THE SURVEY OF THE EXPOSURE TO DIOXINS AND OTHER CHEMICAL COMPOUNDS IN HUMANS (II) - DIOXINS AND OTHER CHEMICAL COMPOUNDS CONCENTRATION IN HUMAN BODIES OF GENERAL PUBLIC IN JAPAN AND INTAKE SURVEY FROM FOOD -

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Introduction

In 2002, the Risk Assessment Office of the Ministry of the Environment, Japan, started a survey, entitled "Survey of Accumulation of Dioxins in Humans", in order to obtain a general picture of the state of the accumulation of dioxins in the Japanese people[1].

The accumulation and uptake of dioxins in Japan was measured by analyzing dioxins in blood and by analyzing dioxins from dietary intake in this survey. In 2011, this survey was expanded as "Exposure Monitoring Survey of Dioxins and Other Chemical Compounds" to include chemical compounds other than dioxins. This report listed it about the survey of 2012.

Materials and methods

In the 2012 survey, three areas were selected: two areas from coastal villages where high blood dioxins concentration was relatively high, and one area from inland area as control. 25 participants and 30 participants were recruited from high concentration area and control area, respectively. These areas were selected from areas where former dioxin survey was conducted. Priority was given to the recruitment of participants of former surveys.

A briefing session was held for each survey area, and investigating it was performed by sampling 50 mL of blood after having obtained informed consent from the subjects. Items analyzed besides chemical pollutants were general biochemical, blood count, thyroidal function, four unsaturated fatty acids (DGLA, AA, EPA, DHA). Also, an interviews on dietary and health conditions were performed on the subjects by community health nurses and nutritionist, to grasp the living and health conditions of the subjects. In addition, 100 mL urine was sampled in the morning of blood sampling.

Dietary survey collected by duplicate method were conducted on approximately five subjects from each area, in addition to the blood survey, The meals for a total of whole three days were collected, to measure the chemical compounds concentration and to calculate chemical compounds intake via daily meals. When collecting meals, details of seasonings and ingredients were measured and recorded by a nutritionist.

Blood survey was performed for 84 subjects (the mean of age 49.3 years old, ranging from 36 to 63 years old) subjects in total, and urine survey and dietary survey was performed for 15 people from the subjects of blood surveys.

Blood analyses were performed by previous report [2].

Results and discussion

The mean blood dioxin concentration of the 84 participants was 10 pg-TEQ/g-fat, ranging from 0.42 to 40 pg-TEQ/g-fat. The dioxins concentration level was within the range of the former surveys conducted from fiscal year 2002 to 2010 (Table 2).

Among the 84 participants, 18 participants had participated in former surveys and had blood dioxins concentration analyzed. In 17 among these 18 participants, a decrease in blood dioxins concentrations was observed (Table 3).

The mean dioxin intake from food was 0.72pg-TEQ/kg/day, with the range of 0.071 to 2.3 pg-TEQ/kg/day. Dioxin intakes from food were thus calculated for the15 subjects (Table 4).

The measurement results of chemical compounds besides dioxins are shown in Tables 6 and 7. The analysis is currently being conducted.

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Reference

1. Hasegawa et al., (2007) *Organohalogen Compounds*, **69**, 2001-2005
2. Matsumura et.al., (2007) *Organohalogen Compounds*, **69**, 1154-1157

Table 1. Chemical substance

classification	Chemical substance	blood	urine	diet
Polychlorinated dioxin	PCDDs, PCDFs, Co-PCBs	*		*
Polybrominated Dioxins	PBDDs, PBDFs	*		
Hydroxylated polychlorobiphenyl	5Cl-HO-PCBs, 6Cl-HO-PCBs, 7Cl-HO-PCBs	*		
Heavy metals	T-Hg, Pb, As, Cu, Se, Zn	*		*
	Me-Hg			*
	Cd	*	*	*
	Speciated As ((Ⅲ), (Ⅴ), arsenobetaine, methylarsonic acid, dimethylarsinic acid)		*	
Pesticide (metabolites)	OP metabolites, Pyrethroid metabolites, Ethylenethiourea, Triclosan, Acephate, Methamidophos, 6-Chloronicotinic acid, 3-methyl-4-nitrophenol, p-nitrophenol, Deet		*	
Others	Mono(2-ethylhexyl) phtalete, bisphenol A, PAHs(Polycyclic aromatic hydrocarbons) metabolites, Parabens, phytoestrogens, caffeine, cotinine, benzophenone3		*	

