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D20 Intake of contaminants in children

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D 20: contaminant intake among Finnish children vs. Finnish adults

Subjects and methods

Data on children consisted of the participants of the DIPP Nutrition Study The Finnish Type I Diabetes Prediction and Prevention (DIPP) study. Families with a genetically susceptible baby are invited to take part in the DIPP study. Ethical approval was obtained from the local ethical committees. All the families gave their written informed consent to the study. The parents and other caregivers (e.g. staff at day-care centers) recorded child's food consumption using 3-day food records that included one weekend day. The families and day-care personnel received written instructions to record with household measures (e.g. spoons, cups, glasses, pieces and deciliters) all the foods the child had eaten. Parents and day-care personnel also recorded the type, brand and preparation method of the foods used. The vitamin and mineral supplements used were recorded with their brand names and amounts as tablets, drops, spoonfuls or milliliters. A research nurse reviewed the records item by item for completeness and accuracy, during the respective study visit after each recording period. When needed, missing data (e.g. portion sizes, food descriptions and food preparation methods) were added after a discussion with the mother or father. The research nurses and physicians received continuous education (by the research nutritionist) to advise the parents to fill in the child's food records and to check the forms for possible controversies and omissions. The food consumption data were analyzed by using an inhouse software program developed at the National Public Health Institute. Nutrient values of the food composition database are mainly derived from chemical analyses of Finnish foods and are continuously updated by complementary data obtained from the Finnish food industry and international food composition tables. The database currently includes about 3000 individual food items and mixed dishes and more than 200 nutrients and other dietary factors. The system also allows creation or modification of specific recipes, which were used when appropriate. Standard recipes in the database are based on current Finnish cook books. Nutritional information of those dietary supplements registered as drugs in Finland were obtained from the Finnish pharmacopoeia. Information on other dietary supplements than drugs was obtained from the National Food Administration and the manufacturers. In this study, The DIPP food consumption data on children aged one, three, and six years old were used. Data on each age group consists of 1000 childrens 3-day food records.

Data on adults was obtained from FINDIET survey which was carried out as part of the FINRISK 2002 Study which monitors cardiovascular risk factors. A random sample of 12 000 persons 25 to 64 years of age and stratified for sex and 10-year age groups was taken from the population register. The participation rate was 65%, i.e. 8799 subjects. The study was carried out in five areas: 1) Helsinki area, 2) cities of Turku and Loimaa and some rural communities in southwestern Finland, and in the provinces of 3) North Carelia, 4) North Savo, and 5) Oulu. Of the invited subjects 32% were randomly selected also to the dietary survey. The final sample of the dietary survey was 2007 subjects. The participants were interviewed using the 48-h recall. The dietary intake data consisted of all days of the week except Fridays. The National Food Composition Database Fineli® (www.fineli.fi) was used to calculate the fish consumption.

The daily intake both for adults and children were estimated using probabilistic non-parametric simulation (400 simulations per round) with assumption that there is intraindividual variation in food contaminant concentration between days (no brand loyalty –assumption). A software (C-SIDE®) was used to obtain usual contaminant intake based on simulation results. The software gives the long-run average of daily intakes (usual daily intake) by taking into accouint day-to-day – correlation and nuisance effects, such as day-of-week and interview sequence. It allows exceptions from normality through grafted polynomial transformations and recognizes the measurement error associated with one-day dietary intake.

The daily intake was calculated per kilogram bodyweight. For adults measured bodyweight was used. For children an average bodyweight was used (1-year old:10.3 kg; 3-year old:15.0 kg; 6-year old: 21.1).

Results

The daily intake per bodyweight for PCDD/F and PCB compounds were at least twice as high in children compared to adults throughout the distribution (mean intake and all percentiles). The highest intakes among children were those of 3-year old children. In methyl mercury intake there was no difference between adults and children. The highest methyl mercury intakes among children were those of 6-year old children.

