Supplementary Material for

Do human individuals differ in their potential for lipophilic contaminant biomagnification?

Yuhao Chen[1,2], Terrence Bell[1], Ying Duan Lei[1], Frank Wania[1,2]

[1] *Department of Physical and Environmental Sciences, University of Toronto Scarborough, 1265 Military Trail, Toronto, Ontario, Canada M1C 1A4*

[2] *Department of Chemistry, University of Toronto Scarborough, 1265 Military Trail, Toronto, Ontario, Canada M1C 1A4*

This supporting file incudes: 23 pages, 14 tables and 11 figures

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Text S1. Detailed food preparation and sample collection

Five volunteers (i.e., M58, M31, M30, F35 and F24) shared the same dietary list from February 4th to 8th, 2023. Each volunteer would prepare and cook the same amount of food (including breakfast, lunch, and dinner) for each other volunteer on a selected day (between February 4th and 7th). On February 8th, volunteers ordered takeouts and shared the food together at the University of Toronto, Scarborough Campus (UTSC). Corn, Enoki mushrooms and pork blood were provided on Day 1 & 5 and served as biomarkers. Foods were enough for six people (5 volunteers + 1 blank) and packed in clean food containers. While blanks were placed in baked glass jars (Uline Canada, Milton). Foods were placed in a refrigerator before being picked up. During the study period, the researcher picked up the dietary and/or fecal (if any) samples from volunteer(s) and delivered the food items to each volunteer. Right after the food delivery, blanks and/or fecal samples were sent to the Alfonse lab at UTSC and stored at -20°C. Volunteers were required to write down the mass of each item consumed and/or leftover every day on a questionnaire provided by the researcher. The volunteers were not expected to consume all provided foods, but the proportion of leftovers should be consistent every day since we wanted to maintain the composition of consumed foods within those 5 days. Dietary ingestion rate can be found in Table S6.

Volunteers should start collecting fecal samples once they see biomarkers in feces on Day 1 and stop collecting samples when biomarkers show up after Day 5. All fecal matters should be collected without the contamination of urine. However, some fecal samples were collected before Day 1 for gut microbiome analysis, so that we can compare the change on the gut microbiomes before and during the study. Commode specimen collectors (Fisher Scientific, Ottawa), coolers (with ice packs), baked aluminum foils and glass jars were provided to each volunteer. The commode specimen collector can be wrapped by an aluminum foil and installed on a toilet. After excretion, the aluminum foil on the commode specimen collector was removed and the fecal sample was wrapped by the aluminum foil. Then, the wrapped sample was placed in a baked glass jar. The jar would be well capped and temporarily stored in a cooler before being picked up. Fecal egestion rate can be found in Table S6.

Around 30 g of blood samples were collected by a family doctor in a clinic at College and Bay in the week of February 13th. All blood samples were stored in BD Vacutainer® blood collection tubes (New Jersey, USA) at -20°C before further analysis.

Text S2. Preparation of sample puree

Dietary items or fecal samples from each volunteer were weighted using a top-loading balance, then placed in a blender for homogenization. D.I. water was added onto the sample to ensure a smooth puree. Since the amount of sample was higher than the capacity of a

blender, the sample was homogenized separately. Then, the sample puree was placed into a 4-L beaker and homogenized again with a solvent-cleaned metal stick. The sample puree was transferred into baked 1-L glass jars and capped well before further analysis.

To spike the sample puree, 9 mL of 100 ng/mL of labeled polychlorinated biphenyls ($^{13}C_{12}$-PCBs) (i.e. $^{13}C_{12}$-PCB-28, -52, -101, -138, -153 and -180) were pipetted into a baked 1-L amber glass jar rotating horizontally on a roller-mixer at 60 rpm. The jar was allowed to stay on the roller-mixer until the solvent had evaporated completely. Then, around 450 g of sample puree was transferred into the 1-L jar with 4.5 g of sodium azide. The same spiking method was applied on the rest of the samples (both dietary and fecal samples).

Text S3. Sample extraction and cleanup

Extraction and clean-up are similar to the method described in our previous works.[1-2] Chemicals used in the experiment were shown in Table S1. Briefly, around 30 g of spiked sample puree was removed from a glass jar. Then, each 10 g of sample puree was spiked with 1 ng of $^{13}C_{12}$-PCB-32, -47, -77, -141 and -188. Chemicals were extracted by the Accelerated Solvent Extraction (ASE). The extracts were purified by Na_2SO_4 column, gel permeation column (GPC) and silica gel column. The lipids in samples can be collected in fraction A from the GPC. The extracts were concentrated by rotary evaporation and nitrogen blowdown. The extracts were blow to almost dry, then 100 μL of $^{13}C_{12}$-PCB105 (with a concentration of 10 ng/mL), was added to each GC vial.

Contaminants in blood samples were extracted by liquid-liquid extraction using 1:1 hexane:ethyl ether as extraction solvent.[3] The samples were spiked by 1 ng of $^{13}C_{12}$-PCB-32, -47, -77, -141 and -188. A total of 300 mL (100 mL each time) of extract was collected. The rest of the steps (e.g., clean-up and concentration) were exactly the same as those of dietary and fecal samples.

Text S4. The mathematical relationship between BMF_{lim} and AE_{lipids}

$BMF_{lim} = (G_D/G_F) \cdot (Z_D/Z_F)$

If lipids solely explain the uptake capacity of diet and feces for the chemicals

$Z_{D\ or\ F} = \text{lipid\%} \cdot Z_{lipid}$,

$BMF_{lim} = (G_D/G_F) \cdot [(V_{lipid\_D}/V_{Diet} \cdot Z_{lipid})/(V_{lipid\_F}/V_{Feces} \cdot Z_{lipid})]$

$= (G_D/G_F) \cdot (V_{lipid\_D}/V_{lipid\_F}) \cdot (V_{Feces}/V_{Diet})$

Where G_D and G_F have units of mL/day. Therefore, $G_{D\ or\ F} = V_{D\ or\ F} / t_{D\ or\ F}$ and $t_{D\ or\ F}$ is the time of dietary and fecal collection with units of day.

