

LEVELS, PROFILES AND RISK ASSESSMENT OF POLYCHLORINATED BIPHENYLS, DIBENZO-P-DIOXINS AND DIBENZOFURANS IN BREAST MILK FROM NORTH CHINA

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Introduction

China have produced and used organochlorine pesticides with low purity in a large quantity. However, there is little information on the environmental levels of organohalogens contamination as well as body burden of these chemicals, especially in Mainland China¹⁻⁴. After recent rapid growth of economy in China, health effects of persistent organohaogens are of growing concern. To assess mother's body burden and perinatal exposure of dioxins and pesticides, we collected breast milk specimens from Shijiazhuang urban and Tangshan rural area, Hebei Province, North China, and measured dioxins by DIPS-CALUX[®] bioassay (Dioxin and PCB specific Chemical-Activated LUCiferase gene eXpression cell bioassay system)⁵⁻⁶.

Materials and Methods

Human breast milk: Thirty breast milk samples were collected from breast-feeding mothers in Shijiazhuang city in November and December 2002, and 29 samples were collected in Tanshan countryside in August 2003, Hebei Province, North China. All of specimens from Shijiazhuang city and one-third specimens from rural area of Tangshan were collected within a week postpartum, and the remaining samples from Tangshan rural area were collected during more than 1-week postpartum (range 2-82 weeks).

Investigation: All mothers were asked to fill out a 59-items questionnaire to evaluate the life style factors concerning physique, past history, occupations, food consumption frequencies, exposure to pesticides, smoking habit, status of breast feeding and so on.

DIPS-CALUX[®] Bioassay: Except one sample due to insufficient quantity, we measured 58 samples by DIPS-CALUX[®] assay at Hiyoshi Corporation (Shiga, Japan). Ten milliliter of sample was extracted by hexane-chlorine, and then purified using acid silica and carbon columns to remove interfering compounds. The assay also incorporated a column-based separation of the dioxins and furans from the PCBs, providing independent total toxic equivalences (TEQs) for these two sets of compounds.

Results and Discussions

Body burden of dioxins in Hebei Province: We report here dioxins body burden in breast milk in agriculture and industry regions of Hebei Province, Mainland China. Table 1 shows the geometric means, median, interquartile range of dioxins concentration of breast milk in gram fat basis in Shijiazhuang urban and Tangshan rural regions by CALUX assay. There was no difference of dioxins concentrations in the breast milk between the two regions. Geometric means dioxin concentrations of all the breast milk (<1 week) from the primiparae (n=37) were 16.7 pgTEQ/gFat for PCDDs+PCDFs, 3.5 pgTEQ/gFat for coPCB, and 20.3 pgTEQ/gFat for total dioxins respectively.

Table1: Dioxins concentration in breast milk (<1-week) from the primiparae

	Urban (n=28)			Rural (n=9)			p _q
	GM*	Median	IQ* rang	GM	Median	IQ rang	
Age(year)	25.5	25.0	3.5	23.9	24.0	2.5	0.97
FAT(%)	1.2	1.35	0.9	1.1	0.9	1.0	0.60
PCDDs/Fs	17.8	17.9	7.5	13.5	16.9	10.9	0.30
Co-PCBs	3.3	2.9	2.0	3.5	4.1	4.5	0.70
total DXNs	21.5	20.3	10.6	17.2	24.2	12.9	0.50

*GM, geometric mean; IQ, interquartile; SD, standard deviation

Unite is pgTEQ/gfat and they were measured by CALUX Assay.

q Two-side p-value from *t* -test after natrual log transformation.

The lactation period and dioxins level: As shown in Table 2, the level of dioxins of 1-week milk was higher than that of more than 1-week and the results are compatible with prior reports. That might be major source of dioxin exposure is from dietary intake and the level of dioxins in breast milk is correlated to that of dioxins accumulated in the adipose tissue.

Table 2: Lactation period and concentration of dioxins in breast milk from primiparae

Table 2. Excretion period and concentration of dioxins in breast milk from primiparae							
n	<1week(3.8, 1~6)*			>1week (304.7, 14~574)			p ^a
	GM	Median	IQ rang	GM	Median	IQ rang	
Age(year)	25.1	25.0	3.2	25.2	24.0	3.5	0.9668
FAT(%)	1.1	1.4	0.8	2.6	3.0	2.6	<0.0001
PCDDs/Fs _a	16.6	17.8	8.8	6.5	6.1	2.8	<0.0001
Co-PCBs _a	3.4	2.9	2.6	1.6	1.6	1.4	0.0084
total DXNs _a	20.1	20.5	10.5	8.1	7.5	3.8	<0.0001

*Samples collection time (mean days, Rang)

GM, geometric mean; IQ, interquartile; SD, standard deviation

_a Unite is pgTEQ/gfat and they were measured by CALUX Assay.

