Toxicokinetics of Chiral Polychlorinated Biphenyls Across Different Species—A Review

SUPPLEMENTARY MATERIAL

Environmental Science and Pollution Research

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Table S1. Levels of chiral PCBs in human blood samples. All units were adjusted to ng/g, see footnotes. The table is organized by continent, country and publication year in descending order. Highest values for a congener are marked in bold.

Sample	Country/ population	Number	PCB 91	PCB 95	PCB 132	PCB 136	PCB 149	PCB 183	Analytical method	Ref/ year
North America										
NHANES- large general population study										
serum	US/gen. pop. (NHANES)	1873					0.004[a]	0.01[a]	GC/HRMS	(Patterson et al. 2009) 2009
	US/gen. pop. (NHANES)	2285					0.004	0.009		
serum	US/gen. pop. (NHANES)	2547					nd	nd	HRGC/ HRMS	(Center for Disease Control and Prevention 2009)
	US/gen. pop. (NHANES)	2274					na	nd		
fish-eating populations, including Native Americans										
serum	US/natives	277						nd-0.35	GC/ECD	(Goncharov et al. 2008) 2008
serum	Greenland/ gen. pop.	70						0.06-1.47	GC/MS	(Rusiecki et al. 2008) 2008
serum	US/workers	180						0-0.05	GC/ECD	(Freels et al. 2007) 2007
	US/fish eaters	217						0-0.04		
serum	US/older pop. fish eaters	253						0.05[d]	GC/ECD	(Fitzgerald et al. 2007) 2007
serum	US/sport fishers	99						**8.5[c]**	GC/ECD	(Turyk et al. 2006) 2006
serum	US/ natives	314					0.8-**8.6**	1.8-5.0	GC/MS	(Schaeffer et al. 2006) 2006
plasma	Greenland/ Inuit women	153						0.04-0.96	GC/ECD	(Côté et al. 2006) 2006
serum	US/sport fishers	308		0.02-0.36[b]		0.003-0.37	0.01-1.0	nd-0.28	GC/ECD	(Bloom et al. 2005) 2005
serum	US/natives	753	nd-**0.19**	nd-0.32	nd-0.23	nd-0.16	nd-0.25[b]	nd-0.75	dGC/ECD	(DeCaprio et al. 2005) 2005
serum	US/natives	271	nd-0.04	nd-0.15	nd-0.08	nd-0.08	nd-0.12[b]	nd-0.15	dGC/ECD	(Schell et al. 2003) 2003
serum	US/sport fishers	66						0.01-0.19	GC/ECD	(Bloom et al. 2003) 2003

Sample	Country/ population	Number	PCB 91	PCB 95	PCB 132	PCB 136	PCB 149	PCB 183	Analytical method	Ref/ year
serum	US/fish eaters	101						nd-1.7	GC/ECD	(Humphrey et al. 2000) 2000
	US/gen. pop.	78						nd-0.6		
serum	US/natives.	282	nd-**0.19**	nd-0.29	nd-0.17	nd-0.16	nd-0.24[b]	nd-0.55	GC/ECD	(DeCaprio et al. 2000) 2000
serum	US/natives	61	0-0.02	0-0.1[b]		0-0.68	0-0.02	0.02-0.38	GC/ECD	(Gerstenberger et al. 2000) 2000
plasma	Canada/fish eaters	43						nd-0.08	GC/ECD	(Kosatsky et al. 1999) 1999
serum	US/sport fishers	32						0.01-0.4	GC/HRMS	(Anderson et al. 1998) 1998
serum	US/seafood eaters	23						nd-2.29	GC/ECD	(Burse et al. 1994) 1994
epidemiological studies on cancer										
plasma	Canada/ caner	214						up to 0.04	GC?ECD	(Aronson et al. 2010) 1997-8
plasma	Canada /gen.pop.and non-H lymp	422						nd-**84.86**	dGC/ECD	(Spinelli et al. 2007) 2007
plasma	US/non-H lymp	200						nd-0.4	GC/MS	(De Roos et al. 2005) 2005
other										
plasma	Canada/ natives.	1776						0.0-0.5	HRGC/MS	(Liberda et al. 2014) 2002-09
plasma	Canada/ elder	1979						0.02-0.05	GC/MS	(Medehouenou et al. 2011)1991-2001
plasma	Canada/ women	109						nd-0.06	GC/MS	(Sandanger et al. 2007) 2007
plasma	Canada/ women	385						nd-0.44	GC/ECD	(Butler Walker et al. 2003) 2003
plasma	Canada/ cord	30				0.001-0.65	nd-0.1	0.002-0.14	GC/MS	(Sandau et al. 2002) 2002
cord plasma	Canada/ Inuit	35						0.4[c]	GC/CED	(Pereg et al. 2002) 2002
plasma	Canada/ gen. pop.	68						0.00004[e]	GC/ECD	(Longnecker et al. 2000) 2000