$BMF_{lim} = (V_{Diet}/V_{Feces}) \cdot (t_{feces}/t_{diet}) \cdot (V_{lipid\_D}/V_{lipid\_F}) \cdot (V_{Feces}/V_{Diet})$

$= (t_{feces}/t_{diet}) \cdot (V_{lipid\_D}/V_{lipid\_F})$

If both the feces and diet collected in the same study period, the time of diet and feces collection should be the same, i.e., $t_{feces}/t_{diet} = 1$. Therefore:

$BMF_{lim} = V_{lipid\_D}/V_{lipid\_F}$

Since $AE_{lipids} = 1 - (V_{lipid\_F}/V_{lipid\_D})$,

$V_{lipid\_F}/V_{lipid\_D} = 1 - AE_{lipids}$

$V_{lipid\_D}/V_{lipid\_F} = 1/(1 - AE_{lipids})$

Therefore, $BMF_{lim} = 1/(1 - AE_{lipids})$

Text S5. Instrumental analysis

The method of instrumental analysis is exactly the same as in our previous works.[1-2] The concentrations of the native and labelled PCB congeners in different samples are given in Table S3 & S4.

Text S6. Preparation of silicone-coated vials

The preparation of silicone-coated vials is similar to the method described in our previous works.[1-2] In this study, five groups of three 40-mL vials each (2 samples + 1 blank) were coated with silicone films of variable thickness (i.e., 4, 6, 8, 10 and 12 µm for diets; 0.2, 0.4, 0.6, 0.8 and 1 µm for fecal matters) for each biological samples. There were totally 90 silicone-coated vials created in this study.

Text S7. Equilibrium passive sampling

Equilibration between biological samples and silicone polymer and cleanup were the same as the method described in our previous works.[1-2] After cleanup, 1 ng of recovery standards (i.e., $^{13}C_{12}$-PCB-32, -47, -77, -141 and -188), were added to each vial to account for any chemical loss during the experiment. The PCB congers were extracted with 3 aliquots of 8 mL hexane on a roller-mixer at 30 rpm for 90 minutes. If necessary, the extracts will be cleaned up with silica gel columns. The extracts were concentrated by rotary evaporation, followed by nitrogen blowdown. When the volume of extract was reduced to around 1 µL (almost dry), 100 µL of 10 ng/mL of $^{13}C_{12}$-PCB105 (in iso-octane) was added as internal standard to account for any instrument fluctuations. The mass of PCBs quantified in the polymer, m_{PCB}, was plotted and regressed against the polymer volume of in a vial. The regression lines for different biological samples are given in Figure S1. The PCB concentrations in polymer were obtained from the slopes of the regression lines (Table S5).[4]

Text S8. Quality assurance

Five isotopically labelled PCBs (i.e. $^{13}C_{12}$-PCB-32, -47, -77, -141 and -188) were added to each biological sample and associated blank as internal recovery standards in order to monitor the extraction efficiency during the experiment. Recoveries, given in Table S2, ranged from 45 to 98 %.

Text S9. Gut microbiome analysis (Mo BIO Laboratories, 2014)

Around 0.15 to 0.25 g of each fecal sample was used for DNA extraction with the Qiagen PowerSoil® DNA Extraction Kit, following the manufacturer's instructions. We sent extracts to Genome Quebec (Montreal, Quebec) for 16S rRNA gene amplicon library preparation with the V4-targeting 515F/806R primer set,[5-6] and libraries were then sequenced on an Illumina NextSeq (PE300). All raw reads were submitted to NCBI and are available under the BioProject ID PRJNA1087346. All initial sequence processing of amplicon sequence data, as well as graphing and statistical analyses, were performed in R v.4.3.1. (R Core Team 2023). We used the DADA2 pipeline to generate amplicon sequence variants (ASVs),[7] with taxonomy assigned with the SILVA database (v.128). Taxa not identified as Bacteria, or that were identified as Archaea, mitochondria, or chloroplasts, were removed. Sequence data are available through PRJNA1087346.

Table S1. List of chemicals, their abbreviations, purity and suppliers.

	Abbreviation	Purity (%)	Supplier
$^{13}C_{12}$- Polychlorinated biphenyls			
$^{13}C_{12}$-2,4,4'-Trichlorobiphenyl	$^{13}C_{12}$-PCB-28	> 98 %	Cambridge Isotope Laboratories (Tewksbury, MA)
$^{13}C_{12}$-2,4',6-Trichlorobiphenyl	$^{13}C_{12}$-PCB-32		
$^{13}C_{12}$-2,2',4,4'-Tetrachlorobiphenyl	$^{13}C_{12}$-PCB-47		
$^{13}C_{12}$-2,2',5,5'-Tetrachlorobiphenyl	$^{13}C_{12}$-PCB-52		
$^{13}C_{12}$-3,3',4,4'-Tetrachlorobiphenyl	$^{13}C_{12}$-PCB-77		
$^{13}C_{12}$-2,2',4,5,5'-Pentachlorobiphenyl	$^{13}C_{12}$-PCB-101		
$^{13}C_{12}$-2,3,3',4,4'-Pentachlorobiphenyl	$^{13}C_{12}$-PCB-105		
$^{13}C_{12}$-2,2',3,4,4',5'-Hexachlorobiphenyl	$^{13}C_{12}$-PCB-138		
$^{13}C_{12}$-2,2',3,4,5,5'-Hexachlorobiphenyl	$^{13}C_{12}$-PCB-141		
$^{13}C_{12}$-2,2',4,4',5,5'-Hexachlorobiphenyl	$^{13}C_{12}$-PCB-153		
$^{13}C_{12}$-2,2',3,4,4',5,5'-Heptachlorobiphenyl	$^{13}C_{12}$-PCB-180		
$^{13}C_{12}$-2,2',3,4',5,6,6'-Heptachlorobiphenyl	$^{13}C_{12}$-PCB-188		
Solvents			
Acetone		GCMS grade	EMD Chemicals Inc. (Mississauga, ON)
Dichloromethane			
Ethyl acetate			
Ethyl ether			
Hexane			
Isooctane			
Ethanol		95 %	Commercial Alcohols (Brampton, ON)
Pentane		> 99 %	Acros Organics (New Jersey, USA)
Others			
Sodium sulfate		≥ 99.5 %	EMD Chemicals Inc. (Mississauga, ON)
Silica gel			
Sodium azide			SIGMA-ALDRICH Co. (St. Louis, MO)
DC1-2577 silicone polymer (octamethyl trisiloxane/poly(dimethyl/methyl phenyl) methoxysiloxane)			DOW Corning Corporation (Mississauga, ON)
Bio-Beads® SX-1 gel permeation column beads			Bio-Rad Laboratories Ltd (Mississauga, ON)
PowerSoil® Solution C1			Mo BIO Laboratories, Inc. (Carlsbad, California)
PowerSoil® Solution C2			
PowerSoil® Solution C3			
PowerSoil® Solution C4			
PowerSoil® Solution C5			
PowerSoil® Solution C6			