Table 1. Hg intake in adults.

Adults						
mean	stdev	0.05	0.25	0.5	0.75	0.95
0.019	0.032	0.000	0.000	0.008	0.023	0.072

1 y						
mean	stdev	0.05	0.25	0.5	0.75	0.95
0.018	0.021	0.000	0.002	0.013	0.027	0.059

3 y						
mean	stdev	0.05	0.25	0.5	0.75	0.95
0.022	0.026	0.002	0.007	0.014	0.028	0.071

6 y						
mean	stdev	0.05	0.25	0.5	0.75	0.95
0.028	0.037	0.003	0.008	0.016	0.033	0.091

Table 2. PCB intake in adults and children aged one, three and six years.

	Adults							1 y						
	mean	stdev	5%	25%	50%	75%	95%	mean	stdev	5%	25%	50%	75%	95%
PCB81	0.56	0.44	0.13	0.27	0.44	0.71	1.39	1.69	1.68	0.21	0.56	1.17	2.27	4.83
PCB77	8.46	8.95	0.99	3.19	5.93	10.18	24.30	20.56	34.92	1.57	5.68	10.70	21.31	70.23
PCB126	3.74	3.94	0.50	1.55	2.59	4.47	10.76	8.17	13.03	0.61	2.15	3.99	9.13	28.21
PCB169	1.23	1.44	0.15	0.40	0.79	1.51	3.73	3.19	5.76	0.27	0.72	1.52	3.36	11.12
PCB18	0.13	0.09	0.04	0.08	0.11	0.17	0.30	0.16	0.14	0.04	0.07	0.12	0.20	0.42
PCB28_31	0.48	0.31	0.14	0.26	0.41	0.62	1.09	0.57	0.54	0.10	0.23	0.41	0.72	1.58
PCB33	0.12	0.07	0.04	0.07	0.10	0.15	0.26	0.12	0.10	0.03	0.06	0.10	0.16	0.32
PCB51	0.01	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.00	0.01	0.02	0.03	0.06
PCB52	0.33	0.35	0.05	0.14	0.23	0.40	0.92	0.55	0.83	0.04	0.16	0.33	0.60	1.80
PCB49	0.13	0.14	0.02	0.05	0.09	0.16	0.37	0.20	0.28	0.02	0.07	0.13	0.22	0.65
PCB47	0.10	0.08	0.03	0.05	0.08	0.12	0.24	0.19	0.21	0.03	0.07	0.13	0.24	0.56
PCB74	0.15	0.14	0.02	0.06	0.11	0.19	0.40	0.29	0.40	0.03	0.09	0.17	0.32	0.93
PCB66	0.20	0.20	0.02	0.08	0.13	0.26	0.56	0.38	0.55	0.03	0.12	0.20	0.45	1.26
PCB60	0.05	0.04	0.01	0.02	0.03	0.06	0.13	0.09	0.13	0.01	0.03	0.05	0.09	0.28
PCB101	0.83	0.99	0.05	0.27	0.54	1.03	2.45	1.92	3.19	0.09	0.46	0.88	2.15	6.80
