THE SURVEY OF THE EXPOSURE TO DIOXINS AND OTHER CHEMICAL COMPOUNDS IN HUMANS
- 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.

Materials and methods

In the 2011 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 86 subjects (the mean of age 44.5 years old, ranging from 15 to 73 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 86 participants was 17 pg-TEQ/g-fat, ranging from 0.83 to 56 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 86 participants, 8 participants had participated in former surveys and had blood dioxins concentration analyzed. In 7 among these 8 participants, a decrease in blood dioxins concentrations was observed (Table 3).

The mean dioxin intake from food was 0.65pg-TEQ/kg/day, with the range of 0.035 to 2.4 pg-TEQ/kg/day. Dioxin intakes from food were thus calculated for the15 subjects.

The measurement results of chemical compounds besides dioxins are shown in Tables 4 and 5. 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
Dioxins	PCDDs, PCDFs, Co-PCBs	*		*
POPs	Polychlorinated biphenyls (PCB), DDT, Chlordane, Aldrin, Dieldrin, Endrin, Hexachlorobenzene (HCB), Heptachlor, Toxaphene, Mirex, Pentabromodiphenyl ether, Pentachlorobenzene, Hexachlorocyclohexanes, Chlordecone, Hexabromobiphenyl, PFOS, PFOA	*		*
POPs(new)	Hexabromocyclododecane, Endosulfan	*		*
Pesticide metabolites	OP metabolites, Pyrethroid metabolites, Ethylenethiourea, Triclosan		*	
Plasticizers	Mono(2-ethylhexyl) phtalete, Bisphenol A		*	
Heavy metals	T-Hg	*		*
	Me-Hg			*
	Cd		*	*
	Speciated As ((Ⅲ), (Ⅴ), arsenobetaine, methylarsonic acid, dimethylarsinic acid)		*	
	Pb			*

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

TEQ	Statistics	2002-2011 (n=2,264)	2012 (n=86)
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)
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)
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)

Table 3. Comparison with past survey result for the 8 participants (Blood Dioxin)

TEQ	Statistics	2002, 2003 (n=8)	2012 (n=8)
PCDDs+PCDFs (pg-TEQ/g-fat)	mean±s.d. (median, range)	21±14 (17, 0.87 - 48)	11±6.1 (9.2, 0.75 - 28)
Co-PCBs (pg-TEQ/g-fat)	mean±s.d. (median, range)	19±20 (8.5, 0.080 - 59)	6.9±5.4 (5.2, 0.072 - 36)

PCDDs+PCDFs +Co-PCBs (pg-TEQ/g-fat)	mean±s.d. (median, range)	40±33 (25, 0.96 - 95)	17±10 (14, 0.83 - 56)

Table 4-2. 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
PCBs	MoCBs	26±91	pg/g-fat	8/86	13±21	pg/kg-weight/day	15/15
	DiCBs	100±150		49/86	230±130		15/15
	TrCBs	1200±750		86/86	580±410		15/15
	TeCBs	8800±6800		86/86	1500±1300		15/15
	PeCBs	25000±21000		86/86	2100±2500		15/15
	HxCBs	140000±130000		86/86	3100±4600		15/15
	HpCBs	97000±100000		86/86	1500±2400		15/15
	OcCBs	21000±22000		86/86	230±360		15/15
	NoCBs	1700±1300		86/86	22±29		15/15
	DeCB	760±470		86/86	12±16		15/15
	Total PCBs	290000±280000		86/86	9200±11000		15/15
DDTs	o,p'-DDD	35±90	pg/g-fat	17/86	120±170	pg/kg-weight/day	15/15
	p,p'-DDD	950±910		85/86	960±1500		15/15
	o,p'-DDE	230±180		77/86	57±70		15/15
	p,p'-DDE	150000±120000		86/86	2700±2500		15/15
	o,p'-DDT	760±750		83/86	240±410		15/15
	p,p'-DDT	7100±4900		86/86	1200±2100		15/15
Chlordane	*cis*-Chlordane	160±170	pg/g-fat	61/86	590±430	pg/kg-weight/day	15/15
	trans-Chlordane	64±100		32/86	250±230		15/15
	oxychlordane	12000±7800		86/86	130±88		15/15
	cis-Nonachlor	5600±5300		86/86	320±320		15/15
	trans-Nonachlor	28000±21000		86/86	730±630		15/15
drin	Aldrin,	all N.D.	pg/g-fat	0/86	0.63±1.7	pg/kg-weight/day	2/15
	Dieldrin,	4800±5400		86/86	640±440		15/15
	Endrin	all N.D.		0/86	70±59		14/15
Hexachloro-benzene	Hexachlorobenzene	14000±5900	pg/g-fat	86/86	840±590	pg/kg-weight/day	15/15
Heptachlor	Heptachlor	all N.D.	pg/g-fat	0/86	14±11	pg/kg-weight/day	15/15
	cis-Heptachlorepoxide	2200±7.6		86/86	170±120		15/15
	trans-Heptachlorepoxide	all N.D.		0/86	all N.D.		0/15
Toxaphene	Parlar-26	1000±770	pg/g-fat	85/86	80±94	pg/kg-weight/day	14/15
	Parlar-50	1400±890		85/86	170±180		15/15
	Parlar-62	180±590		9/86	120±140		10/15
Mirex	Mirex	2100±1400	pg/g-fat	86/86	34±52	pg/kg-weight/day	15/15