Table S2. Recovery rate of each trial in the experiment.

	Recovery rates (%)				
	Determination of PCB concentrations in raw sample			Equilibrium passive sampling	
	diet	feces	blood	diet	feces
$^{13}C_{12}$-PCB-32	78	74	52	82	80
$^{13}C_{12}$-PCB-47	79	71	45	80	80
$^{13}C_{12}$-PCB-77	93	94	52	90	90
$^{13}C_{12}$-PCB-141	98	86	55	90	88
$^{13}C_{12}$-PCB-188	84	71	46	84	81

Table S3. Concentrations (mean and standard deviation of three replicates, in ng/mL) of native and labeled PCBs in different biological samples.

	diet	feces				
		M58	M31	M30	F35	F24
native						
PCB-28	0.05±0.01	0.02±0.004	0.01±0.004	0.02±0.003	0.02±0.004	0.01±0.003
PCB-44	0.13±0.01	0.13±0.02	0.14±0.02	0.18±0.02	0.12±0.01	0.10±0.02
PCB-52	0.21±0.01	0.19±0.03	0.23±0.04	0.28±0.03	0.18±0.02	0.16±0.03
PCB-99	0.23±0.03	0.18±0.02	0.11±0.01	0.18±0.03	0.16±0.02	0.08±0.02
PCB-101	0.36±0.03	0.28±0.05	0.22±0.03	0.35±0.05	0.29±0.04	0.18±0.04
PCB-118	0.42±0.06	0.31±0.03	0.17±0.01	0.28±0.03	0.26±0.03	0.16±0.02
PCB-138	0.98±0.14	0.49±0.05	0.12±0.01	0.33±0.04	0.28±0.03	0.12±0.02
PCB-153	0.98±0.08	0.44±0.04	0.14±0.01	0.36±0.04	0.26±0.02	0.12±0.02
PCB-180	0.59±0.10	0.35±0.03	0.03±0.002	0.16±0.01	0.09±0.01	0.03±0.01
$^{13}C_{12}$-labelled						
PCB-28	2.0±0.1	2.0±0.2	2.0±0.1	2.2±0.2	2.0±0.1	2.2±0.2
PCB-52	2.1±0.1	2.3±0.2	2.1±0.1	2.0±0.1	2.1±0.1	2.2±0.1
PCB-101	2.1±0.1	2.3±0.1	2.1±0.1	2.1±0.1	2.1±0.1	2.2±0.1
PCB-138	2.0±0.1	2.0±0.1	2.1±0.1	2.1±0.1	2.0±0.1	2.4±0.2
PCB-153	2.0±0.1	2.0±0.1	2.1±0.1	2.3±0.1	2.1±0.1	2.3±0.02
PCB-180	1.8±0.1	1.8±0.2	2.0±0.2	2.0±0.1	2.1±0.1	2.1±0.02

Table S4. Concentrations of native PCBs in blood samples from four volunteers. No standard deviation is provided as small sample volume prevent replicate analysis.

	C_{PCB} (ng/mL)			
	M58	M30	F35	F24
PCB-28	0.007	0.008	0.013	0.009
PCB-44	0.021	0.028	0.049	0.026
PCB-52	0.029	0.044	0.069	0.039
PCB-99	0.039	0.044	0.065	0.044
PCB-101	0.054	0.078	0.116	0.073
PCB-118	0.084	0.084	0.155	0.100
PCB-138	0.105	0.050	0.099	0.050
PCB-153	0.093	0.061	0.111	0.056
PCB-180	0.086	0.016	0.021	0.007
Sum of 9 PCBs	0.52	0.41	0.70	0.40
	lipid content (g/mL)			
lipid	0.01	0.01	0.01	0.01
	C_{PCB} (ng/g lipid)			
PCB-28	0.7	0.8	1.3	0.9
PCB-44	2.1	2.8	4.9	2.6
PCB-52	2.9	4.4	6.9	3.9
PCB-99	3.9	4.4	6.5	4.4
PCB-101	5.4	7.8	11.6	7.3
PCB-118	8.4	8.4	15.5	10.0
PCB-138	10.5	5.0	9.9	5.0
PCB-153	9.3	6.1	11.1	5.6
PCB-180	8.6	1.6	2.1	0.7
Sum of 9 PCBs	51.8	41.3	69.8	40.4

Table S5. Concentrations (in ng/mL) of labeled PCB in silicone layer after equilibration.

	diet	feces				
		M58	M31	M30	F35	F24
$^{13}C_{12}$-PCB-28	16	117	24	27	26	36
$^{13}C_{12}$-PCB-52	24	233	48	46	52	58
$^{13}C_{12}$-PCB-101	24	306	79	80	85	108
$^{13}C_{12}$-PCB-138	38	572	139	134	136	203
$^{13}C_{12}$-PCB-153	22	320	91	91	89	120
$^{13}C_{12}$-PCB-180	16	190	48	48	54	67

Table S6. Information on the collected samples (i.e., diet, feces and blood).