PCB99	0.42	0.43	0.05	0.16	0.28	0.54	1.20	0.87	1.37	0.07	0.23	0.43	0.97	3.02
PCB110	0.57	0.71	0.03	0.17	0.34	0.70	1.71	1.27	2.17	0.05	0.29	0.51	1.45	4.58
PCB123	0.08	0.08	0.01	0.03	0.05	0.09	0.22	0.14	0.20	0.01	0.04	0.07	0.17	0.48
PCB118	0.81	0.84	0.10	0.33	0.57	0.99	2.32	1.75	2.86	0.13	0.46	0.84	1.90	6.10
PCB114	0.01	0.02	0.00	0.01	0.01	0.02	0.04	0.03	0.05	0.00	0.01	0.02	0.04	0.11
PCB122	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.02
PCB105	0.25	0.26	0.03	0.09	0.16	0.32	0.72	0.52	0.83	0.03	0.12	0.24	0.59	1.84
PCB153	2.10	2.17	0.24	0.76	1.43	2.71	6.05	4.34	6.83	0.28	1.16	1.92	5.03	15.20
PCB141	0.19	0.22	0.01	0.06	0.12	0.23	0.58	0.45	0.91	0.03	0.10	0.20	0.43	1.63
PCB138	1.62	1.66	0.19	0.59	1.09	2.09	4.63	3.43	5.76	0.22	0.84	1.57	3.77	12.19
PCB167	0.05	0.05	0.00	0.02	0.03	0.06	0.15	0.11	0.17	0.01	0.03	0.05	0.13	0.38
PCB128	0.22	0.23	0.02	0.08	0.15	0.28	0.63	0.45	0.76	0.03	0.10	0.20	0.49	1.61
PCB156	0.12	0.13	0.01	0.04	0.07	0.15	0.35	0.26	0.47	0.02	0.06	0.11	0.28	0.94
PCB157	0.02	0.03	0.00	0.01	0.02	0.03	0.07	0.05	0.07	0.00	0.01	0.02	0.06	0.17
PCB187	0.38	0.42	0.03	0.12	0.26	0.46	1.12	0.73	1.08	0.04	0.19	0.38	0.84	2.43
PCB183	0.18	0.20	0.02	0.06	0.12	0.23	0.53	0.37	0.60	0.03	0.09	0.17	0.42	1.30
PCB180	0.69	0.73	0.08	0.23	0.44	0.90	2.02	1.42	2.42	0.09	0.35	0.60	1.59	5.08
PCB170	0.31	0.34	0.04	0.11	0.20	0.41	0.93	0.66	1.13	0.05	0.16	0.31	0.71	2.33
PCB189	0.01	0.02	0.00	0.01	0.01	0.02	0.04	0.03	0.05	0.00	0.01	0.02	0.03	0.10
PCB194	0.07	0.07	0.01	0.02	0.04	0.09	0.20	0.13	0.19	0.01	0.04	0.06	0.15	0.43
PCB206	0.02	0.02	0.00	0.01	0.01	0.02	0.05	0.04	0.06	0.01	0.02	0.02	0.05	0.13
PCB209	0.01	0.01	0.0	0.01	0.01	0.02	0.04	0.03	0.03	0.0	0.01	0.02	0.03	0.08

