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## Metanalytical assessment of reference values for polychlorinated biphenyl in human blood

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**RIASSUNTO.** Per le loro caratteristiche chimiche, i policlorobifenili (PCB) presentano un'elevata persistenza nell'ambiente accumulandosi nel suolo, nei vegetali, negli animali in modo proporzionale al livello trofico occupato nella catena alimentare e, pertanto, sono reperibili nelle matrici biologiche di gruppi sempre più ampi di popolazione anche nelle aree più remote del pianeta. Diventa, quindi, utile disporre anche per questi composti di adeguati Valori di Riferimento (VR). In questo lavoro abbiamo cercato di applicare la metodologia metanalitica ai dati esistenti in letteratura sui valori di PCB nel sangue umano per verificare lo stato dell'arte sul tema e per mettere a fuoco alcune specifiche problematiche che sicuramente dovrà affrontare chi intendesse cimentarsi nella produzione dei VR di tali composti. I VR calcolati per i PCB totali sono risultati compresi tra 1.2 e 8.28 µg/L per i maschi e tra 2.69 e 5.17 µg/L per le femmine con un range generale compreso fra 0.9 e 56 µg/L. Come già evidenziato da studi precedenti, la metanalisi, oltre che fornire utili elementi di orientamento sui VR, appare una procedura in grado di evidenziare limiti e proporre soluzioni possibili nella fase di produzione diretta dei VR. I punti critici per i PCB sono: la necessità di includere nelle indagini un numero adeguato di soggetti, definendo ed applicando precisi criteri di esclusione e stratificazione; la scelta di idonei metodi analitici; la definizione di quali congeneri dosare (con i rispettivi limiti di rilevabilità) ed in quale numero; la decisione su come esprimere la concentrazione dei PCB (su volume o su peso dei lipidi); l'adozione di una adeguata analisi statistica, in particolare il trattamento di valori non dosabili; le modalità di presentazione dei dati ottenuti.

**Parole chiave:** PCB, sangue, valori di riferimento, popolazione generale.

**ABSTRACT.** [www.gimle.fsm.it](http://www.gimle.fsm.it)

*Due to their physico-chemical characteristics, polychlorinated biphenyls (PCBs) are highly persistent in the environment and therefore easily measured in the biological matrices of more and more large groups of general population. For these reasons it would be useful to determine suitable Reference Values (RVs) for these xenobiotics. In this paper, a metanalysis to the published data on PCBs values in human blood is presented. This investigation was carried out in order to reach adequate information on their RVs and to focus some specific topics to be taken into account when producing directly RVs for PCBs.*

*The PCBs RVs resulted between 1.2 e 8.28 µg/L for males and between 2.69 e 5.17 µg/L for females. the general range varied from 0.9 to 56 µg/L.*

*The main criticisms in the assessment of RVs for PCBs resulted: the number of examined subjects; the inclusion and stratification criteria; the analytical method adopted and their quality assurance; the type and number of congeners to be determined and their specific quantification; the calculation of blood PCBs concentration (weight/volume or weight/lipids); the statistical analysis and in particular the treatment of not detectable data.*

**Key words:** PCB, blood, general population, reference values.

### 1. Introduction

Polychlorinated biphenyls (PCBs) are highly persistent in the environment and they accumulate in soil, plants and animals progressively and proportionally to the trophic level in the food chain (1).

For this reason PCBs are easily found in the biological matrices of more and more large groups of animals and humans, even in remote areas in the world (11; 61).

For xenobiotics like PCBs, it may be therefore useful to have available Reference Values (RVs), defined as the level of xenobiotics measurable in the biological fluids of subjects belonging to the general population not occupationally or environmentally exposed to them. RVs, in fact, allow to assess the existence of exposure-absorption and, on the basis of dose-response relationship, they also may give information about the probability that adverse effects on human health occur (8).