	Lipid content (% in w.w.)	Density (g/mL)	Feeding or egestion rate (mL/day)	Date of collection (mm/yyyy)
M58_diet	6.87	0.97	1112.0	From Feb 4th to Feb 8th
M58_feces	0.65	1.25	145.6	From Feb 4th to Feb 9th
M58_blood	0.17	1.06		Feb 13th
M32_diet	6.87	0.97	1639.8	From Feb 4th to Feb 8th
M32_feces	2.47	1.11	280.6	From Feb 4th to Feb 8th
M32_blood				n.a.
M31_diet	6.87	0.97	1181.9	From Feb 4th to Feb 8th
M31_feces	2.45	1.18	126.6	From Feb 4th to Feb 10th
M31_blood	0.13	1.06		Feb 13th
F35_diet	6.87	0.97	1019.0	From Feb 4th to Feb 8th
F35_feces	2.31	1.05	119.8	From Feb 4th to Feb 10th
F35_blood	0.17	1.06		Feb 13th
F24_diet	6.87	0.97	1486.0	From Feb 4th to Feb 8th
F24_feces	1.88	1.22	264.1	From Feb 4th to Feb 9th
F24_blood	0.10	1.06		Feb 13th

*The collection of blood samples from M31 was not successful due to personal reasons.

Table S7. Lipid assimilation efficiency (%) and PCB uptake rate (ng/day) of five volunteers.

	M58	M31	M30	F35	F24
	Lipid assimilation efficiency (%)				
	99	93	96	96	95
	PCB uptake rate (ng/day)				
PCB-28	53	79	57	49	72
PCB-44	126	174	131	118	167
PCB-52	206	280	213	192	270
PCB-99	230	346	249	215	321
PCB-101	360	529	381	332	487
PCB-118	422	641	461	397	582
PCB-138	1018	1573	1116	965	1425
PCB-153	1026	1568	1113	967	1425
PCB-180	605	959	677	590	869

Table S8. Calculated thermodynamic biomagnification limits and feces-based biomagnification factors.

	M58		M31		M30		F35		F24	
	BMF_{lim}	BMF_F	BMF_{lim}	BMF_F	BMF_{lim}	BMF_F	BMF_{lim}	BMF_F	BMF_{lim}	BMF_F
PCB-28	56	2.7	9	0.5	14	0.6	14	0.7	11	0.5
PCB-52	69	8.0	12	2.2	19	2.7	19	1.9	15	2.0
PCB-101	90	9.1	20	2.0	32	3.2	30	2.9	25	2.2
PCB-138	116	7.5	20	0.4	31	1.1	31	1.0	25	0.5
PCB-153	112	6.6	21	0.5	34	1.3	33	1.0	27	0.6
PCB-180	89	6.9	15	0.1	25	0.7	24	0.4	20	0.2

Table S9. Calculated fugacity capacities of diet and feces (in unit of $mol \cdot Pa^{-1} \cdot m^{-3}$) from five volunteers.

	Z_{PCB} ($mol \cdot Pa^{-1} \cdot m^{-3}$)									
	M58		M31		M30		F35		F24	
	Z_{diet}	Z_{feces}	Z_{diet}	Z_{feces}	Z_{diet}	Z_{feces}	Z_{diet}	Z_{feces}	Z_{diet}	Z_{feces}
PCB-28	7.3×10^3	1.0×10^3	7.3×10^3	4.8×10^3	7.3×10^3	4.8×10^3	7.3×10^3	4.5×10^3	7.3×10^3	3.6×10^3
PCB-52	1.4×10^4	1.6×10^3	1.4×10^4	7.0×10^3	1.4×10^4	6.9×10^3	1.4×10^4	6.5×10^3	1.4×10^4	5.2×10^3
PCB-101	6.1×10^4	5.2×10^3	6.1×10^4	1.8×10^4	6.1×10^4	1.8×10^4	6.1×10^4	1.7×10^4	6.1×10^4	1.4×10^4
PCB-138	2.7×10^5	1.8×10^4	2.7×10^5	8.0×10^4	2.7×10^5	8.0×10^4	2.7×10^5	7.5×10^4	2.7×10^5	6.0×10^4
PCB-153	2.8×10^5	1.9×10^4	2.8×10^5	7.8×10^4	2.8×10^5	7.7×10^4	2.8×10^5	7.2×10^4	2.8×10^5	5.9×10^4
PCB-180	1.2×10^6	1.1×10^5	1.2×10^6	4.8×10^5	1.2×10^6	4.7×10^5	1.2×10^6	4.4×10^5	1.2×10^6	3.6×10^5

Table S10. Estimated fugacity of blood (in unit of Pa) and *BMF* for five volunteers.

	M58	M30	F35	F24
PCB-28	4.3×10^{-10}	5.8×10^{-10}	7.6×10^{-10}	9.1×10^{-10}
PCB-52	4.0×10^{-10}	7.7×10^{-10}	9.1×10^{-10}	8.9×10^{-10}
PCB-101	1.9×10^{-10}	3.5×10^{-10}	3.9×10^{-10}	4.2×10^{-10}
PCB-138	1.2×10^{-10}	7.5×10^{-11}	1.1×10^{-10}	9.6×10^{-11}
PCB-153	7.5×10^{-11}	6.2×10^{-11}	8.6×10^{-11}	7.5×10^{-11}
PCB-180	8.1×10^{-12}	1.9×10^{-12}	1.9×10^{-12}	1.1×10^{-12}

Table S11. Calculated fugacity capacities of blood (in unit of $mol \cdot Pa^{-1} \cdot m^{-3}$) for four participants.

	M58	M30	F35	F24
PCB-28	6.5×10^{1}	5.1×10^{1}	6.8×10^{1}	3.9×10^{1}
PCB-52	2.5×10^{2}	2.0×10^{2}	2.6×10^{2}	1.5×10^{2}
PCB-101	8.8×10^{2}	6.9×10^{2}	9.1×10^{2}	5.3×10^{2}
PCB-138	2.4×10^{3}	1.9×10^{3}	2.5×10^{3}	1.4×10^{3}
PCB-153	3.4×10^{3}	2.7×10^{3}	3.6×10^{3}	2.1×10^{3}
PCB-180	2.7×10^{4}	2.1×10^{4}	2.8×10^{4}	1.6×10^{4}

Table S12. The contribution of the *Z*-value of lipids to the *Z*-value of the bulk phase.