Sample	Country/ population	Number	PCB 91	PCB 95	PCB 132	PCB 136	PCB 149	PCB 183	Analytical method	Ref/ year
serum	US/Anniston	765					nd–0.31	nd-3.5	HRGC/ID-HRMS	(Pavuk et al. 2014) 1996-98
serum	US/gen. pop.	85	nd	nr			nd	0-0.01	HRGC/HRMS	(Marek et al. 2013) 2008-09
serum	US/gen. pop.	26	nd	nd		nd	nd		GC/ECD	(Knobeloch et al. 2012) 2004-05
serum	US/gen. pop	37						0.014-0.016	GC/ECD	(Arguin et al. 2010)
serum	US/women	17						0.007	GC/HRMS	(LaKind et al. 2009) 2008
serum	US/construct	6		0.022[b,c]		0.003[c]	0.009[c]	0.036[c]	GC/ECD	(Herrick et al. 2007) 2007
serum	US/gen.pop.	50		0.05[b]			0.7	0.09	GC/MS and HRMS	(Schantz et al. 2007) 2007
serum	US/women	15			nd-**8.58**	0.54-**22.3**		2.17-6.97	GC/CED	(Whitcomb et al. 2005) 2005
serum	US/Anniston	12		nd-0.06		nd-0.09	nd-0.11[b]	nd-0.68	GC/ECD	(Hansen et al. 2003) 2003
plasma	US/obese men	36						0.02[c]	GC?ECD	(Bray et al. 2002) 2000
serum	US/gen. pop.	10						nd-0.37	GC/ECD	(Najam et al. 1999) 1999
plasma	US/gen. pop.	68					0.03	0.04-0.06	HRGC/ECD	(DeVoto et al. 1997) 1997
whole blood	US/gen. pop.	1	nd	0.13[b]		3.2	0.025	0.25	GC/ECD	(Wilson-Yang et al. 1992) 1992
serum	US/ occup. exp.	165		0.4-**93**[b]				0.06-26	GC/ECD	(Wolff et al. 1992) 1992
serum	US/ children	8		3.8					GC/ECD	(Wolff and Schecter 1991) 1991
serum	US/ gen. pop.	29						0.03-0.2	dGC/ECD	(Duebelbeis et al. 1989) 1989
	US/ occup. exp.	3						0.3-2.0		
serum	US/ occup. exp.	52					0.16-**11**[b]	0.14-6.9[b]	GC/MS and ECD	(Fait et al. 1989) 1989
	US/gen.pop.	56			0.08		0.15-5.5	0.05-2.4		

Sample	Country/ population	Number	PCB 91	PCB 95	PCB 132	PCB 136	PCB 149	PCB 183	Analytical method	Ref/ year
serum	US/gen. pop.	243						0.052[c]	HRGC/LRMS	(Patterson et al. 1989) 1989
serum	US/mothers US/fetus	101			0.05			0.07[c] 0.03	GC/ECD	(Bush et al. 1984) 1984
plasma	Mexico/chilren	45						nd	GC?MS	(Trejo-Acevedo et al. 2012) 2006
serum	US/Mex-Am women	285						nd-8.2	HRGC/ HRMS	(Chevrier et al. 2007) 2007
serum	Mexico	123						nd -0.004	GC/MS	(Orta-García et al. 2014) 2010
South America										
Whole blood	Brasil	155						0.001	GC/MS	(Rudge et al. 2012) 2007-08
Asia										
plasma	Russia/ women	48						nd-0.14	GC/MS	(Eik Anda et al. 2007) 2007
serum	Russia/ women	446					0.003-0.04	0.003-0.3	GC/HRMS	(Humblet et al. 2010) 2003-05
plasma	Russia	50						0.012-0.26	GC/MS	(Sandanger et al. 2003)
serum	Korea/urban	40						nd-0.08	GC/HRMS	(Kang et al. 2008) 2008
serum	Korea/ gen.pop.	87		nd-0.12			nd-0.12	nd-0.13	HRGC/ HRMS	(Park et al. 2007) 2007
serum	China/ occup. exp.	47		nd-0.02			nd-0.05	nd-0.02	GC/MS	(Bi et al. 2007) 2007
whole blood	China/ occup. exp.	50						0.03[c]	HRGC/ HRMS	(Ling et al. 2008)
plasma	Hong-Kong/ gen. pop.	111						0.002-0.04	GC/MS	(Qin et al. 2011) 2008
plasma	Bangladesh/ gen. pop.	98						0.04-0.65	GC/ECD	(Zamir et al. 2009)
plasma	Vietnam/ women	189					0.02-0.25	0.02-0.07	GC/MS	(Hansen et al. 2009) 2005
serum	Japan/ cancer	51						nd-0.12	HRGC/ HRMS	(Nomiyama et al. 2009)

