SURVEY OF DIOXIN-LIKE PCBS IN HUMAN BREAST MILK COLLECTED FROM TWO DIFFERENT AREAS IN KOREA

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Introduction

Dioxin-like polychlorinated biphenyls (Dioxin-like PCBs) are ubiquitous contaminants in the global environmental. Due to their bioaccumulation potential, these compounds tend to magnify in the food chain and cause adverse effects on human and wildlife situated at the top of the food chain. Therefore, in considering the human exposure assessment, many investigations have reported the human tissue contamination levels of these contaminants. However, there is little information on the contamination status of human exposure in Korea.

The purpose of this study was to measure the contamination levels and to investigate the residue profiles of dioxin-like PCBs in human breast milk collected from residents of living in Seoul and Chungbuk area in Korea. Furthermore, we investigate the variation of dioxin-like PCB levels in human milk during lactation.

Materials and Methods

Sample collection

The human breast milk samples analyzed in this study were collected at maternal clinic in Seoul city (a metropolitan area with many types of dioxin-like PCBs emission) and Chungbuk area (a rural agriculture area : located approximately 150 km south-east from Seoul). As donors of human breast milk, 20 mothers were selected in Seoul (mean age : 32 ± 3.5years) and 24 mothers in Chungbuk area (28 ± 4.5years). The human milk samples were collected about 50 mL each time on 0, 5, 30, 100, 150 and 200 day after delivery. A questionnaire including personal data of the donors, such as weight, height, occupation, dietary habits, smoking habits, periods of menstruation, and journeys abroad during lactation was completed by each mother. The milk was expressed manually, preferentially before the infant was nursed in the morning. Human milk samples were immediately frozen in clean glass bottles and kept frozen at –20 °C until analysis.

Determination of dioxin-like PCBs

Extration and clean-up of milk samples were made according to slightly modified the method of US EPA 1613 and CDC (Centers for Disease Controls & Prevention). Approximately 50mL of human breast milk samples was extracted using a Soxhlet apparatus with dichloromethane. Fractionation was carried out with an activated silic-gel and an activated carbon column. Identification and quantification of dioxin like PCBs was performed by GC-MSD (Agilent 5973). The separation of dioxin-like PCBs was achieved using a HP 6890 instrument equipped with DB-5 column with splitless and solvent cut mode. The mass spectrometer was operated at an EI energy of 40 eV. Mono-*ortho* and di-*ortho*-substituted PCB congeners were monitored by SIM at the two most intensive ions at the molecular ion cluster.

Table 1. Dioxin-like PCB concentrations (ng/g lipid weight basis) of human breast milk depending on the days after delivery collected from Seoul.

Days after delivery (day)	0	5	30	100	150	200
Number of donnors	20	13	11	13	6	2
Lipid contents (%)	1.5	1.92	3.96	2.79	2.13	3.05
#123	<0.03	<0.03	<0.02	<0.03	<0.03	<0.02
#118	8.77	3.32	1.92	1.78	1.25	1.03
#114	0.15	<0.03	<0.02	<0.03	<0.03	<0.02
#105	1.72	0.34	0.46	0.48	0.22	0.30
#167	0.42	0.24	0.25	0.19	0.03	0.07
#156	1.01	0.87	0.38	0.23	0.20	0.39
#157	<0.01	0.02	0.06	0.04	0.15	0.04
#189	<0.02	<0.02	<0.02	<0.04	<0.02	<0.02
Sum Mono-*ortho* PCBs	12.07	4.79	3.08	2.72	1.86	1.83
#180	17.02	4.98	3.20	2.70	2.21	1.91
#170	6.43	1.80	1.08	0.96	1.02	0.81
Sum Di-*ortho* PCBs	23.45	6.78	4.28	3.66	3.22	2.73

Result and Discussion

Contamination level and characterization of dioxin-like PCBs in colostrums samples

The concentrations of eight mono-*ortho* PCB congeners (IUPAC No. 123, 118, 114, 105, 167,156, 157, 189), of two di-*ortho* PCB congeners (IUPAC No. 180, 170) were determined in 43 individual colostrums samples from two areas in Korea, the urban area (20 human milk samples : Seoul area) and the rural area (23 human milk samples : Chungbuk area). The mean concentrations of individual dioxin-like PCB congeners in the human breast milk samples collected from Korea are shown in Table 1 and Table 2. The mean concentrations of total dioxin-like PCBs (sum of mono-*ortho* PCBs and di-*ortho* PCBs) in colostrums samples determined from human breast milk were 35.5 ng/g (lipid wt. basis : n=20) in Seoul, 20.8 ng/g (n=23) in Chungbuk area, respectively. The percent contribution of IUPAC No. 180 to the total dioxin-like PCB concentrations was 48 % followed by 24.7 % for #118, 18.1 % for #170, 4.9 % for #105, 2.8 % for #156, 1.2 % for # 167 and 0.4 % for #114. In this study, #123 and #189 were not detected in human breast milk. This residue profiles of dioxin-like PCBs in human breast milk collected from Korea were similar with human milk other countries [1,2] .