Some examples of the production of RVs for some of main xenobiotics are supplied by the surveys of the Italian Society of Reference Values (SIVR) in the nineties (5; 6; 7).

Besides the direct production of RVs, we can recall the metanalytical approach based on the analysis of published data dealing with the values of a specific xenobiotic measured in control or reference groups. The metanalysis has been defined as the method which combines the results of different studies carried out on the same theme. The studies individually taken into account can show limits (such as scarce number of cases, methods not adequately validated and/or evaluated, inappropriate statistics) being unable to guarantee suitable results. On the contrary, when studies are combined, we can get a reinforcement in evidence and a consequent general improvement in informative quality (18; 53).

In the specific field of xenobiotics, after dealing with the methodological issues of metanalysis for RVs of trace metals (55), specific applications have been applied to elements such as Hg, Cd, Cr, Pb (15; 3; 14; 30). By this approach, the selection of subjects, the study of biological variability factors, the role of preanalytical and analytical techniques, the statistical treatment emerged as crucial points for determining accurate RVs.

In this paper, we applied a metanalytical method to the published data on PCB values in human blood in order to acquire, by this way, bearing data about RVs for PCBs and

to point out some specific topics to be taken into account when producing directly their RVs.

## 2. Methods

We selected the articles, on PCB concentrations in blood of subjects belonging to control groups or to reference groups of not exposed individuals, published from 1990 to 2003 and quoted in the Pubmed and Toxnet database. For each of the 37 found out publications we analysed, by standardized criteria, the variables of interest such as the procedures for subjects selection; the collection, storage and preparation of biological samples; the analytical methods and quality; the statistical elaboration and presentation of results. The considered variables are described in table I. Particular attention was paid to age, gender, diet, residence in PCBs or other POPs polluted areas, method used to determine PCBs and statistical treatment of data.

The analysis was carried out by two independent reviewers and the results of combined evaluation generally resulted in a good agreement.

The exclusion criteria were stated on the absence or insufficient information about:

- gender and age;
- occupational/environmental exposure;
- diet (in particular fish consumption);
- analytical method;
- statistical treatment of data.

Applying these criteria we excluded:

- 1 article for the absence of information on age (44);
- 2 for the absence of information on gender (38; 69);
- 1 for insufficient description of examined individuals (29);
- 4 for including subjects living in polluted areas (60; 31; 4; 28);
- 3 for investigating only pooled samples (33; 11; 65);
- 6 for lack of information on total PCB values (64; 51; 62; 70; 42; 10) 4 among these papers reported data only for some congeners (64; 62; 70; 42);
- 6 for the absence of information about the analytical method used (64; 66; 31; 24; 62; 70); among these 4 (64; 31; 62; 70) had already been excluded for other reasons;
- 2 for an insufficient statistical treatment and/or presentation of data (36; 43)

At the end of this step of the analysis 21 articles were excluded.

Eligible publications were then evaluated following the grading scheme reported in table II. As can be observed, the maximum ascribable grade was 26 points.

The articles admitted to metanalysis were divided on the basis of their grade into three categories: low level (grade up to 12) including 7 papers; middle level (grade between 12 and 18) with 5 papers; high level (grade over 18) with 4 publications.

Ideally when reference values are established only publications with assigned major grade should be considered. However, since few papers met this requirement, all the publications were used. For each paper we considered the

**Table I. Examined variables**

References
Year Country
SURVEY
N°subjects
Gender
Age
Weight/BMI
Health status
Diet
Residence in polluted area
Accidental exposure
Medication
Current working activity
Hobbies Breast-feeding
ANALYTICAL METHOD
PCB (total/congeners)
Method
Detection limit
Values set for PCB less than the DL
Quality assurance
STATISTICAL ANALYSIS
Lipid transformation
Statistical Distribution
Descriptive statistical analysis
Inferential statistical analysis
RESULTS
TOTAL PCB
Arit. Mean /SD
Geom.Mean /SD
Median
Range
Percentiles
PCB CONGENERS
Arit.Mean / SD
Geom. Mean/SD
Median
Range
Percentiles