Sample	Country/ population	Number	PCB 91	PCB 95	PCB 132	PCB 136	PCB 149	PCB 183	Analytical method	Ref/ year
whole blood	Japan/ gen. pop.	151						0.004-0.23	HRGC/ HRMS	2001 (Masuda et al. 2005)
whole blood	Japan/ gen. pop.	24	nd-0.0003	0.0005-0.007[b]	nd-0.001	nd-0.0006	0.0005-0.006[b]	0.005-0.02	HRGC/ HRMS	2005 (Hirai et al. 2005)
whole blood	Japan/ women	514		0-0.007	0-0.003		0-0.005	0-0.04	HRGC/ HRMS	2005 (Todaka et al. 2011)
whole blood	Japan/ women	119		0-0.01[b]	0-0.004		0-0.01	0.004-0.07	HRGC/ HRMS	2002-05 (Todaka et al. 2010)
serum	Japan	129						0.003-0.02	HRGC/MS	2002-05 (Hisada et al. 2014)
whole blood	Japan/ elderly	127		0.02[b]	0.008			0.11	HRGC/ HRMS	2009-11 (Todaka et al. 2008a)
whole blood	Japan/ women	195		0.0003-0.011	0.0003-0.003			0.002-0.07	HRGC/ HRMS	2004 (Todaka et al. 2008b)
whole blood	Japan/ Yusho	316		0-0.02[b]	0-0.001			0.004-0.4	HRGC/ HRMS	2002-04 (Todaka et al. 2009)
serum	Taiwan/ Yucheng	56						nd-0.0006	HRGC/ HRMS	2004 (Guo et al. 1997)
Europe										1997
serum	EU ministers	14					0.001-0.007	0.01-0.2	unknown	pdf
serum	Faroe Island	36						0.07-1.8	GC/CED	(Fängström et al. 2002)
serum	Slovakia/ gen.pop.	315		nd-0.31	0.0002-0.5	nd-0.32[b]	nd-1.2	0.3-5.3	GC/MS	2002 (Jursa et al. 2006)
serum	Romania/ gen .pop.	142						nd-1.1	GC/MS	2006 (Dirtu et al. 2006)
serum	Romania Belgium	53 20						nd-0.4 nd-0.16	GC-MS	2006 (Dirtu et al. 2009)
serum	Belgium/ gen. pop. Romania/ gen. pop.	5 5						0.07-0.2 nd-0.18	GC/ECD and GC/MS	2006-07 (Covaci and Schepens 2001)
serum	Romania/ gen. pop.	2					0.13-2.9	0.04-0.64	GC/ECD and GC/MS	2001 (Covaci et al. 2001)
serum	Romania/	7					nd	0.09-0.4	GC/ECD	2001 (Covaci et al. 2000)

Sample	Country/ population	Number	PCB 91	PCB 95	PCB 132	PCB 136	PCB 149	PCB 183	Analytical method	Ref/ year
serum	gen. pop. Italy/gen. pop.	164					nd-0.69	nd-0.17	GC/LRMS	2000 (Turci et al. 2006) 2006
serum	Italy/gen. pop.	134						nd-0.54	GC/HRMS	(Turci et al. 2004) 2004
serum	UK/gen. pop.	154		nd-0.06			nd-0.08	nd-0.11	GC/MS	(Thomas et al. 2006) 2006
serum	Germany/ children	320						nd-0.12	GC/ECD	(Osius et al. 1999) 1999
plasma	Norway/ rural	31						0.02-0.16	GC/MS	(Sandanger et al. 2006) 2006
serum	Greece/ gen. pop.	61						0.003-0.06	GC/MS	(Kalantzi et al. 2011) 2007
whole blood	Sweden/ gen. pop.	89						0.01-0.29	HRGC/MS	(Hardell et al. 2004) 2004
plasma	Sweden/ occup. exp.	36		0.063					GC/MS	(Wingfors et al. 2006) 2006
	Sweden/ gen. pop.	33		0.010						
serum	Finland/ gen. pop.	unknwn					nd	nd	HRGC/ECD or HRMS	(Luotamo et al. 1991a) 1991
	Finland/ occup. exp.	6					1.09	1.31		
	Finland/ acc.release	8					2.24	nd		
serum	Finland/ gen. pop.	30						nd-3.7	HRGC/ECD	(Luotamo et al. 1991b) 1991
	Finland/ occup. exp.	21						nd-5.7		
	Finland/ acc. release	33						0.1-0.3		

Abbreviations: dGC- dual column; nd- MDL or otherwise defined detection limit, where available; non-H. Lymph. – non-Hodginks lymphoma; gen. pop. – general population; occup. exp. – occupational exposure; acc. release – accidental release; unknwn – unknown. [a] geometric mean; [b] co-eluting with another congener(s); [c] mean; [d] adjusted mean; [e] median; Data reexpression for the table: a) according to published data(Ward et al. 2000), the density of serum used was 1.026 g/ml, and the following units were assumed to be equivalent: ppb, ng/g, ng/ml, μg/L. The same assumption was made for blood plasma. b) The serum lipids content was calculated as 7 mg/g according to (Phillips et al. 1989) (factor x0.007), and plasma lipids were calculated as 6 mg/ml according to (Michaels et al. 1960). The whole blood lipids were assumed to be same as plasma.

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