_q Two-side p-value from *t* -test after natural log transformation indicates.

Mother's age and dioxins level: We compared the dioxin levels of the groups of more than 30 or less 30 year-old of age as shown in Figure 1, mothers over 30-year old showed higher dioxin-like activity in the bioassay.

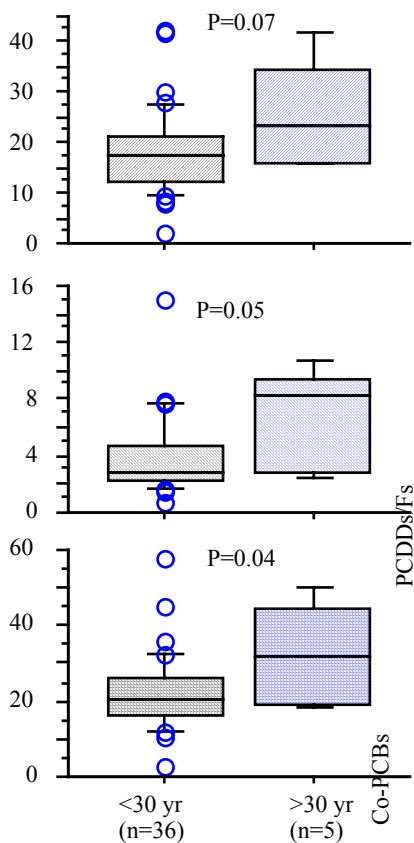


Figure1. Dioxins level (pgTEQ/g fat) in 1-week breast milk from different age subjects including primiparae and multiparae.

Dioxins level was higher in the group with history of pesticides exposure: We found the positive correlation of both PCDDs/Fs and total dioxins and history of pesticides exposure as shown in Fig2.

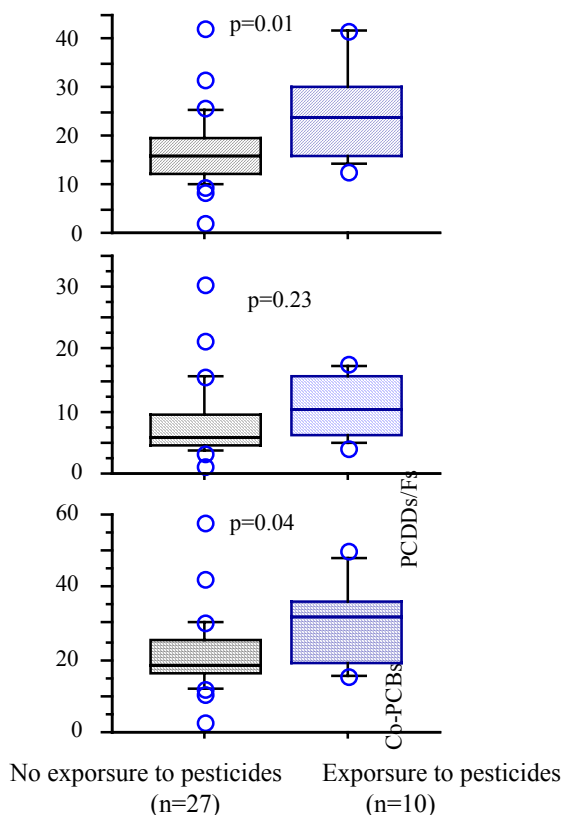


Figure2. History of pesticides exposure and dioxins level (pgTEQ/g fat) in 1-week breast milks from the first mothers. Data are presented as means \pm SEM.

Schechter AJ reported that pesticide Na-PCP is recognized as a source of environmental and human dioxin exposure in the Chinese schistosomiasis area¹. However, our study areas belong to common agriculture and industry areas and no current and past Na-PCP usages were reported. Therefore, further investigation is required to reveal the origin of dioxins contamination.

Recently there were two reports on dioxins in breast milk in China, one was from Hong Kong Special District and another was from the schistosomiasis area. We report here dioxins body burden in breast milk in agriculture and industry regions of Hebei Province located Mainland China. The levels of dioxins were similar as in Dalian but higher than in Shenyang, both of them located in Northeast China⁷. The contamination level of Dalian and our study regions were almost similar to that of Japan⁷.

Nation-wide survey on dioxin contamination in environmental and biological samples is needed in China.

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