**Table II. Criteria for grading**

Variables	Criteria	Grade
Study group	Age (Range)	1
	Age(<4 groups)	2
	Age (>4 groups)	3
	BMI	2
	Groups according to fish consumption	2
Method	Internal quality assurance	1
	External quality assurance	2
	Detection limit	3
	Analytical method total PCB	1
	PCB groups	2
	PCB congeners	3
Statistics	Single measure of central tendency or variability	1
	More measures of central tendency or variability	2
	Distribution characteristics	3

indices of central position (mean and median), and the range and/or percentiles. The 4 studies presenting only the indices of central position (54; 59; 37; 39) were considered apart.

In order to standardize the elaboration and the presentation of results, we expressed all the data as weight/volume, transforming data reported in  $\mu\text{g/g}$  of lipid considering, as suggested by Akins et al, a standard concentration of total lipids of 646 mg/100 ml (2).

For statistical treatment of data, the approach B suggested by Brune et al (14) was adopted. This method is applicable when individual data are not available and consists in the treatment of data, coming from original elaborations, as they were published. This approach requires the

knowledge of data distribution and takes into considerations the index of central position and the range.

### 3. Results

In table III the analytical methods adopted in the 37 studies considered are summarized. Parameters such as the initial volume of blood, the extraction-concentration procedures, the number of congeners analysed, the reference standards, widely varied. The technique used were: the Gas Chromatography (GC) with electron capture relevation system (ECD) adopted in 26 studies; the GC with mass spectrometry (MS) adopted in 8 studies; the GC

**Table III. Analytical methods**

Reference	Biological sample	Method	Detection limit	Quality assurance
Karmaus et al, 2002	Serum	GC (ECD)	DL: 3 $\mu\text{g/Kg}$ Aroclor 1260	No
Moysich et al, 2002	Serum	HRGC (ECD)	DL: 0.09 ng/g PCB153	Yes (internal)
Kirivanta et al, 2002	Serum	HRGC (ECD)	DL: 1.5 pg/g lipid non-orto PCB DL: 50pg/g lipid others PCB	Yes (external)
Koppen et al, 2002	Serum	HRGC (ECD)	DL: 0.015 ng/ml for each congener	No
Fangstrom et al, 2002	Serum	GC (ECD)	/	Yes (internal, external)
Heudorf et al, 2002	Plasma	GC (ECD)	LQ: 0.1 $\mu\text{g/l}$	No
Hagmar et al, 2001 b	Plasma	GC (ECD)	/	No
Shadel et al, 2001	Serum	/	1.9 ppt	Yes
Hagmar et al, 2001 a	Plasma	GC (ECD)	/	No
Sala et al, 2001	Serum	GC (LRMS)	/	Yes (external)
Bjerregaard et al, 2000	Plasma	GC (ECD)	DL: 0.02 $\mu\text{g/l}$ for congeners	Yes (internal, external)
Wingfors et al, 2001	/	HRGC (MS)	/	No
Longnecker et al, 2000	Plasma	GC (ECD)	DL: 2-10 $\mu\text{g/Kg}$ lipid for congeners	No
Glynn et al, 2000	Serum	GC (ECD)	LQ: 10 pg/ g serum=2 ng/g lipid for each congener	Yes (internal)
Longnecker et al, 1999	Serum	GC (ECD)	DL: 1 $\mu\text{g/l}$	No
Hanrahan et al, 1999	Serum	GC (ECD)	'reference	Yes (internal, estrno)
Tuomisto,Hagmar, 1999	Plasma	/	/	
Kearney et al, 1999	Plasma	GC (ECD)	LQ 0.5 $\mu\text{g/l}$ PCB total DL 0.2 $\mu\text{g/l}$ PCB total	Yes (internal-external)
Fitzgerald et al, 1999	Serum	GC (ECD)	DL: 0.01-10 ppb for each congener	No
Gladen et al, 1999	/	/	/	No
Sala et al, 1999	Serum	GC (ECD)	DL: 0.05 ng/ml	Yes (external)
Laden et al, 1999	Plasma	GC (ECD)	DL<1 ppb	Yes (internal-external)
Ewers et al, 1999	Serum/plasma	/	/	No
Devoto et al, 1998	Plasma	GC	/	No
Anderson et al, 1998	Serum	HRGC (MS) HRGC (ECD)	/	No
Gonzales et al, 1998	Blood	GC (MS)	/	Yes
Devoto et al, 1997	Plasma	GC (ECD)	QL 0.025 $\mu\text{g/l}$ for each congener	No
Schmid et al, 1997	Plasma	/	/	Yes
Ayotte et al, 1997	Plasma	GC (ECD) GC (MS)	DL 0.2 $\mu\text{g/l}$ DL 10ng/kg	No
Wuthe et al, 1997	/	/	/	No
Grimvall et al, 1997	Plasma	GC (MS)	DL 30 fg	No
Jimenez et al, 1996	Serum	HRGC -HRMS	/	No
Svensson et al, 1995	Plasma	GC (HRMS) GC (ECD)	/	Yes (external)
Kannan et al,1994	Blood	GC (ECD)	/	No
Asplund et al, 1994	Plasma	GC (ECD) GC (MS)	DL 0.005-0.05 pg/g plasma DL 0.01-0.1 Pg/g plasma	Yes (internal-external)
Frank et al, 1993	Blood	GC (MS)	QL 6 $\mu\text{g/Kg}$	No
Hovinga et al, 1992	Serum	GC	DL 3ppb	Yes (internal)

