

DIETARY INTAKE OF DIOXINS AND DIOXIN-LIKE PCBS BY THE POPULATION OF CATALONIA, SPAIN

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Introduction

Polychlorinated dibenzo-p-dioxins (PCDD), dibenzofurans (PCDF) and polychlorinated biphenyls are highly lipophilic compounds which are widely spread in the environment¹. It is well established that food intake represents the main route of human exposure to these contaminants, with fat-containing animal products, and fish and shellfish being the major contributors^{2,3}. In recent years, a decreasing tendency in dietary intake of dioxins and dioxin-like compounds has been observed in a number of studies from different countries^{3,4}.

Until recently, the tolerable daily intake (TDI) for PCDD/PCDF was 10 pg TEQ/kg/day. However, in May 1998 and taking into account new epidemiological and toxicological data, the WHO revised the health risks of PCDD/PCDF and recommended a new TDI range of 1-4 pg WHO-TEQ/kg body weight, which is only applicable to general toxic effects (other than cancer) of PCDD/PCDF. For the first time, this new TDI included also the 12 polychlorinated biphenyl congeners, which possess dioxin-like toxicity⁵. In turn, the Scientific Committee on Food of the European Commission established a tolerable weekly intake (TWI) for dioxins and dioxin-like PCBs of 14 pg/kg body weight⁶.

In 1996, food samples were obtained from local markets and supermarkets in Tarragona Province, (Catalonia, Spain) and analyzed for PCDD/PCDF concentrations. A total dietary intake of 210 pg TEQ/day was estimated for the general population⁷. Between June and August 2000, food samples were again collected and PCDD/PCDF and PCBs analyzed in a wide survey whose sampling was carried out in seven different cities from Catalonia^{8,9}. The current dietary intake of dioxins and dioxin-like PCBs by the population of Catalonia is here presented. Results are compared with those from our previous survey for PCDD/PCDF⁷ as well and with recent data from other countries¹⁰⁻¹³.

Methods and Materials

Food items, details of sampling, and analytical procedures are described in companion papers of this conference^{8,9}. For all food groups, the quantity of each specific item was estimated according to the dietary habits of the population of Catalonia. For TEQ calculations, the WHO-98 toxicity equivalent factors (TEF) were used. It was assumed that non-detected isomer concentrations would be equal to one-half of the respective limit of detection (ND = 1/2 LOD).

Results and Discussion

Data on total daily intake (pg WHO-TEQ) of PCDD/PCDF and dioxin-like PCB in a number of food groups by the general population in Catalonia are summarized in Table 1. The consumption rate (g/day) of each food group and their percentages of contribution to the total intake are also shown.

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Table 1. Estimated daily intake of PCDD/PCDF and PCBs for the general population of Catalonia, Spain

Food group	Consumption rate ^a (g/day)	Intake pg WHO-TEQ/day		
		PCDD/PCDF	PCBs	PCDD/PCDF+PCBs
Vegetables	226 (15.7)	1.67	1.07	2.74
Pulses	24 (1.7)	0.33	0.37	0.70
Cereals	206 (14.3)	13.76	11.36	25.12
Tubercles	74 (5.1)	0.90	0.83	1.73
Fruits	239 (16.6)	2.20	2.10	4.30
Fish and shellfish	92 (6.4)	28.74	82.87	111.61
Meats	185 (12.8)	12.09	8.85	20.94
Eggs	34 (2.4)	2.37	0.84	3.22
Dairy products	106 (7.3)	23.32	29.38	52.70
Milk	217 (15.0)	2.10	1.78	3.88
Oils	41 (2.8)	7.93	10.67	18.60
TOTAL INTAKE	1444 (100)	95.40	150.13	245.53

^aIn parentheses: percentages of the total consumption

Total dietary intake was 95.40 pg WHO-TEQ/day for PCDD/PCDF and 150.13 pg WHO-TEQ/day for PCBs being the sum of PCDD/PCDF and PCBs equal to 245.53 pg WHO-TEQ/day. The greatest contribution for both PCDD/PCDF (28.74 pg WHO-TEQ/day) and PCBs (82.87 pg WHO-TEQ/day), corresponded to fish and shellfish, followed by dairy products: 23.32 and 29.38 pg WHO-TEQ/day for PCDD/PCDF and PCBs, respectively.

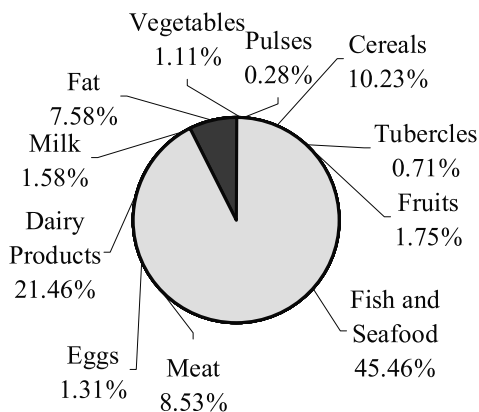


Figure 1. Percentages of contribution from each food group to the total dietary intake of dioxins and dioxin-like PCBs by the general population of Catalonia, Spain.