Summa	11.67	12.50	1.32	4.29	7.74	14.67	33.90	24.18	33.81	1.62	7.22	12.37	29.27	80.63
WHOPCB_TEQ	0.58	0.62	0.07	0.24	0.40	0.70	1.68	1.28	2.16	0.09	0.33	0.62	1.39	4.47
indPCBs	6.10	6.59	0.72	2.24	4.02	7.65	17.81	12.13	19.30	0.84	3.24	5.60	13.83	42.29

	3 y							6y						
	mean	stdev	5%	25%	50%	75%	95%	mean	stdev	5%	25%	50%	75%	95%
PCB81	2.31	1.39	0.78	1.37	1.99	2.87	4.92	1.97	1.04	0.78	1.26	1.74	2.42	3.92
PCB77	31.81	35.69	4.46	10.50	18.20	42.12	95.92	22.81	24.64	5.14	9.60	14.56	27.40	64.52
PCB126	12.57	13.78	1.99	4.21	7.90	16.11	37.34	9.18	9.62	2.28	4.11	6.22	10.63	25.40
PCB169	4.74	5.60	0.93	1.78	3.02	5.55	14.03	3.49	3.60	0.96	1.61	2.42	3.98	9.46
PCB18	0.25	0.14	0.09	0.15	0.22	0.31	0.52	0.21	0.13	0.08	0.12	0.18	0.26	0.45
PCB28_31	0.98	0.60	0.33	0.57	0.84	1.23	2.12	0.81	0.49	0.28	0.47	0.69	1.01	1.75
PCB33	0.22	0.12	0.09	0.14	0.20	0.28	0.44	0.19	0.10	0.07	0.11	0.16	0.23	0.38
PCB51	0.03	0.01	0.01	0.02	0.03	0.04	0.06	0.03	0.01	0.01	0.02	0.03	0.03	0.05
PCB52	0.87	0.79	0.15	0.37	0.65	1.11	2.31	0.65	0.61	0.13	0.30	0.47	0.78	1.72
PCB49	0.32	0.28	0.05	0.14	0.24	0.41	0.83	0.25	0.23	0.04	0.11	0.19	0.31	0.68
PCB47	0.28	0.19	0.09	0.15	0.23	0.35	0.63	0.22	0.13	0.09	0.13	0.19	0.27	0.46
PCB74	0.43	0.38	0.09	0.18	0.31	0.54	1.13	0.33	0.26	0.10	0.17	0.26	0.40	0.81
PCB66	0.59	0.60	0.09	0.22	0.39	0.76	1.69	0.45	0.43	0.11	0.21	0.32	0.54	1.20
PCB60	0.13	0.13	0.02	0.05	0.09	0.17	0.37	0.10	0.09	0.03	0.05	0.08	0.12	0.26
PCB101	3.14	3.58	0.31	0.87	1.72	4.45	9.54	2.24	2.78	0.31	0.73	1.27	2.77	6.96
PCB99	1.32	1.44	0.21	0.45	0.84	1.66	3.90	1.00	0.98	0.24	0.44	0.70	1.18	2.71
PCB110	2.12	2.66	0.18	0.49	1.16	2.86	6.81	1.53	2.03	0.14	0.45	0.79	1.82	5.02
PCB123	0.23	0.24	0.03	0.07	0.15	0.32	0.69	0.18	0.16	0.05	0.08	0.13	0.22	0.46
PCB118	2.64	2.84	0.43	0.91	1.72	3.34	7.75	1.92	1.87	0.49	0.88	1.36	2.27	5.20
PCB114	0.05	0.05	0.01	0.02	0.03	0.07	0.15	0.04	0.04	0.01	0.02	0.03	0.04	0.10
PCB122	0.01	0.01	0.00	0.01	0.01	0.01	0.03	0.01	0.01	0.00	0.00	0.01	0.01	0.02
PCB105	0.82	0.89	0.12	0.25	0.51	1.08	2.47	0.58	0.59	0.14	0.26	0.40	0.69	1.60
PCB153	7.13	7.88	0.95	2.13	3.90	9.85	21.84	5.08	5.34	1.19	2.07	3.33	6.15	14.29
PCB141	0.74	0.90	0.08	0.20	0.37	1.03	2.34	0.52	0.69	0.08	0.17	0.28	0.61	1.63
PCB138	5.52	6.16	0.73	1.64	3.09	7.49	16.96	3.85	4.24	0.89	1.72	2.54	4.38	10.83
PCB167	0.18	0.20	0.02	0.05	0.10	0.25	0.55	0.13	0.15	0.03	0.05	0.08	0.15	0.37
PCB128	0.73	0.83	0.09	0.21	0.42	0.98	2.27	0.52	0.55	0.12	0.22	0.35	0.61	1.46
PCB156	0.43	0.50	0.05	0.12	0.22	0.60	1.37	0.30	0.38	0.06	0.12	0.18	0.33	0.89
PCB157	0.08	0.09	0.01	0.02	0.05	0.11	0.25	0.06	0.06	0.01	0.02	0.04	0.07	0.16
PCB187	1.24	1.41	0.15	0.33	0.77	1.65	3.81	0.90	0.88	0.18	0.34	0.61	1.16	2.51
PCB183	0.62	0.70	0.08	0.18	0.33	0.84	1.91	0.45	0.47	0.10	0.17	0.29	0.55	1.27
PCB180	2.37	2.77	0.30	0.67	1.22	3.24	7.51	1.69	1.90	0.38	0.65	1.06	2.03	4.90
PCB170	1.08	1.23	0.15	0.32	0.58	1.45	3.34	0.78	0.88	0.18	0.32	0.49	0.91	2.23
PCB189	0.05	0.05	0.01	0.02	0.03	0.06	0.14	0.03	0.03	0.01	0.01	0.02	0.04	0.09