high resolution mass spectrometry (MS HR) adopted in 3 studies. The 209 possible congeners of PCBs were therefore examined with techniques different both for identification and limit of detection. The detection limits varied between 0.01 and 0.03 µg/L for single congeners and between 0.5 and 3 µg/L for PCB mixtures. In 16 papers quality assurance procedures that reported external and/or internal quality control programs were adopted; while the other 21 articles did not specified any quality procedures.

Only 12 out of 37 studies specified the number of congeners analysed, which varied from a minimum of 2 to a maximum of 37 congeners. The PCB congeners with assigned Toxicological Equivalent Factor (TEF), in respect to 2,3,7,8-Tetrachlorodibenzodioxin, ranged between 0 and 6 and only in 2 papers their number was higher, respectively 8 and 11 congeners (table IV).

Table V summarizes the results of 37 studies and for each of them the number of examined subject, the PCB values and their unity of measure are reported.

The number of subjects examined varied from 28 to 624, being in 9 papers lower than 100 (in particular in 6 papers below 50) and in 9 higher than 150.

In table VI the 16 studies selected for final analysis are reported after transforming PCB values and in µg/L.

The results of metanalysis for total PCBs, PCB 153 (a congener of interest for its possible effect on thyroid metabolism) are reported in table VII. Mean RVs computed for total PCBs ranged between 1.2 and 8.28 µg/L for males, and between 2.69 and 5.17 µg/L for females. Total PCBs ranged between 0.9 to 56 µg/L. Overall, mean RVs for congener 153 varied between 0.05 and 2.04 (with a range between 0.05 to 40.9 µg/L).

Devoto's paper (20) was examined separately as it dealt with PCB values in a specific subgroup of general population including subjects over 65 years with a mean value of about 20 µg/l and a range between 0 and 212 µg/l.

The values in males and in females were analysed separately and are reported in figure 1 and 2, specifying also the grading of the different studies from which the data were extracted.

#### 4. Discussion

In the present study, the mean-median values of PCBs varied between 1.2 e 8.28 µg/L in males and between 2.69 e 5.17 µg/L in females, with a general range varying from 0.9 to 56 µg/L.