Table 2. Comparison with past survey result (Blood Dioxin)

TEQ	Statistics	2002-2010 (n=2,264)	2011 (n=86)	2012 (n=84)
PCDDs+PCDFs (pg-TEQ/g-fat)	mean±s.d. (median, range)	11±7.6 (9.8, 0.040 - 63)	11±6.1 (9.2, 0.75 - 28)	6.1±3.9 (5.5, 0.37 - 22)
Co-PCBs (pg-TEQ/g-fat)	mean±s.d. (median, range)	7.9±7.2 (5.6, 0.013 - 81)	6.9±5.4 (5.2, 0.072 - 36)	3.9±3.3 (3.2, 0.054 - 18)
PCDDs+PCDFs +Co-PCBs (pg-TEQ/g-fat)	mean±s.d. (median, range)	19±14 (16, 0.10 - 130)	17±10 (14, 0.83 - 56)	10±6.9 (9.0, 0.42 - 40)

Table 3. Comparison with past survey result for the 18 participants (Blood Dioxin)

TEQ	Statistics	2002, 2004 (n=18)	2012 (n=18)
PCDDs+PCDFs (pg-TEQ/g-fat)	mean±s.d. (median, range)	12±6.4 (12, 4.5 - 30)	6.0±2.8 (5.8, 1.4 - 11)
Co-PCBs (pg-TEQ/g-fat)	mean±s.d. (median, range)	6.4±3.1 (6.2, 2.1 - 13)	4.3±2.3 (3.9, 1.1 - 12)
PCDDs+PCDFs +Co-PCBs (pg-TEQ/g-fat)	mean±s.d. (median, range)	19±8.9 (17, 7.6 - 43)	10±4.6 (9.5, 3.0 - 23)

Table 4. Comparison with past survey result (Dioxin intake from food)

TEQ	Statistics	2002-2010 (n=625)	2011 (n=15)	2012 (n=15)
PCDDs+PCDFs (pg-TEQ/kg/day)	mean±s.d. (median, range)	0.35±0.35 (0.25, 0.015-3.8)	0.31±0.30 (0.21, 0.016-1.0)	0.25±0.11 (0.23, 0.037-0.47)
Co-PCBs (pg-TEQ/kg/day)	mean±s.d. (median, range)	0.47±0.58 (0.28, 0.016-4.2)	0.34±0.47 (0.17, 0.019-1.7)	0.46±0.45 (0.38, 0.034-1.8)
PCDDs+PCDFs +Co-PCBs (pg-TEQ/kg/day)	mean±s.d. (median, range)	0.82±0.86 (0.56, 0.031-6.2)	0.65±0.71 (0.39, 0.035-2.4)	0.72±0.55 (0.57, 0.071-2.3)

Table 5. Comparison with past survey result for the 4 participants (Dioxin intake from food)

TEQ	Statistics	2002, 2004 (n=4)	2012 (n=4)
PCDDs+PCDFs (pg-TEQ/kg/day)	mean±s.d. (median, range)	0.42±0.23 (0.44, 0.11 – 0.69)	0.25±0.093 (0.25, 0.16 – 0.36)
Co-PCBs (pg-TEQ/kg/day)	mean±s.d. (median, range)	0.35±0.20 (0.32, 0.13 – 0.59)	0.39±0.19 (0.35, 0.22 – 0.66)
PCDDs+PCDFs +Co-PCBs (pg-TEQ/kg/day)	mean±s.d. (median, range)	0.77±0.40 (0.88, 0.31 – 1.3)	0.64±0.27 (0.59, 0.38 – 1.0)

