PCB BODY BURDEN IN THE VICINITY OF DIFFERENT SOURCES OF ENVIRONMENTAL POLLUTION IN BELGIUM

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Introduction

An epidemiological study was carried out in 2000/2001 in Wallonia, Belgium, to quantify the dioxin and polychlorinated biphenyl (PCB) body burdens of subjects living in the vicinity of potential sources of such organochlorine compounds and compare them to levels in a rural unpolluted area. We reported previously the results of the quantification of dioxins (PCDDs and PCDFs) and coplanar PCBs in this population [1,2]. Here are presented the levels of 12 PCB congeners measured on serum samples from the same volunteers.

Methods and Materials

The study was approved by the Ethical Committee of the Catholic University of Louvain. Analyses were performed on serum samples obtained from a total of 246 subjects who had lived for at least 20 years in the same area. A total of 191 subjects, divided in five groups, were recruited in the vicinity of potential sources of dioxin: (i) 43 subjects aged 27 to 80 years who were living within a distance of 2 km from a municipal solid waste incinerator (MSWI) in a rural area (Thumaide); (ii) 25 subjects aged 33 to 65 years were recruited within a distance of 2 km from a MSWI in an industrial area (Pont-de-Loup); (iii) 51 subjects aged 26 to 71 years who were living within a distance of 1 km from the largest Belgian waste dumping site (Mont-Saint-Guibert); (iv) 57 subjects aged 25 to 67 years were living within a distance of 4 km from two iron and steel plants in the suburb of two industrial cities (Liège, n=12 and Charleroi, n=45) and (v) 15 subjects aged 30 to 56 years exposed to urban traffic (bus drivers). These subjects were compared with 55 referents aged 33 to 66 years who were living in three villages in rural areas of the Ardenne, in the South of Belgium. After having given their informed consent, the volunteers provided approximately 200 ml of blood under fasting conditions in the morning. In order to evaluate the PCB body burden, 12 PCB congeners (IUPAC n° 3, 8, 28, 52, 101, 118, 138, 153, 180, 194, 206 and 209) were quantified by GC-HRMS on the lipid fraction of serum. The statistical analysis was done using the SAS software version 8.0 (Enterprise Guide 2.0).

Results and Discussion

The characteristics of the studied population are given in Table 1. The five groups were not significantly different regarding to body mass index (BMI) and age, with the exception of the group living around the MSWI in the industrial area and the group exposed to urban traffic where volunteers were on average younger than referents ($p<0.008$). The group exposed to urban traffic differed also in sex ratio because only composed by men.

The mean concentration of the sum of the 12 congeners (Σ12-PCBs) in the whole population (n=246) was 402 ng/g fat (380 ng/g fat for the 7 markers), for a mean age of 51 years. The individual values ranged from 123 to 1275 ng/g fat. The only group having PCB concentrations higher than the referents was the group living around the MSWI in the rural area. This increase (12 %) was however much smaller than that observed for dioxins (59 %) and coplanar PCBs (47 %) as reported previously [2]. The mean levels of the sum of the 7 PCB markers in the different groups were similar to background levels observed in Belgium [3,4] and other industrialized countries [5], taking into account the difference of age. These concentrations, even around the MSWI in rural area, remain lower than that founded for population regularly consuming seafood products [5,6].

Table 1. Characteristics of studied populations and PCBs concentrations.

	Referents n=55	MSWI 1 n=43	MSWI 2 n=25	Dump n=51	Sinter plant n=57	Traffic n=15	Total n=246
Age (years)	52.6 (50.5-54.7)	53.5 (49.8-57.1)	45.4 (42.0-48.8)	51.8 (49.4-54.2)	52.0 (49.3-54.8)	43.6 (39.2-48.0)	51.2 (50.0-52.4)
Gender (women/men)	29/26	20/23	12/13	29/22	31/26	0/15	121/125
BMI (kg/m^2)	25.4 (24.4-26.4)	27.6 (26.1-29.2)	27.4 (25.7-29.2)	23.6 (22.7-24.5)	25.8 (24.8-26.9)	25.1 (22.7-28.0)	25.6 (25.1-26.1)
Σ12 PCBs[a] (ng/g fat)	416 (385-450)	465 (406-530)	375 (320-440)	380 (344-420)	402 (358-451)	321 (257-400)	402 (383-422)
Σ7 PCBs[b] (ng/g fat)	394 (364-426)	440 (385-502)	356 (305-417)	359 (324-396)	380 (338-427)	301 (241-376)	380 (362-399)