The publications before 1990, selected by ATSDR (1) and summarized in table VIII, show median values of total PCBs between 4 e 6.4 µg/l (range 1-60), with an evident trend to decrease, within the considered period.

The variability in PCB values may be explained by analytical methods adopted and by the type and number of congeners examined.

In 37 studies, PCBs were examined through 3 analytical technique (GC ECD, GC MS, GC MS HR) and by at least 18 different analytical methods. Moreover, PCB values were calculated by some authors by measuring total

PCBs, by others by adding the most significant congeners (for their toxicity and environmental relevance).

The number of examined congeners varied between 2 and 37 and PCB 153 resulted the most frequently measured congener, with an index of central position ranging between 0.05 and 2.04 µg/L.

Among the main factors of biological variability influencing PCB levels, age is one of the most investigated. A clear progressive increase of PCBs was observed during lifetime (20) and Ewers et al. (24) presented RVs classified in different age categories as reported in table IX.

Another variability factor was represented by the method adopted to calculate the blood concentrations of PCBs: e.g. weight on volume of plasma/serum (µg/L) or weight on quantity of lipids (µg/g lipids) and how lipids were evaluated (as total lipids, or as sum of triglycerides and cholesterol actually determined or on theoretical basis considering a fixed concentration of lipids).

Fish consumption from PCB polluted waters has been identified as one of most important factor of biological variability. This kind of variability was evaluated for people living in the Lakes Region (4), in Michigan (40), in New York (27); in Wisconsin (26), in Northern Illinois (56), in Alabama (49) and in Canada (57). Some studies demonstrated a direct relationship between the amount of fish consumption (number of meals based on fish) and PCB concentrations (26; 39; 40). In two recent studies, moreover, Hanrahan e Kearney determined the PCB concentration in serum in two different groups of subjects (frequent and not frequent fish consumers). They found that the mean concentration of PCB in blood of 252 and 101 frequent fish consumers resulted 4.8 (range 0.7-58.2) and 5.5 (range 0.9-21) µg/l; while in 57 and 45 subjects not consuming fish resulted to be 1.5 and 3.9 µg/l (37, 45).

Also following these observations, a serious control of the variable "Assumption of PCB through diet" appears to be mandatory and when diet data are not available it is advisable to exclude the data from analysis.

**Tabella IV. Number of determined congeners and TEQ congeners**

Reference	Year	N° congeners	N° TEQ congeners
Kirivanta et al.	2002	37	11
Fangstrom et al.	2002	4	4
Shadel et al.	2001	18	4
Glynn et al.	2000	10	4
Longnecker et al.	2000	14	6
Sala et al.	1999	5	1
Anderson et al.	1998	32	4
Schmid et al.	1997	3	-
Devoto et al.	1997	32	2
Wuthe et al.	1997	12	6
Grimvall et al.	1997	14	8
Jimenez et al.	1996	2	2

In this paper we demonstrated serious limits in producing RVs for PCBs. In general when applying meta-analysis for the production of RVs, the limits derives from the lack of criteria suggested for well-designed investigations oriented to produce RVs directly. In fact, many studies do not adequately examine and put under control factors such as availability of analytical methods, knowledge of toxicokinetics, control of pre-analytical misleading variables, accurate selection of reference cases, adequate statistical treatment of data.

As already recalled, in a previous study (9), the use of meta-analysis for assessing RVs appears an useful procedure to inform about their possible approximate amount, and suitable to demonstrate the limits of considered sur-

veys. Starting from these evidences, we would be able to suggest the critical points to put under control in the production of RVs.

In conclusion the main aspects to be focused in the production of RVs for PCBs, as resulted, are an adequate number of subjects, setting and applying correct exclusion and stratification criteria; the proper analytical method, the type and number of congeners to be determined, the specific detection limits; the report of PCB concentration (volume/lipids); the statistical analysis and data elaboration, aspects often neglected, moving from an accurate assessment of the shape of the PCBs distribution in the population considered, to treatment of not detectable values, to the more appropriate inferential analysis.