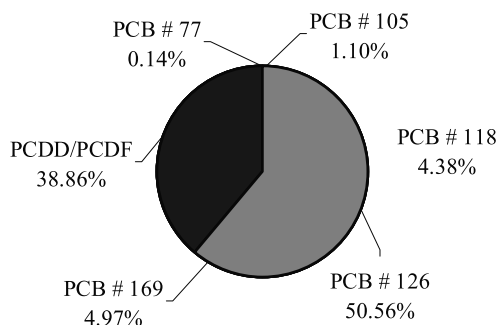


Figure 2. Percentages of contribution from each PCB congener and PCDD/PCDF to the total intake (pg WHO-TEQ/day).

The percentages of contribution to total daily intake of PCDD/PCDF and PCBs are depicted in Figure 1. The high contribution of cereals to this intake (10.23%), which had been also noted in our previous survey⁷, is probably due to the notable consumption of cereals in the region of the current study, which is associated with the *Mediterranean diet*.

The percentages of contribution of PCDD/PCDF and the different PCBs congeners to the total dietary intake of these contaminants are shown in Figure 2. PCB# 126 reached the highest contribution to the total TEQ intake (50.56%).

Table 2 summarizes the estimated daily intake of dioxins and dioxin-like PCBs for the population of Catalonia according to sex and age. Total daily intake range was between 186.43 pg WHO-TEQ/day for females in the group of 4-9 years, and 246.98 pg WHO-TEQ/day for males in the group of 51-65 years. In all age groups, total daily intake of dioxins and dioxin-like PCBs was lower for females than for males, which could be explained by a greater ingestion of food by males.

Table 2. Estimated dietary intake of PCDD/PCDF and PCBs (pg WHO-TEQ/day) from the general population of Catalonia according to sex and age

Age group (years)	4-9		10-19		20-34		35-50		51-65		>65	
	M	F	M	F	M	F	M	F	M	F	M	F
Meat	15.85	15.85	20.49	17.32	25.47	15.62	18.79	14.38	18.45	12.45	13.70	12.11
Fish/Shellfish	65.51	59.44	77.64	72.79	90.98	88.56	115.25	93.41	128.59	106.75	94.62	99.48
Eggs	3.22	1.80	2.84	1.99	3.60	2.18	2.93	2.37	3.22	2.08	2.74	1.51
Milk	5.83	5.22	5.42	4.11	4.10	4.35	4.01	4.33	3.54	4.92	3.92	5.15
Dairy Products	56.18	57.18	67.62	54.20	61.65	44.25	51.21	43.26	45.25	48.73	34.31	37.29
Fats	14.97	15.43	18.60	14.07	19.51	14.07	19.51	14.52	16.79	13.61	12.71	13.61
Cereals	24.38	24.51	32.07	21.82	28.90	19.75	25.24	16.46	21.34	14.39	21.70	16.46
Pulses	0.75	0.72	0.72	0.67	0.67	0.64	0.81	0.75	0.61	0.58	0.72	0.55
Vegetables	1.57	1.45	1.98	1.95	2.29	2.10	3.01	2.62	2.89	2.61	2.31	2.27
Tubercles	1.62	1.36	2.04	1.55	1.85	1.38	1.73	1.29	1.62	1.34	2.11	1.15
Fruits	3.58	3.47	3.69	3.58	3.79	3.69	4.39	3.76	4.69	4.78	5.36	4.28
TOTAL	193.47	186.43	233.11	194.03	242.80	196.58	246.88	197.14	246.98	212.24	194.20	193.87

M=males; F=females

Data of total dietary PCDD/PCDF and dioxin-like PCBs intake from a number of recent reports from different countries, together with those of the present survey are summarized in Table 3. Because of the notable differences in the methodologies used, including the kind and number of analyzed samples, the results of these studies must be compared very carefully.

Although an important reduction in the dietary intake of dioxins by the population of Catalonia has been found between 1996 and 2000, it could be still necessary to establish strategies, including environmental measures, to reduce human exposure to dioxins and PCBs to levels below the current limits proposed by the European Commission and the WHO.

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Table 3. Total dietary intake of PCDD/PCDF and PCBs (pg WHO-TEQ/kg body weight/day) reported for various countries. Comparison with the present study

Country	Food groups analyzed	PCDD/PCDF	PCBs	PCDD/PCDF+PCBs	Reference
Japan	Cereals, vegetables, meat, fish and shellfish, milk and dairy products, fats and oils, prepared foods	1.79	2.06	3.85	Toyoda <i>et al.</i> ⁴ (1999)
Japan	Meats and meat products, fish and shellfish, milk and dairy products, vegetables, fruits, cereals, pulses, oils and fats	1.17	1.13	2.3	Tsutsumi <i>et al.</i> ¹⁰ (2001)
Finland	Meats and meats products, fish and derivative products, vegetables, flour, eggs, milk	0.66	0.76	1.43	Kiviranta <i>et al.</i> ¹¹ (2001)
USA	Meats and meat products, fish, eggs milk and dairy products, vegetables	—	—	2.4	Schecter <i>et al.</i> ³ (2001)
United Kingdom	Not detailed	1	0.8	1.7	Rose <i>et al.</i> ¹² (2001)
The Netherlands	Not detailed	0.8	0.7	1.5	Freijer <i>et al.</i> ¹³ (2001)
Catalonia (Spain)	Meats and meats products, fish and shellfish, vegetables, fruits, cereals, pulses, eggs, milk and dairy products, oils and fats	1.36	2.14	3.5	Present study

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