Geographical aspects of dioxin-like PCBs in colostrums samples

On the whole, we found that the concentrations of individual dioxin-like PCB congeners in colostrums samples were higher in the urban area compared to the rural area (Fig. 1). Especially, the concentrations of IUPAC No.180, 170 in milk samples collected from Seoul were significantly higher than in those from Chungbuk area. In general, it was known that the potential dioxin-like PCBs source is to releases from commercial PCB formulations and to emission from combustion process [3]. It seems to be that the higher residues of dioxin-like PCBs in colostrums milk samples in the urban area were related with their contamination sources. The similar result was observed by Kang et al. [4]. They have reported that total PCB levels in human adipose tissue samples were relatively higher in the urban area compared to the rural area in Korea.

Table 2. Dioxin-like PCB concentrations (ng/g lipid weight basis) of human breast milk depending on the days after delivery collected from Chungbuk area.

Days after delivery (day)		0	5	30	100	150	200
Number of donnors		23	8	8	8	8	4
Lipid contents (%)		2.07	2.55	3.86	1.93	2.56	3.10
	#123	<0.02	<0.01	<0.01	<0.03	<0.05	<0.02
	#118	7.75	6.01	1.97	2.15	0.76	0.87
	#114	<0.02	<0.01	<0.01	<0.03	0.03	<0.02
	#105	0.52	1.78	0.58	0.62	0.22	0.20
	#167	0.03	0.24	0.14	0.18	0.08	0.49
	#156	0.32	<0.01	0.38	0.28	0.25	0.02
	#157	<0.01	0.18	0.15	0.18	0.02	0.02
	#189	<0.01	<0.01	<0.01	<0.04	<0.01	<0.01
Sum Mono-*ortho* PCBs		8.62	8.21	3.24	3.40	1.36	1.59
	#180	7.49	6.58	4.24	3.70	3.72	2.03
	#170	4.71	2.69	1.84	1.52	1.57	0.85
Sum Di-*ortho* PCBs		12.20	9.27	6.08	5.22	5.29	2.88

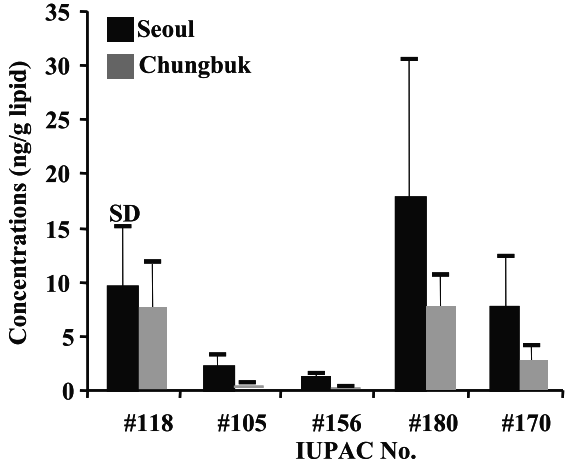

Fig. 1. Mean values of dioxin-like PCBs in human breast milk from different regions of Korea.

The decline trend of residue levels during the lactation periods

Both mono-*ortho* PCBs and di-*ortho* PCBs concentrations in human breast milk collected from Seoul were significantly reduced during the period of observation in this study (Fig. 2). This decline tendency of residues in milk samples was also observed from Chungbuk area. Donors from Seoul had collected milk samples from their first lactation to 200 days after delivery. The residues of mono- *ortho* PCBs and di-*ortho*

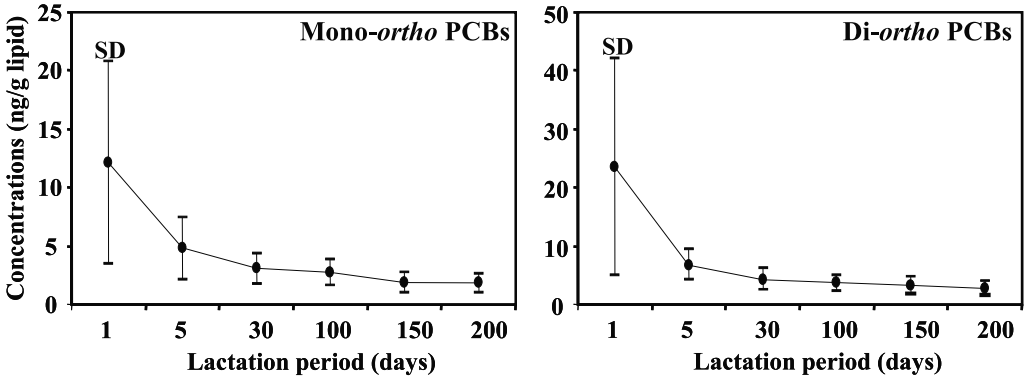

Fig. 2. The decline in residue levels of Mono-, Di-*ortho* PCBs during the lactation periods of donors from Seoul.

PCBs were reduced during that period by about 60 % and 71 %, respectively. On the other hand, the decline tendency was not observed with the fat content in human milk over the lactation period. There have been several investigations on the changes in organochlorine residue levels in human milk during lactation. These investigations demonstrated a gradual decrease of organochlorine residue levels in milk during lactation period [5,6,7]. Our results were in agreement with these references. The present findings of a decline during lactations of dioxin-like PCBs demonstrate that women decrease their body burden of these toxic compounds by milk extraction.

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