**Table V. Articles from data banks**

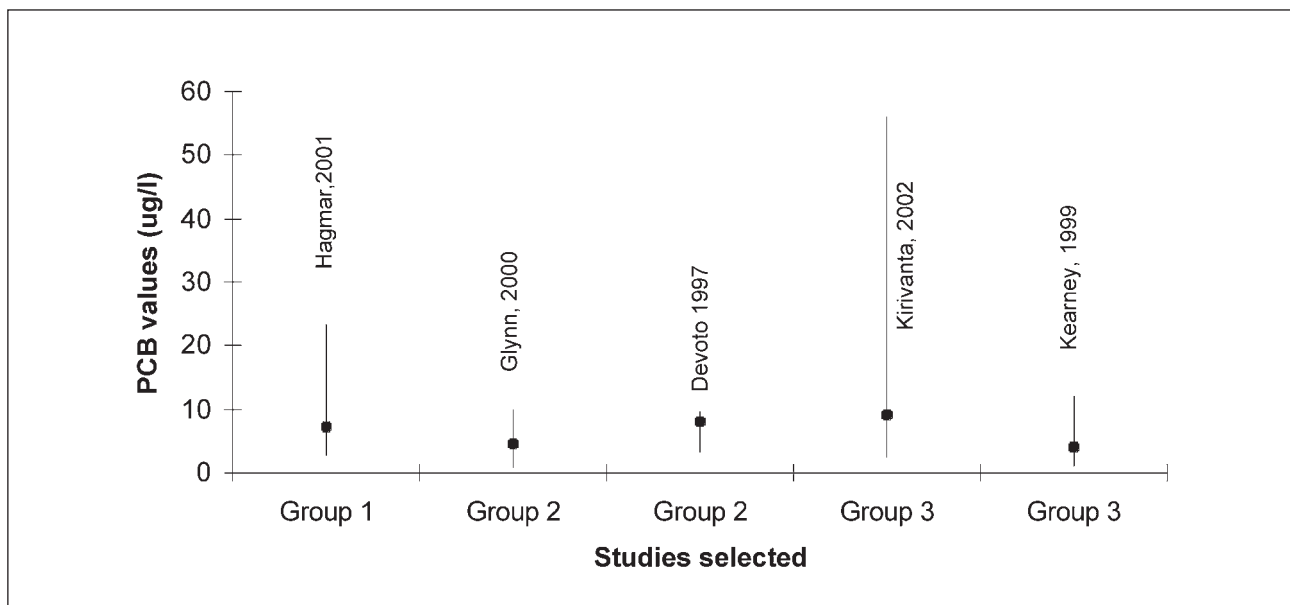
Reference	N° subjects	PCB					Unit of measure
		Mean	SD	Median	Range	Percentiles	
Karmausl, 2002	245 F					0 (5°)-34.6 (95°)	µg/L
	354 M					3(5°)- 65.8(95°)	µg/L
Moysich, 2002	192 F	4.12	2.24				µg/L
Kirivanta, 2002	47	2100		1400	360-8700		ng/g lipid
Koppen, 2002	200 F	390					ng/ g lipid
Fangstrom, 2002	182 F			750		460(10°)-5900(90°)	ng/ g lipid
Heudorf, 2002	624				<LOD-10.13		µg/L
Hagmar 2, 2001	182 F				0.5-10.4		ng/g lipid
Shadel, 2001		ONLY CONGENERS					
Hagmar 1, 2001	110					402 (10°)-1137(50°)-3617(90°)	ng/g lipid
Sala, 2001	608	3.2	3.1				µg/L
Bjerregard, 2000	180 F	6.7	5.3	5.2	1.1-34		µg/L
Wingfors, 2000	28	1310	1.3				ng/g lipid
	35	1450	2.3				ng/g lipid
Longnecker, 2000	63	CLORURATION GROUPS					
Glynn, 2000	120 M	749.6	282.7	700.6	147.7-1545.9		ng/g lipid
Longnecker, 1999	67F			5.1		3.7 (25°)-7.6 (75°)	µg/L
Hanrahan, 1999	57M			1.3			ppb
	42F			0.9			ppb
Tuomisto, 1999		ONLY CONGENERS					
Kearney, 1999	35F			3.2	1.3-12		µg/L
	45M			3.9	1.1-12		µg/L
Fitzgerald, 1999	139M	4.9	5.6	3.2			ppb
Gladden, 1999	44	ONLY CONGENERS					
Sala, 1999	608	4.3			0-143.43	1.27(25°)-4.92(75°)	µg/L
Laden, 1999	480F	5.22	2.35		1.61-16.62		ppb
Ewers, 1999		RV FOR GROUPS OF AGE					
Devoto, 1998	155F	24.8		20.2	0-212		µg/kg
	142M	25.3		21.5	0-98.7		µg/kg
Anderson, 1998	41	1.2			0.46-2.9		ppb
Gonzales, 1998	198	POOLED					
Devoto, 1997	68F			0.65		0.25(25°)-1.02(75°)	µg/L
Schmid, 1997		ONLY CONGENERS					
Ayotte, 1997		POOLED					
Wuthe, 1997		ONLY CONGENERS					
Grimvall, 1997	50 F		3010		1020-10700		pg/ml
Jimenez, 1996		ONLY CONGENERS					
Svensson, 1995		POOLED					
Kannan, 1994		POOLED					
Asplund, 1994		ONLY CONGENERS					
Frank, 1993	750	9.2	14.5		0-110		µg/kg
Hovinga, 1992	95	6.6					ppb

