DIOXIN CONCENTRATION IN BREAST MILK OF PRIMIPARA MOTHERS IN BIEN HOA, A HOT SPOT AREA IN VIETNAM －A PRELIMINARY STUDY IN 2012－

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Introduction

In Vietnam, there are some areas around former US military airbases which were storages of the herbicides sprayed during the Vietnam War, and called "hot spot" of dioxin contamination. Previous studies shown that the levels of dioxins, especially 2,3,7,8-tetrachlorodibenzo-p-dioxin (TetraCDD), in environmental samples were dramatically elevated in "hot spot" [1]. Therefore, residents around "hot spot" are highly risky to exposure of 2,3,7,8-TetraCDD, because of not only previous exposure but also resent exposure due to contaminated dust and water from air base. Previously, we reported that dioxin levels in breast milk of mothers in the hot spots including Da Nang and Phu Cat were approximately 4-fold higher than those of mothers in unsprayed areas [2]. Thus, Vietnamese infants living in hot spots are also exposed to dioxin during pregnancy through the placenta and postnatally through breastfeeding.

In a hot spot in Bien Hoa city, southern Vietnam, we have recently set up a new cohort including 245 newborns delivered in September to December in 2012 in Dong Nai General Hospital. These infants were followed up 1 month after birth, and maternal breast milk samples were collected from mothers.

Therefore, we try to compare dioxin levels in breast milk samples of primipara mothers in Bien Hoa with 6 areas including hot spot areas of dioxins in Da Nang and Phu Cat, a sprayed area and non-sprayed areas.

Materials and methods

1. Study subjects

Total of 245 newborn babies whose mothers was living in 10 communes around former US air base and gave birth in Dong Nai General Hospital from the end of September to early December, 2012 was enrolled to the survey. When the infants became 1 month old, nurses of commune health center visited them, and followed up 228 infants (93%). In this 1 month survey, breast milk samples were collected, frozen and transferred to Japan for pretreatment and measurement of dioxin concentration of 17 isomers of polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in Kanazawa Medical University. Only 52 samples of primipara mothers collected before November in Bien Hoa were analyzed in the present survey. Maternal age and parity were also obtained by interview.

2. Breast milk sample analysis

About 10 g breast milk was used to extract fat content. A series of purification operations consisting of alkali digestion, hexane extraction and chromatography were carried out. The established method of analysis was described in details elsewhere [3]. The final extract were concentrated to 20 µl and analyzed by gas chromatography coupled to high-resolution mass spectrometry (HR-GC/MS, MStation-JMS700, JEOL, Japan)

Toxic equivalent of PCDDs (PCDDs TEQ), PCDFs (PCDFs TEQ) and PCDDs/PCDFs TEQ (total TEQ) were calculated by adding up the multiplying each congener concentration with its toxic equivalent factor (TEF) referred from the WHO 2005-TEF [4].

Dioxin levels in breast milk in Bien Hoa including contribution of 2,3,7,8-TetraCDD per TEQ-PCDDs/Fs (%TCDD) were compared with 3 areas in hot spots of dioxin contamination, DaNang (Thanh Khe; TK),

DaNang (Son Tra; ST) and Phu Cat, a sprayed area of herbicide, Cam Lo, and non-sprayed areas, Cam Xuyen, and Kim Bang (Figure 1) by one-way ANOVA with post hoc tests. However, these milk samples except samples in 2 areas in DaNang were collected in postnatal 2-22 weeks.

Results and discussion

In Table 1, means and standard deviations (SDs) of 2,3,7,8-TetraCDD, TEQ-PCDDs/Fs and %TCDD in breast milk of primipara mothers living in 7 different areas in Vietnam, including 4 areas in hot spots of dioxin contamination, a sprayed area in middle Vietnam and 2 un-sprayed areas. Means of 2,3,7,8-TetraCDD in 4 areas of hot spots were higher than that in Kim Bang, a non-sprayed area in north Vietnam. Moreover, mean of 2,3,7,8-TetraCDD in Bien Hoa was most highest among 4 hot spots and significantly higher than those in sprayed area and Son Tra in DaNang. In comparisons of TEQ-PCDDs/Fs in breast milk with those in 2 non-sprayed areas , all 4 hot spot areas and 1 sprayed area, Cam Lo, showed significantly higher levels. However, samples in Bien Hoa showed significantly lower TEQ-PCDDs/Fs in breast milk than samples in Da Nang (TK).

Contribution of 2,3,7,8-TetraCDD to all TEQ-PCDDs/Fs (percentage of TEQ value from 2,3,7,8-TetraCDD for TEQ from all dioxin and furan isomers) were also compared among 7 areas (Table 1). Contribution of 2,3,7,8-TCDD in Bien Hoa was the highest and significantly higher than those in other areas except 1 non-sprayed area, Cam Xuyen. This fact suggest that dioxin exposure in Bien Hoa may be related to Orange Agent because 2,3,7,8-TetraCDD, not furan isomer, is the most abundant isomer of Orange agent.

It was suggested in previous studies in Italy [5] , Osaka [6] and Tokyo [7], that mothers' age and history of breast feeding were main factors that influenced the concentrations of dioxins in breast milk. Therefore, we try to analyze area differences again after adjusting maternal age, because our subjects were only primipara mothers.

After adjustment for age, the level of 2,3,7,8-TetraCDD in Bien Hoa was significantly higher than those in other areas except Da Nang (TK). However, the level of TEQ-PCDDs/Fs in Bien Hoa was significantly lower than those in other hot spot areas after adjusting age, suggesting that increased 2,3,7,8-TetraCDD was characteristic in Bien Hoa.