Table 6. Blood concentrations and intake from food

classification	Chemical substance	Blood concentration			Intake from food		
		mean±s.d.	unit	rate of detection	mean±s.d.	unit	rate of detection
Polybrominated Dioxins	PBDDs	all N.D.	pg/g-fat	0/84	—	—	—
	PBDFs	all N.D.		0/84	—	—	—
Hydroxylated polychlorobiphenyl	5Cl-HO-PCBs	30±19	pg/g	15/15	—	—	—
	6Cl-HO-PCBs	33±29		15/15	—	—	—
	7Cl-HO-PCBs	30±25		15/15	—	—	—
heavy metal	T-Hg	10±6.6	ng/mL	84/84	0.11±0.087	μg/kg-weight/day	15/15
	Me-Hg	—	—	—	0.10±0.085		15/15
	Cd	1.7±0.83	ng/mL	84/84	0.27±0.12		15/15
	Pb	12±4.4		84/84	0.11±0.060		15/15
	As	6.5±5.3		84/84	3.8±3.5		15/15
	Cu	810±99		84/84	17±4.8		15/15
	Se	280±78		84/84	1.4±0.33		15/15
	Zn	6400±730		84/84	130±26		15/15

Table 7. Urine concentrations (creatinine corrected)

classification		Chemical substance	mean±s.d.	unit	rate of detection
Pesticide metabolites	OP metabolites	DMP	3.2±2.5	μg/g cr	30/30
		DEP	35±99		27/30
		DMTP	12±17		26/30
		DETP	0.67±1.9		5/30
	Pyrethroid metabolites	PBA	0.31±0.34		23/30
		DCCA	0.24±0.69		5/30
	Carbamate metabolite	Ethylenethiourea	0.054±0.14		4/30
	Triclosan		12±30		30/30
	Acephate		0.010±0.055		1/30
	Methamidophos		0.0036±0.014		1/30
	Imidacloprid metabolite	6-Chloronicotinic acid	0.14±0.41		8/30
	Fenitrothion metabolite	3-methyl-4-nitrophenol	0.17±0.2		8/30
	parathion metabolite	p-nitrophenol	0.88±0.81		30/30
	Deet		all N.D.		84/84
others	Mono(2-ethylhexyl) phtalete	MBP	19±8.7	μg/g cr	84/84
		MEHP	3.7±3.0		84/84
		MEHHP	12±8.2		84/84
		MEOHP	7.9±5.0		84/84
		MBzP	1.9±4.8		83/84
	Bisphenol A		1.1±3.5		80/84
	PAHs	1-Hydroxypyrene	0.24±0.18		30/30
		1&9- Hydroxyphenanthrene	0.17±0.1		30/30
		2- Hydroxyphenanthrene	0.16±0.099		30/30
		3- Hydroxyphenanthrene	0.27±0.16		30/30
		4- Hydroxyphenanthrene	0.032±0.049		13/30
	Parabens	Methylparaben	150±220		30/30
		Ethylparaben	14±27		25/30
		Propylparaben	8.7±17		19/30
		Butylparaben	2.7±6.9		8/30
		Benzylparaben	all N.D.		0/30
	phytoestrogens	Genistein	2000±1400		30/30
		Daidzein	2800±2000		30/30
		Equol	3000±6100		30/30
	caffein		210±2300		30/30
	Cotinine		120±360		30/30
	benzophenone3		4.3±22		6/30
Heavy metals	As	As (Ⅴ)	0.19±0.38	μg/g cr	32/84
		As (Ⅲ)	1.8±1.1		80/84
		methylarsonic acid	2.3±1.4		84/84
		dimethylarsinic acid	42±26		84/84
		arsenobetaine	79±110		84/84
	Cd		0.98±0.56		84/84