**Table VI. Studies selected for metanalysis**

Reference	N° soggetti	PCBs				
		Arithmetic Mean (SD)	Geometric Mean	Median	Range	Percentiles (5-95)
Moysich, 2002	192 F	4.12 (2.24)				
Kirivanta, 2002	21 M	13.6		9.04	2.3-56	
Koppen, 2002	200 F	2.5		2.69		2.14-3.45
Fangstrom, 2002	182 F			4.8		2.9 (10)-38.1(90)
Sala, 2001	83 M	3.4 (3.7				
	338 F	3.2 (3.0)				
	421	3.2 (3.1)				
Hagmar 1, 2001	110 M					2.6 (10); 7.3 (50); 23.4 (90)
Bjerregard, 2000	175 F	6.7 (5.3)		5.2	1.1-34	
Glynn, 2000	120 M	4.8	1.8	4.5	0.9-9.9	
Longnecker, 1999	67 F			5.1		3.7 (25)-7.6 (75)
Kearney, 1999	35 F			3.2	1.3-12	
	45 M			3.9	1.1-12	
Hanrahan, 1999	57 M			1.3		
	42 F			0.9		
Laden, 1999	240 F	5.22 (2.35)			1.61-16.62	
Devoto, 1998	155 F	24.8		20.2	0-212	14.5 (25)-29.5(75)
	142 M	25.3		21.5	0-98.7	13.7 (25)-32.6 (75)
Devoto, 1997	68 F			0.65		0.25 (25)-1.02 (75)
	100 M			7.98		3.29 (25)-9.76 (75)
Grimvall, 1997	50 F	4.27			1.86-14.48	
Hovinga, 1992	95 (44 M-51 F)	6.6				