Since more than 90% of human exposure to dioxins is through foods in the general environment, diet is suspected to play an important role in increasing body burden of dioxins in contaminated areas as well. Animal originated foods such as meat, fish, egg, and milk which contain fat were reported as high risk foods for dioxin contamination. Previously, in Bien Hoa, Schecter et al. [8] reported the highest dioxin levels of locally grown chicken and duck meat of all samples, with 18.8 and 236 ppt TEQ respectively, and indicated that the meat of chicken and duck might be high risk foods for dioxin exposure in Bien Hoa. Schecter et al.[8] has also reported that freshwater fish was one of the highest dioxin-contaminated foods in Bien Hoa,, with the elevation of 2,3,7,8 TetraCDD (0.063-65 ppt) and TEQ-PCDDS/Fs (26.9 ppt TEQ), suggesting that food survey of these subjects is necessary to clarify relationships between food and dioxin contamination in future.

In conclusion, dioxin levels, particularly 2,3,7,8 TetraCDD was suspected high in the residents living in 10 communities around former airbase in Bien Hoa, Viet Nam . We need to follow-up these mothers and infant pairs and clarify the influence of dioxin exposure on infant health.

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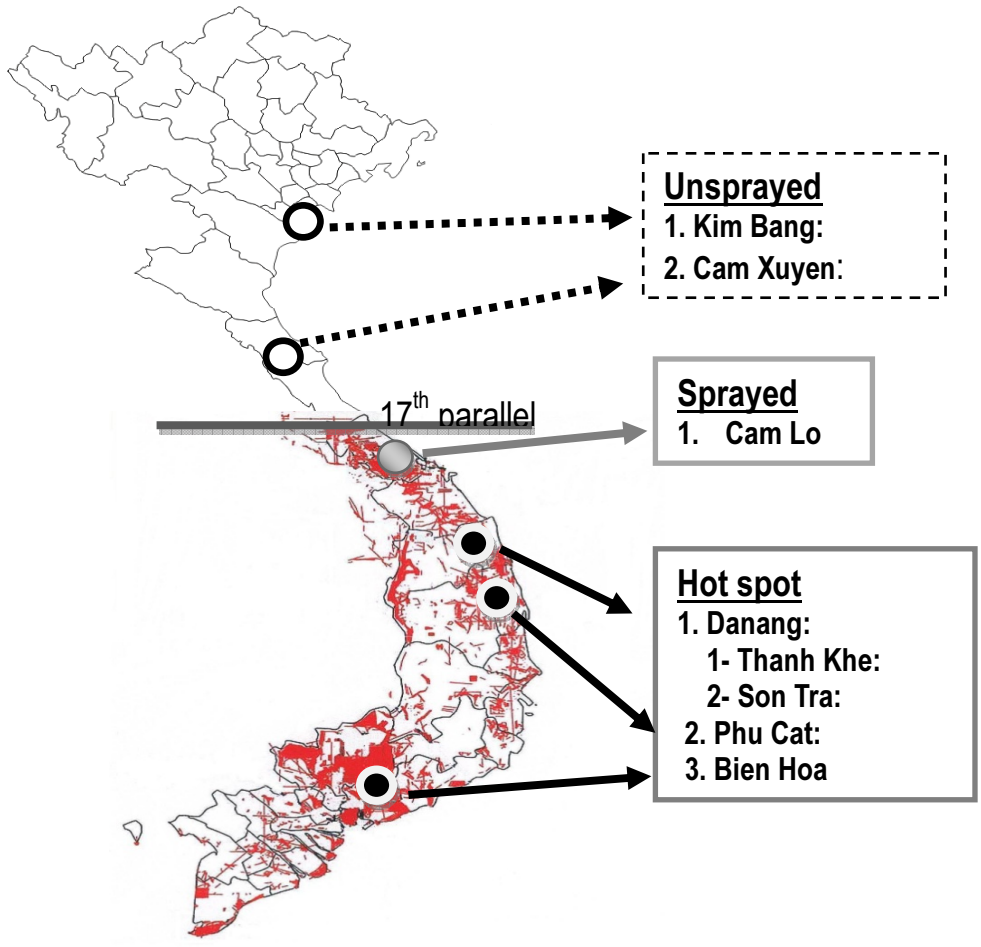

Figure 1 The map of samling areas in Vietnam

Table 1 Dioxin levels in breast milk of primipara mothers in 7 areas in Vietnam

		2,3,7,8-TetraCDD (pg/gfat)			TEQ-PCDDs/Fs (pg-TEQ/gfat)			Contribution of 2,3,7,8-TetraCDD (%)		
	No	Mean	SD		Mean	SD		Mean	SD	
Hot spots										
Bien Hoa	52	2.47	2.02	b,d,e,f	9.89	1.57	a,e,f	27.2	11.9	a,b,d,f
DaNang (TK)	43	1.97	1.90	e,f	14.30	1.57	e,f	15.1	7.4	
DaNang (ST)	26	1.39	1.82	f	13.87	1.47	e,f	11.1	4.1	e
Phu Cat	23	1.66	1.51	f	12.53	1.41	e,f	13.7	3.4	
Sprayed area										
Cam Lo	15	1.09	2.20		9.32	1.66	e,f	13.1	5.0	
Non-sprayed area										
Cam Xuyen	15	0.72	1.41		3.41	1.29		21.4	4.5	
Kim Bang	19	0.50	2.35		3.58	1.36		16.1	7.9	

a: P<0.05 as compared with DaNangTK, b: P<0.05 as compared with DaNang ST,

c: P<0.05 as compared with Phu Cat, d: P<0.05 as compared with Cam Lo,

e: P<0.05 as compared with Cam Xuyen, f: P<0.05 as compared with Kim Bang