

CONTAMINATION BY DIOXIN RELATED COMPOUNDS IN HUMAN BREAST MILK COLLECTED FROM ASIAN DEVELOPING COUNTRIES

Tatsuya Kunisue¹, Mafumi Watanabe¹, In Monirith¹, Annamalai Subramanian²,
Touch Seang Tana³, Maricar Prudente⁴ and Shinsuke Tanabe¹

Center for Marine Environmental Studies, Ehime University, Tarumi 3-5-7, Matsuyama 790-8566, Japan¹ Center of Advanced Studies in Marine Biology, Annamalai University, Parangipettai 608502, Tamil Nadu, India² Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries, Cambodia³ Science Education Department, De La Salle University, 2401 Taft Avenue, 1004 Manila, Philippines⁴

Introduction

Polychlorinated dibenzo-*p*-dioxins (PCDDs), dibenzofurans (PCDFs), and biphenyls (PCBs) are lipophilic stable contaminants that occur widely in the environment, and have been of great concern on their toxic effects on humans and wildlife. In developed countries, it is suggested that residue levels of dioxin related compounds in various environmental media and biota has generally decreased since 1990s, because of complete adjustment of highly efficient incinerators and strict regulation of various chemicals (1). In Asian developing countries, however, there are little studies regarding pollution of dioxin related compounds, while occurrence of these contaminants is anticipated.

In dumping sites of municipal wastes in Asian developing countries, secondary formation of dioxin related compounds is anticipated, because a lot of various wastes has been dumped daily and continuously burned under low temperature by spontaneous combustion or intentional incineration. Furthermore, it is suspected that many residents around these dumping sites are exposed to these contaminants, because of their labor there as 'waste-picker'. It is especially feared that, *in utero* and lactational exposure to dioxin related compounds, may adversely affect brain development, endocrine and immune systems of infants and children (2, 3).

The present study attempted to elucidate the contamination status of dioxin related compounds in human breast milk collected from dumping sites of municipal wastes in Asian developing countries, such as India, Cambodia, and Philippines, and to assess the risk of exposure in their infants.

Materials and Methods

Human breast milk samples were collected from Perungudi, Chennai in India on August 2000, Meanchey, Phnom Penh City in Cambodia on November 1999, and Payatas, Quezon City in Philippines on February 2000, which have dumping sites of municipal wastes in the suburbs of urban area. Breast milk samples were stored at -20 °C until analysis.

About 50 g of human breast milk was spiked internal standards ([¹³C]-PCDDs, PCDFs, and **ORGANOHALOGEN COMPOUNDS**

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coplanar PCBs ; cleanup spike), and then added to 40g diatomaceous earth (Extrelut NT) packed in a glass column. After leaving it for 30 minutes, dioxin related compounds were eluted with diethylether. Fat was removed from target compounds using a gel permeation chromatography (GPC), and then the extract was passed through activated silica-gel (Wako-gel S-1) packed in a glass column. Separation of PCDD/PCDFs and coplanar PCBs fraction was performed by passing through activated alumina and activated carbon (activated carbon-dispersed silicagel) packed in a glass column. Internal standard (syringe spike) was spiked in analytical solution. Identification and quantification of PCDDs, PCDFs, and non-*ortho* coplanar PCBs was performed using HRGC (Hewlett-Packard 6890)-HRMS (JEOL JMS-700D), and mono-*ortho* coplanar PCBs using HRGC (Hewlett-Packard 6890)-HRMS (JEOL GCmate). TEQs (toxic equivalencies) were calculated using WHO-TEFs (4).

Results and Discussion

Dioxin related compounds (PCDDs, PCDFs, and coplanar PCBs) were detected in all the samples of human breast milk analyzed in this study (Table 1), indicating that the residents around dumping sites of municipal wastes in India, Cambodia, and Philippines have been exposed to these contaminants. The TEQs of dioxin related compounds in human breast milk were in the order of India > Cambodia > Philippines.

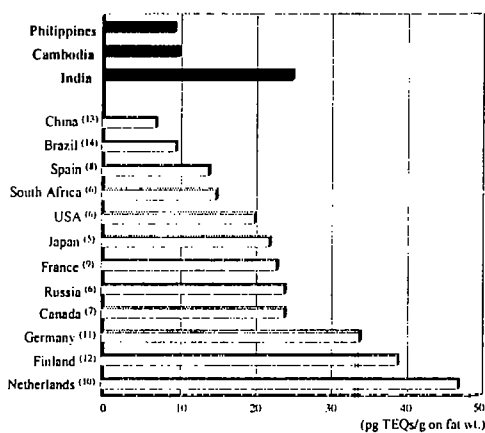
Table 1. Mean concentrations of 2,3,7,8-substituted PCDD/Fs and non-, mono- *ortho* coplanar PCBs, and those TEQs in human breast milk collected from residents around dumping sites of municipal wastes in India, Cambodia, and Philippines

	Concentration (pg/g on fat wt.)		
	India	Cambodia	Philippines
PCDDs	270	74	190
PCDFs	42	39	20
PCDDs-TEQs	8.0	5.2	2.8
PCDFs-TEQs	5.8	2.5	2.9
Non-ortho PCBs	190	45	80
Mono-ortho PCBs	23000	3600	7800
Non-ortho PCBs-TEQs	7.2	1.9	2.4
Mono-ortho PCBs-TEQs	3.4	0.57	1.3
Total TEQs	25	10	9.4

TEQs found in Indian were compared with those in general public of developed countries, such as Japanese (5), American (6), and Canadian (7), and was almost middle value among levels reported in European (8, 9, 10, 11, 12) (Fig. 1). This indicates that significant pollution sources of dioxin related compounds present in dumping sites in this country, probably due to the secondary formation under the burning of municipal wastes. On the other hands, TEQs in breast milk of Cambodian and Filipino

were relatively low, and the levels were comparable to those in Chinese (13) and Brazilian (14).

Daily intakes (DIs) of TEQs in breast milk to infants were calculated, based on the assumption that an infant ingests the milk 700 ml per day and weight of infant is 5 kg. The DIs were exceeded over 4 pg TEQs/kg/day of TDI proposed by WHO in 1998 for all the countries estimated (Fig. 2). It is reported that infants of one to three month-old after birth absorb more than 90% of 2,3,7,8-substituted PCDD/F congeners contained in human breast milk except hepta-, octa-CDD/Fs (15, 16, 17), and indicated that exposure to high levels of dioxin related compounds at this term influences their immune system when infants became preschool children (3). In order to reduce the levels and possible toxic effects of dioxin related compounds in humans around dumping sites of developing countries, the international cooperation and supports are requested from developed nations.



Reference data (5-14) were recalculated with TEFs by Van den Berg *et al.* (1998).

Figure 1. Comparisons of TEQs in human breast milk found in this study (India, Cambodia, and Philippines) with those reported from various countries.

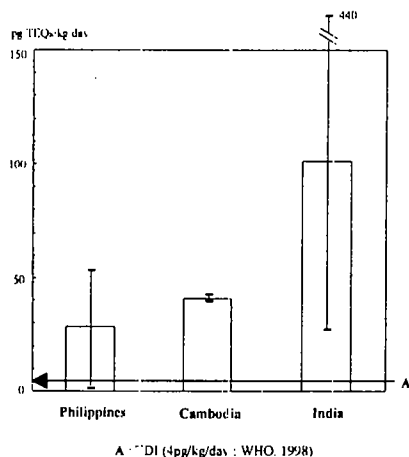


Figure 2. Daily intake of TEQs to infants estimated from their human breast milk.

Acknowledgments

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