PCB194	0.21	0.23	0.03	0.07	0.12	0.29	0.66	0.16	0.15	0.04	0.06	0.11	0.20	0.43
PCB206	0.06	0.06	0.01	0.02	0.04	0.08	0.17	0.05	0.04	0.01	0.02	0.03	0.05	0.11
PCB209	0.04	0.03	0.01	0.02	0.03	0.05	0.10	0.03	0.02	0.01	0.02	0.03	0.04	0.07
Summa	39.58	39.72	6.37	14.82	24.92	52.45	113.36	31.04	28.40	7.65	13.60	21.79	39.07	82.49
WHOPCB_TEQ	2.02	2.20	0.30	0.63	1.21	2.68	6.06	1.44	1.62	0.34	0.64	0.95	1.63	4.07
indPCBs	20.08	21.94	2.87	6.29	11.33	27.30	60.71	14.41	15.93	3.25	6.06	9.38	16.85	40.97

Table 3. PCDD/F intake in adults and children aged one, three and six years.

	adults							1 y						
	mean	stdev	5%	25%	50%	75%	95%	mean	stdev	5%	25%	50%	75%	95%
2378-TCDF	0.40	0.43	0.03	0.14	0.24	0.54	1.17	0.74	1.45	0.04	0.15	0.34	0.74	2.64
2378-TCDD	0.05	0.05	0.02	0.03	0.04	0.07	0.14	0.14	0.19	0.03	0.06	0.09	0.14	0.39
12378-PF	0.09	0.11	0.01	0.02	0.05	0.11	0.27	0.17	0.35	0.02	0.04	0.07	0.15	0.58
23478-PF	0.52	0.78	0.03	0.10	0.27	0.64	1.80	1.27	5.93	0.05	0.12	0.24	0.65	4.23
12378-PD	0.10	0.10	0.02	0.03	0.06	0.13	0.28	0.20	0.42	0.03	0.06	0.09	0.18	0.63
123478-HF	0.04	0.04	0.01	0.02	0.03	0.05	0.11	0.09	0.07	0.03	0.05	0.07	0.11	0.22
123678-HF	0.04	0.05	0.01	0.02	0.03	0.05	0.12	0.09	0.10	0.03	0.05	0.06	0.09	0.22
234678-HF	0.05	0.05	0.01	0.02	0.04	0.06	0.13	0.11	0.09	0.04	0.06	0.09	0.13	0.27
123789-HF	0.06	0.03	0.03	0.04	0.05	0.07	0.10	0.16	0.08	0.05	0.10	0.15	0.20	0.31
123478-HD	0.05	0.02	0.02	0.03	0.04	0.06	0.10	0.15	0.08	0.05	0.09	0.14	0.19	0.29
123678-HD	0.12	0.11	0.03	0.05	0.08	0.15	0.31	0.23	0.23	0.06	0.12	0.17	0.26	0.59
123789-HD	0.05	0.03	0.02	0.03	0.05	0.06	0.10	0.14	0.07	0.05	0.09	0.13	0.18	0.28
1234678-F	0.20	0.08	0.09	0.14	0.19	0.25	0.36	0.68	0.31	0.27	0.45	0.63	0.85	1.25
1234789-F	0.09	0.04	0.04	0.06	0.08	0.11	0.15	0.23	0.12	0.07	0.14	0.21	0.29	0.46
1234678-D	0.26	0.14	0.09	0.16	0.23	0.33	0.54	0.59	0.34	0.19	0.34	0.51	0.75	1.25
OCDF	0.26	0.11	0.11	0.18	0.24	0.32	0.48	0.68	0.37	0.23	0.43	0.61	0.86	1.39
OCDD	0.88	0.50	0.32	0.54	0.76	1.08	1.81	4.90	3.32	1.39	2.71	4.03	6.13	11.34
summa	3.29	2.42	1.10	1.76	2.61	4.04	7.65	9.91	6.52	3.43	5.72	8.17	12.06	22.24
$WHO_{PCDD/F}$-TEQ	0.52	0.63	0.07	0.14	0.31	0.68	1.60	1.11	2.72	0.15	0.27	0.43	0.95	3.81