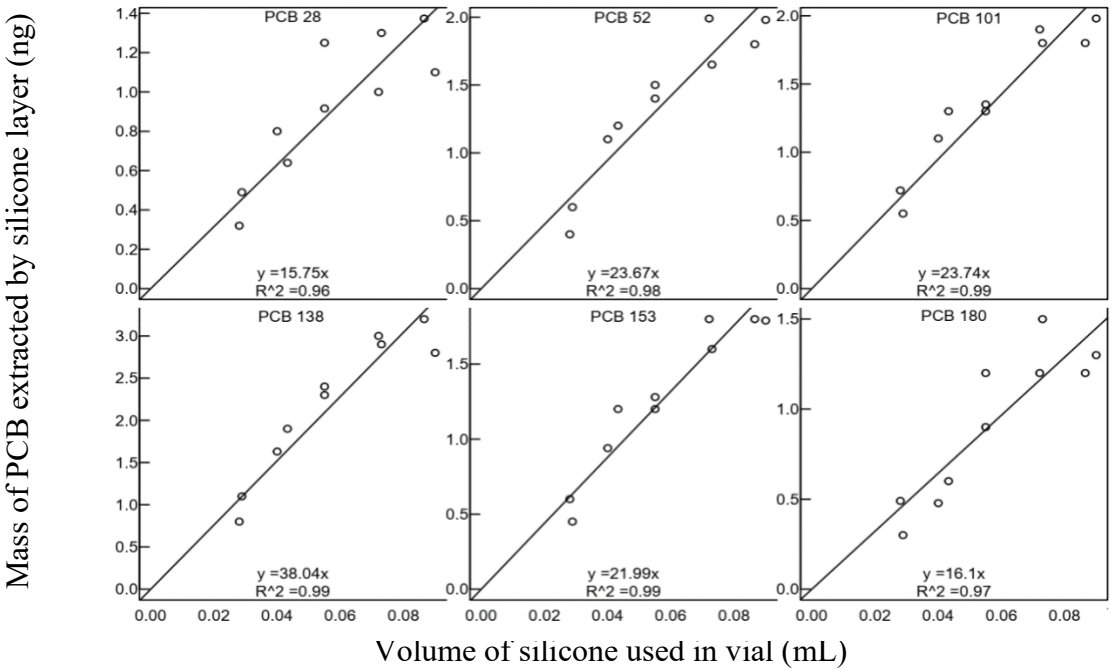
	Diet	Feces				
		M58	M31	M30	F35	F24
PCB-28	0.37	0.28	0.24	0.25	0.20	0.22
PCB-52	0.73	0.66	0.64	0.65	0.53	0.57
PCB-101	0.60	0.72	0.88	0.88	0.72	0.76
PCB-138	0.37	0.56	0.53	0.54	0.44	0.48
PCB-153	0.51	0.76	0.80	0.80	0.66	0.71
PCB-180	0.91	1.07	1.03	1.04	0.85	0.92
average	0.58	0.68	0.69	0.69	0.57	0.61

Table S13. Method detection limit (MDL) of each PCB congers (in units of ng/mL) and the ratio of PCB concentration in blood (C) and the MDL.

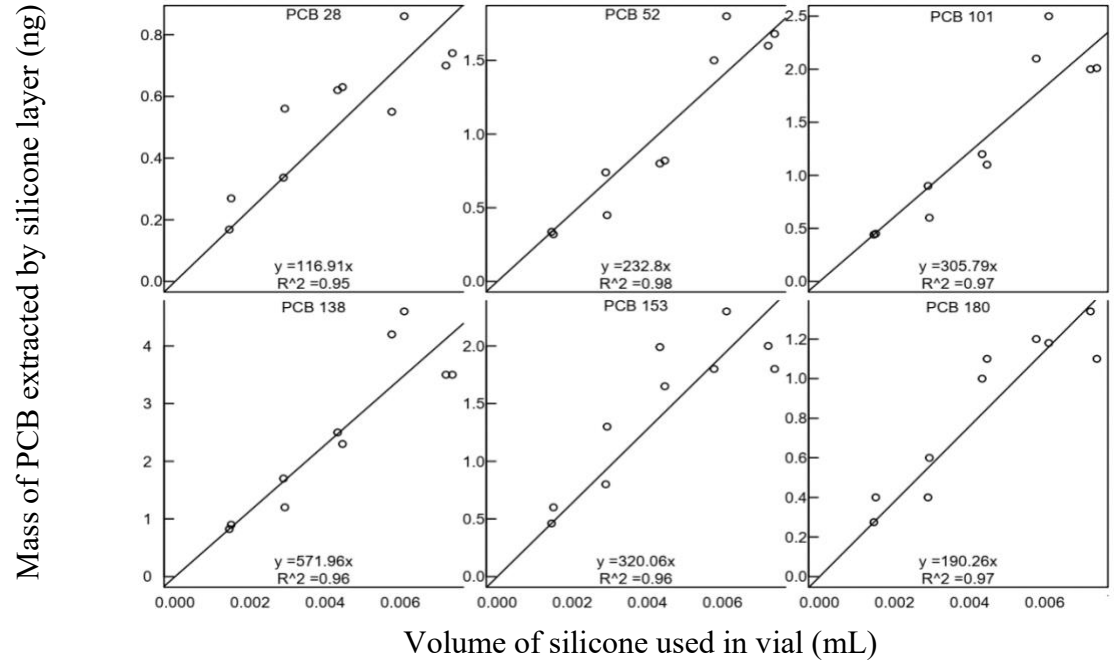
	M58		M30		F35		F24	
	MDL	C/MDL	MDL	C/MDL	MDL	C/MDL	MDL	C/MDL
PCB-28	0.004	1.8	0.005	1.5	0.004	3.3	0..006	1.5
PCB-52	0.006	5.0	0.009	4.8	0.010	6.7	0.008	5.0
PCB-101	0.005	10.0	0.009	8.3	0.007	16.7	0.009	8.3
PCB-138	0.008	12.5	0.005	11.1	0.007	14.3	0.004	11.1
PCB-153	0.007	12.5	0.005	12.6	0.008	14.3	0.005	11.1
PCB-180	0.003	25.0	0.001	20.0	0.001	21.3	0.0004	16.7