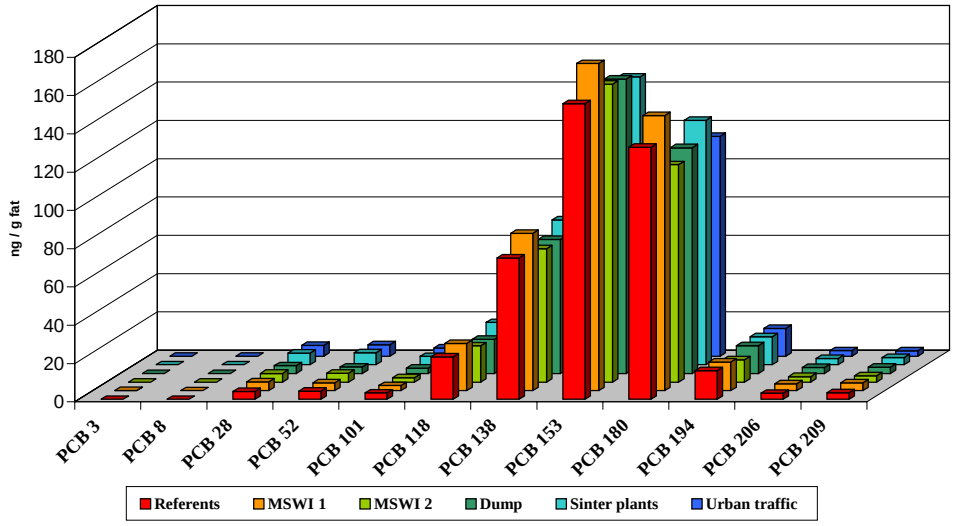
Data are mean (95 % CI). PCBs values were log-transformed and BMI (body mass index) values were inverse-transformed for normalization. MSWI 1 = rural area. MSWI 2 = industrial area.
[a]12 PCBs are IUPAC n° 3, 8, 28, 52, 101, 118, 138, 153, 180, 194, 206 and 209.
[b]7 PCBs are IUPAC n° 28, 52, 101, 118, 138, 153 and 180.

A multiple linear regression analysis was performed to identify factors influencing the accumulation of PCB in the total population. We used a stepwise regression model with a significance level of 0.25 to enter the model and of 0.05 to stay in the model. The Σ12-PCB concentrations were significantly influenced by age (r^2=0.25), sex (r^2=0.05; higher in men than women), animal fat consumption (r^2=0.03), fish consumption (r^2=0.02), exposure to MSWI in rural area (r^2=0.01) and body mass index (r^2=0.01).

In agreement with previous findings[7], the serum concentrations of Σ12-PCBs were significantly correlated with that of dioxins (r=0.72; p<0.0001) and coplanar PCBs (r=0.55; p<0.0001) quantified in serum of the same volunteers.

As shown in figure 1, all groups showed a similar pattern of congeners dominated by the PCB-153, PCB-180 and PCB-138. On average, these three congeners accounted for 85 % of the Σ12-PCB congeners.

Figure 1. Congener profiles of the 12 PCB markers.



In conclusion, little variation is found in the PCB body burden of different groups of the general population in Wallonia, living in the vicinity of potential sources of environmental pollution or in an unpolluted rural area. The only significant variation between studied sites was a small increase (12%) around the MSWI in the rural area in comparison with referents. On average the Σ12-PCB body burden of these different groups is 402 ng/g fat (380 ng/g fat for the 7 markers) for a mean age of 51 years. These values are within the range of background values reported in other industrialized countries for population groups of the same age.

Acknowledgments

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