid weight basis (N=100)

Compound	Whole Weight		Lipid Weight	
	Odds Ratio	<i>p</i> -value	Odds Ratio	<i>p</i> -value
< HLA-DR+ >				
HCH	0.12	0.02	0.11	0.02
DDT	0.22	0.04	–	–
< CD4+ >				
HCE	3.62	0.03	2.39	0.10
< CD8+ >				
Dioxins	0.00001	0.002	–	–
HCE	5.19	0.006	5.49	0.002
Chlordane	0.42	0.17	2.08	0.15
< CD4+/CD8+ >				
Dioxins	4.50	0.02	2.91	0.08
PCBs	2.83	0.08	–	–
< CD3+ >				
DDT	0.46	0.19	0.25	0.07
HCE	3.87	0.04	2.46	0.13
Chlordane	–	–	2.82	0.07
< CD20+ >				
HCE	0.27	0.05	0.33	0.09

Their effects on thyroid hormone system in Japanese infants and their mothers are shown, respectively, in Tables 3 and 4. In case of the infants, HCE showed almost the same effects on the concentration of TSH in the concentrations of both whole and lipid weight basis, but DDT significantly decreased the concentrations of T₃ only in the concentration on lipid weight basis and significantly increased that of TSH only in the concentration on whole weight basis. Dieldrin significantly increased the concentration of T₄ only in the concentration on whole weight basis. In case of the mothers, for example, dioxins significantly decreased the concentration of T₃ and significantly increased that of TSH only in the concentration on lipid weight basis.

As indicated above, effects of dioxins, PCBs and organochlorine pesticides on these two biological systems were quite different each other in their concentrations on whole and lipid weight bases. Due to, however, the difficulties of quantitative and reproducible lipid extraction from the breast milk and blood^{1,2}, their effects obtained from the concentrations on whole weight basis seemed much more precise than those obtained from the concentrations on lipid weight basis. There so far have been many studies on human health, in which dioxins and PCBs may contribute to numerous adverse health effects^{7~21}. These studies, however, have been done by using the concentrations on lipid

weight basis, so findings indicated in these studies are considered not to be precise and may be wrong. Therefore, in conclusion, we have to establish international standard method for the quantitative and reproducible lipid extraction from the human samples, as soon as possible, in order to know much precise exposure to toxic compounds and then to be able to accurately evaluate their toxic effects and risks on human health.

Table 2. Effects of exposure to the organochlorine compounds on lymphocyte subsets in the peripheral blood of Japanese mothers by whole or lipid weight basis (N=45)

Compound	Whole Weight		Lipid Weight	
	Odds Ratio	<i>p</i> -value	Odds Ratio	<i>p</i> -value
			< HLA-DR+ >	
DDT	0.16	0.11	–	–
PCBs	0.15	0.08	–	–
			< CD4+ >	
HCE	–	–	5.4	0.05
			< CD8+ >	
Dioxins	–	–	0.18	0.11
PCBs	3.8	0.11	–	–
Chlordane	–	–	0.16	0.11
			< CD4+/CD8+ >	
Dioxins	–	–	7.6	0.05
Chlordane	–	–	4.7	0.10

Table 3. Effects of the organochlorine compounds on thyroid hormone system of Japanese infants by whole or lipid weight basis (N=100)

Compound	Whole Weight		Lipid Weight	
	Odds Ratio	<i>p</i> -value	Odds Ratio	<i>p</i> -value
			< T ₃ >	
DDT	0.49	0.18	0.32	0.06
			< T ₄ >	
Dieldrin	2.80	0.07	–	–
			< TSH >	
DDT	3.60	0.03	2.42	0.14
HCE	0.30	0.05	0.27	0.04

Table 4. Effects of the organochlorine compounds on thyroid hormone system of Japanese mothers by whole or lipid weight basis (N=94)

Compound	Whole Weight		Lipid Weight	
	Odds Ratio	p-value	Odds Ratio	p-value
			< T ₃ >	
Dioxins	–	–	0.18	0.01
Chlordane	0.36	0.07	0.27	0.06
PCBs	0.29	0.10	–	–
			< T ₄ >	
Dioxins	0.14	0.007	0.15	0.01
			< TSH >	
Dioxins	–	–	3.4	0.03
PCBs	2.31	0.10	–	–

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