Table S14. Calculated fugacity of PCbs in diet and feces (in unit of 10^{-11} Pa) from five volunteers.

	f_{diet}	f_{feces}				
		M58	M31	M30	F35	F24
PCB-28	2.4	6.4	1.1	1.4	1.6	1.1
PCB-52	5.1	40	11	14	9.4	10
PCB-101	1.8	17	3.7	5.9	5.2	4.0
PCB-138	1.0	7.6	0.43	1.2	1.0	0.53
PCB-153	0.96	6.4	0.51	1.3	0.97	0.59
PCB-180	0.12	0.82	0.018	0.087	0.052	0.022

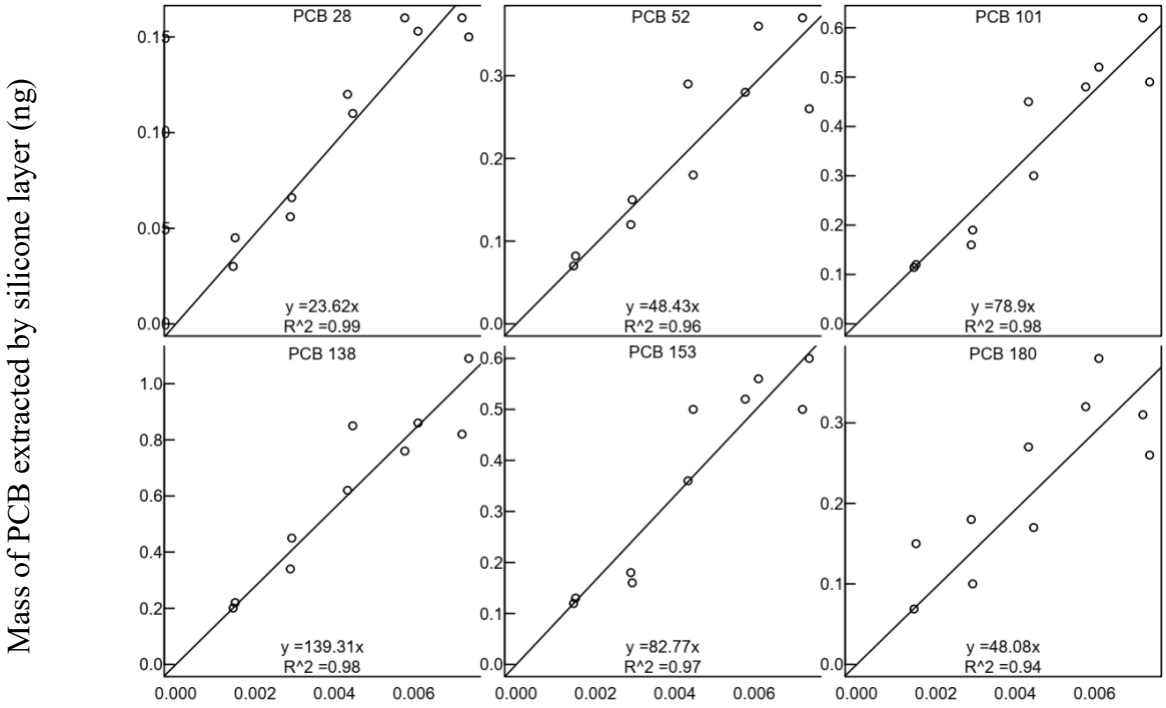


a) diet

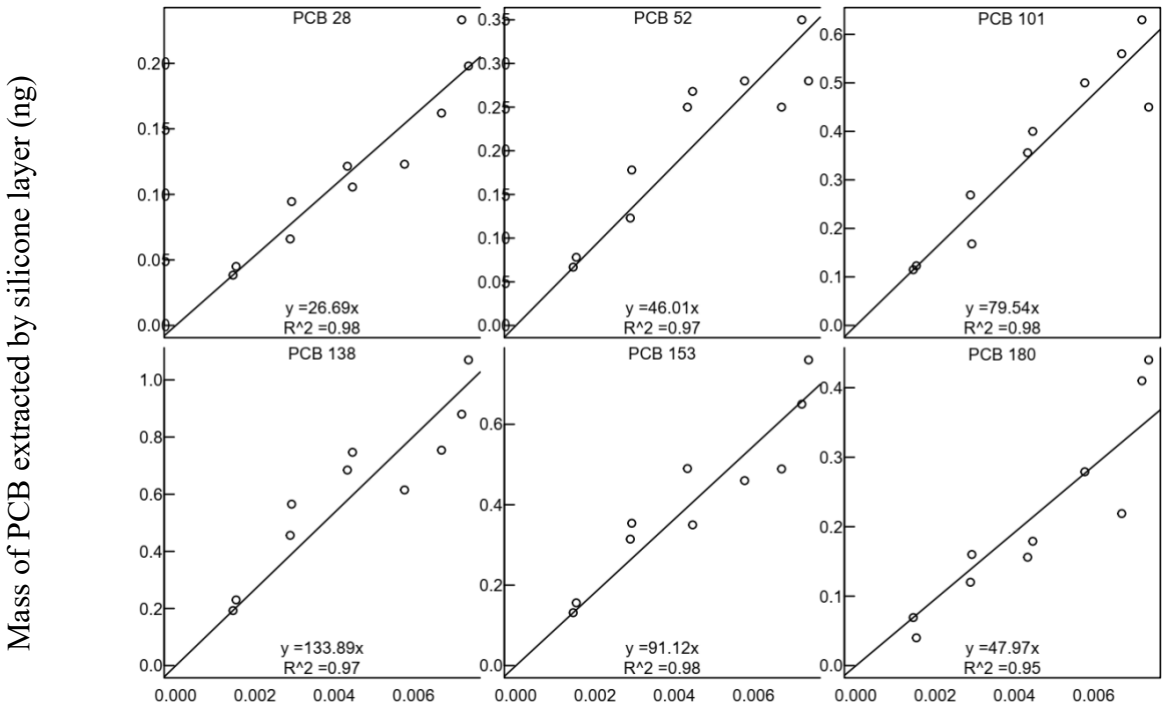


b) M58's fecal matter

Figure S1. Relationship between the mass of PCBs extracted by silicone polymers (in unit of ng) and the volumes of polymer (in unit if mL) used. The slope of regression is the concentration of PCBs in polymer phase.