**Table VII. RVs from metanalysis**

	MEAN RANGE (µg/L)		GENERAL RANGE (µg/L)
	MALES	FEMALES	
TOTAL PCB	1.2-8.28	2.69-5.17	0.9-56
PCB 153	0.3-2.6		0.2-2.4

**Figure 1. Total PCBs in males (median-mean and SD)**

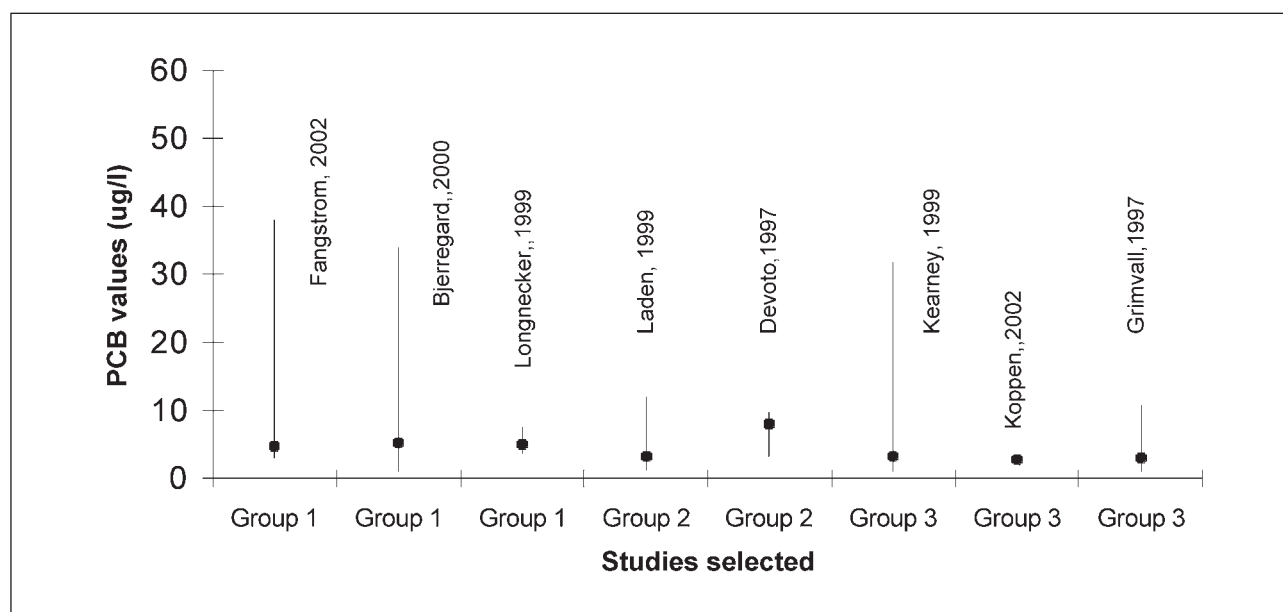


Figure 2. Total PCBs in females (median-mean and SD)

Table VIII. Serum PCB values in non occupational exposed populations examined before 1990 (ATSDR, 1997)

Reference	N° subjects	PCBs (µg/l)			
		Arithmetic Mean	SD	Geometric mean	Range
Baker, 1980	110	18.8	10.8		6-79
Vernon, 1981	7	4.9	3.1	4.2	2-11
Drotman, 1981	17	7.5	6.8	5.8	2-30
Chase, 1982	19	12			10-27
Kreiss, 1982	1631	7.7		6.4	1-57
Humphrey 1983	418			6.6 (median)	3-60
Condon 1983	990	4.9	3.5	4.2	2-30
Schwartz 1983	71	4			
Welty 1983	59	5.8	6.5	4.4	1-45
Welty 1983	40	6.7	5.3	5	1-23
Sahl 1985	738	5	4.37	4 (median)	1-37

Table IX. Reference values for age classes (Ewers, 1999)

AGE CLASSES	TOTAL PCBs	
	BLOOD	PLASMA
7-10	1.3	-
18-25	2.5	3.2
26-35	3.5	5.6
36-45	4.6	7.6
46-55	5.7	10.0
56-65	6.8	12.2
>65	-	-

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