PBDEs	Total TeBDEs	550±210	pg/g-fat	61/86	440±370	pg/kg-weight/day	15/15
	Total PeBDEs	240±220		84/86	210±180		15/15
	Total HxBDEs	820±460		86/86	110±160		15/15
	Total HpBDEs	all N.D.		0/86	7.2±12		6/15
	Total OBDEs	340±430		55/86	27±27		13/15
	Total NoBDEs	120±320		13/86	36±31		12/15
	DeBDE	910±1200		50/86	300±220		15/15
	Total PBDEs	3000±1800		86/86	1100±750		15/15

Table 4-2. 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
Pentachloro-benzene	Pentachlorobenzene	390±220	pg/g-fat	86/86	82±53	pg/kg-weight/day	15/15
HCHs	α-HCH	140±160	pg/g-fat	65/86	300±310		15/15
	β-HCH	41000±41000		86/86	460±530		15/15
	γ-HCH	93±190		22/86	110±110		15/15
	δ-HCH	all N.D.		0/86	13±8.8		15/15
Chlordecone	Chlordecone	0.012±0.11	ng/g-fat	1/86	all N.D.		0/15
Hexabromo-biphenyl	Hexabromobiphenyl	70±140	pg/g-fat	20/86	0.97±2.1		3/15
HBCD	α-HBCD	1.0±2.1	ng/g-fat	20/86	1.0±2.5		3/15
	β-HBCD	all N.D.		0/86	all N.D.		0/15
	γ-HBCD	0.044±0.38		1/86	all N.D.		0/15
	δ-HBCD	all N.D.		0/86	all N.D.		0/15
	ε-HBCD	all N.D.		0/86	all N.D.		0/15
Endosulfan	α-Endosulfan	1200±1100	pg/g-fat	55/86	650±240		15/15
	β-Endosulfan	44±210		4/86	340±200		15/15
Organo-fluorine compounds	PFOS	5.8±3.1	ng/mL	86/86	0.57±0.51		10/15
	PFOA	2.2±1.4		86/86	0.69±0.70		12/15
heavy metal	T-Hg	11±5.8	ng/mL	86/86	0.069±0.044	μg/kg-weight/day	14/15
	Me-Hg	—	—	—	0.064±0.037		14/15
	Cd	—	—	—	0.091±0.040		15/15
	Pb	—	—	—	0.24±0.10		15/15

Table 5. Urine concentrations (creatinine corrected)

classification		Chemical substance	mean±s.d.	unit	rate of detection
Pesticide metabolites	OP metabolites,	DMP	6.7±3.8	μg/g cr	15/15
		DEP	7.5±7.8		14/15
		DMTP	18±19		12/15
		DETP	0.38±0.93		3/15
	Pyrethroid metabolites	PBA	0.50±0.83		12/15
		DCCA	1.1±3.3		4/15
	Ethylenethiourea	Ethylenethiourea	0.015±0.059		1/15
	Triclosan	Triclosan	12±24		15/15
Plasticizers	Mono(2-ethylhexyl) phtalete	MBP	67±170		15/15
		MEHP	4.5±2.0		15/15
		MEHHP	17±10		15/15

		MEOHP	10±4.0	15/15
		MBzP	1.8±3.0	15/15
	Bisphenol A	Bisphenol A	0.79±0.39	15/15
Heavy metals	As	As (Ⅴ)	0.62±0.76	13/15
		As (Ⅲ)	1.7±1.5	13/15
		methylarsonic acid	2.3±1.2	15/15
		dimethylarsinic acid	59±44	15/15
		arsenobetaine	100±91	15/15
	Cd	Cd	1.2±0.98	15/15