	3 y							6y						
	mean	stdev	5%	25%	50%	75%	95%	mean	stdev	5%	25%	50%	75%	95%
2378-TCDF	1.31	1.51	0.09	0.33	0.82	1.76	4.09	0.85	0.79	0.16	0.39	0.63	1.04	2.28
2378-TCDD	0.20	0.18	0.06	0.09	0.13	0.25	0.53	0.14	0.12	0.06	0.08	0.11	0.16	0.32
12378-PF	0.28	0.37	0.03	0.06	0.14	0.36	0.91	0.18	0.23	0.04	0.07	0.11	0.21	0.55
23478-PF	1.72	2.48	0.12	0.24	0.67	2.33	6.22	1.01	1.82	0.14	0.26	0.49	1.04	3.40
12378-PD	0.32	0.37	0.06	0.09	0.16	0.43	1.01	0.21	0.24	0.06	0.09	0.14	0.25	0.60
123478-HF	0.12	0.07	0.05	0.07	0.10	0.14	0.26	0.10	0.04	0.05	0.07	0.09	0.12	0.18
123678-HF	0.12	0.11	0.04	0.06	0.08	0.15	0.31	0.09	0.06	0.04	0.06	0.07	0.10	0.19
234678-HF	0.15	0.11	0.06	0.08	0.11	0.17	0.34	0.12	0.07	0.06	0.08	0.10	0.13	0.23
123789-HF	0.18	0.06	0.10	0.14	0.17	0.21	0.28	0.16	0.04	0.09	0.13	0.15	0.18	0.23
123478-HD	0.16	0.06	0.09	0.12	0.15	0.19	0.27	0.14	0.04	0.08	0.11	0.13	0.16	0.22
123678-HD	0.33	0.26	0.12	0.18	0.25	0.39	0.80	0.26	0.16	0.12	0.17	0.22	0.30	0.54
123789-HD	0.16	0.06	0.09	0.12	0.15	0.19	0.27	0.14	0.04	0.08	0.11	0.14	0.16	0.22
1234678-F	0.62	0.22	0.32	0.46	0.59	0.75	1.02	0.51	0.15	0.29	0.40	0.49	0.60	0.79
1234789-F	0.27	0.09	0.14	0.20	0.26	0.32	0.42	0.23	0.07	0.14	0.19	0.23	0.27	0.35
1234678-D	0.65	0.27	0.30	0.46	0.60	0.79	1.15	0.55	0.21	0.28	0.40	0.52	0.66	0.94
OCDF	0.80	0.27	0.42	0.61	0.76	0.95	1.30	0.71	0.21	0.41	0.56	0.68	0.83	1.08
OCDD	3.05	1.63	1.21	1.93	2.68	3.75	6.12	2.51	1.16	1.13	1.70	2.28	3.05	4.70
summa	10.50	7.00	3.99	5.89	8.48	12.91	23.44	7.86	4.26	3.76	5.22	6.76	9.16	15.64
$WHO_{PCDD/F}$-TEQ	1.83	2.47	0.27	0.41	0.82	2.40	6.15	1.18	1.79	0.27	0.41	0.66	1.25	3.65