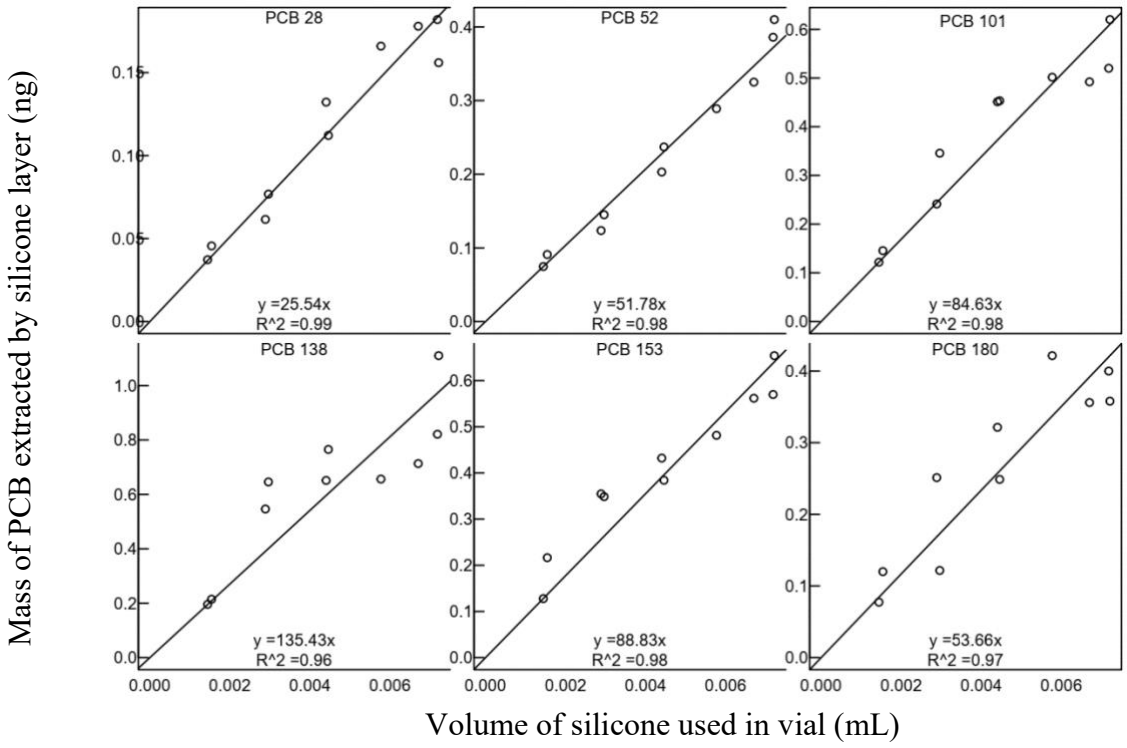


c) M31's fecal matter

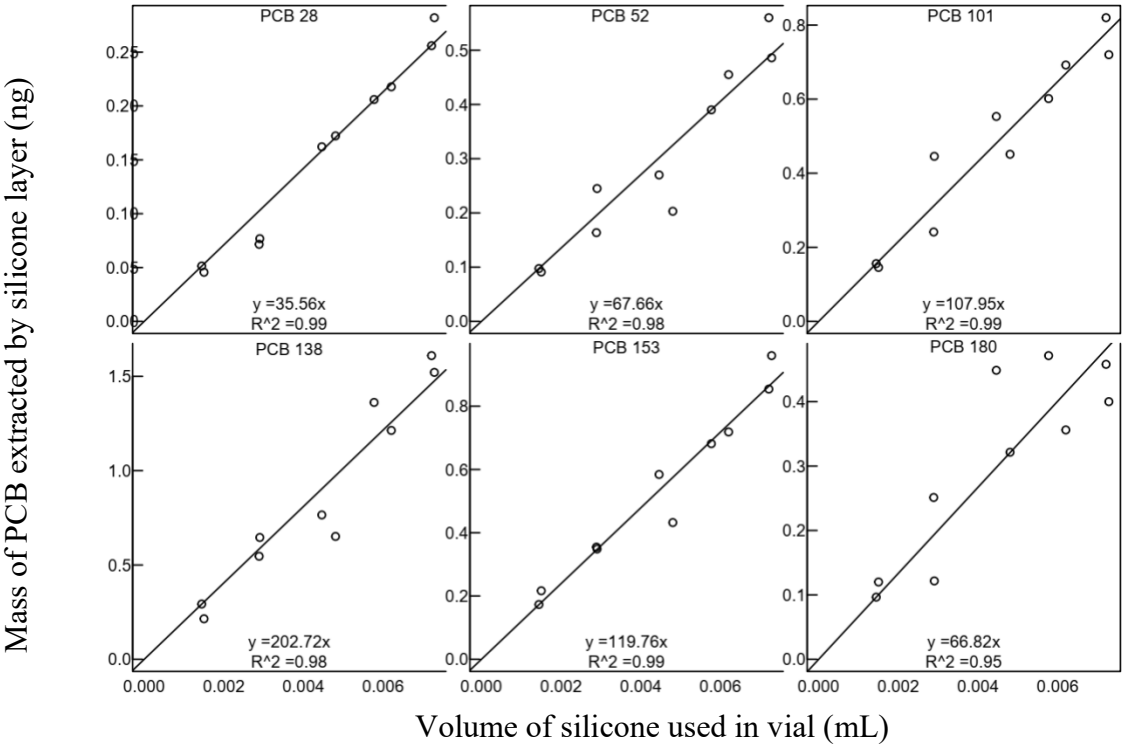


d) M30's fecal matter

Figure S1. continued



e) F35's fecal matter



f) F24's fecal matter

Figure S1. Continued

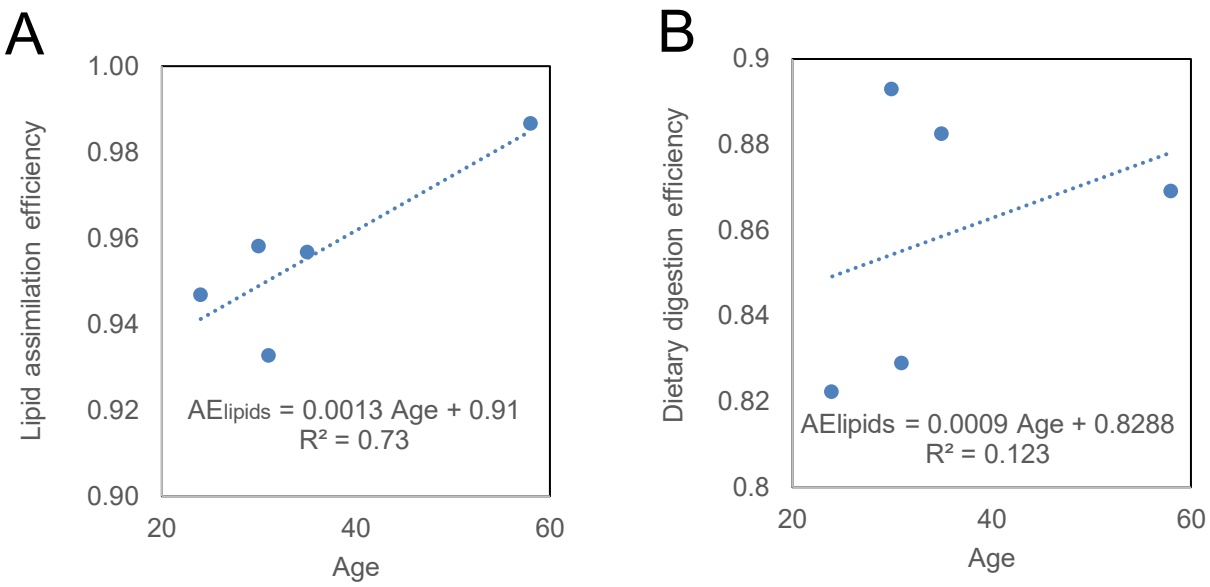


Figure S2. Relationship between the lipid assimilation efficiency (AE_{lipids}) and age (A, left) and between dietary digestion efficiency (DE%) and age (B, right).

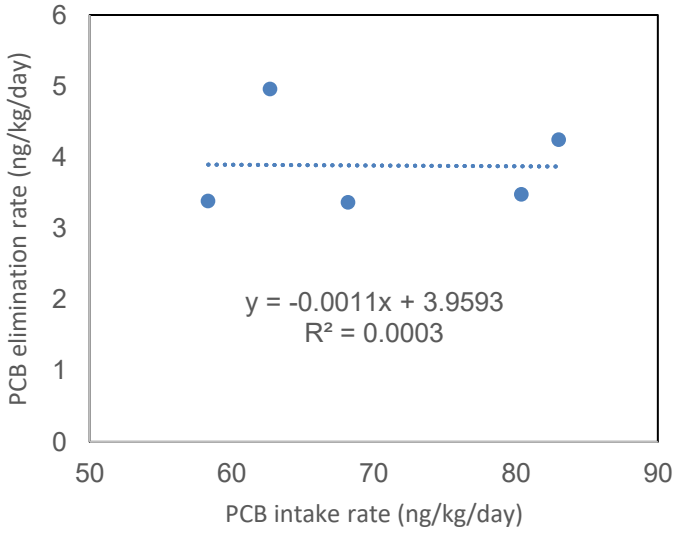


Figure S3. Relationship between PCB intake rate and elimination rate (in units of ng/kg/day).

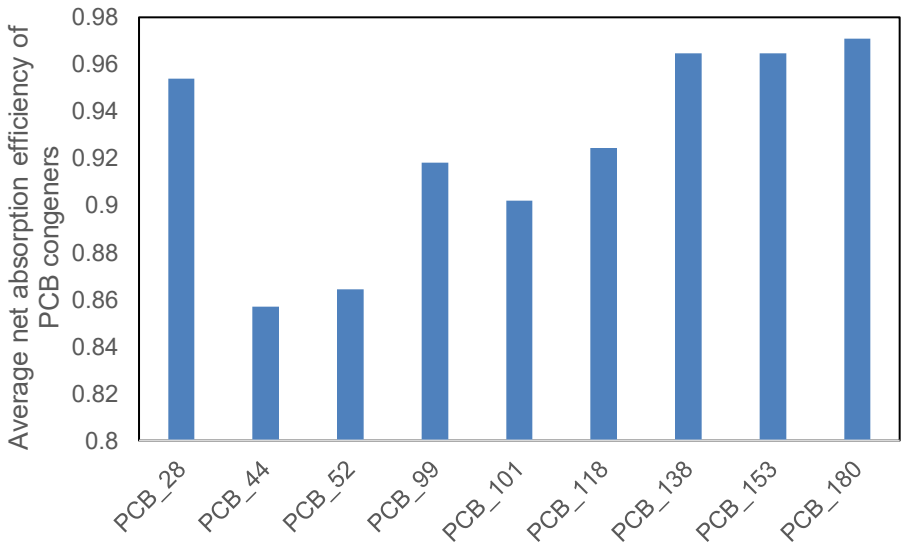


Figure S4. Average net absorption efficiencies of 9 PCB congeners.

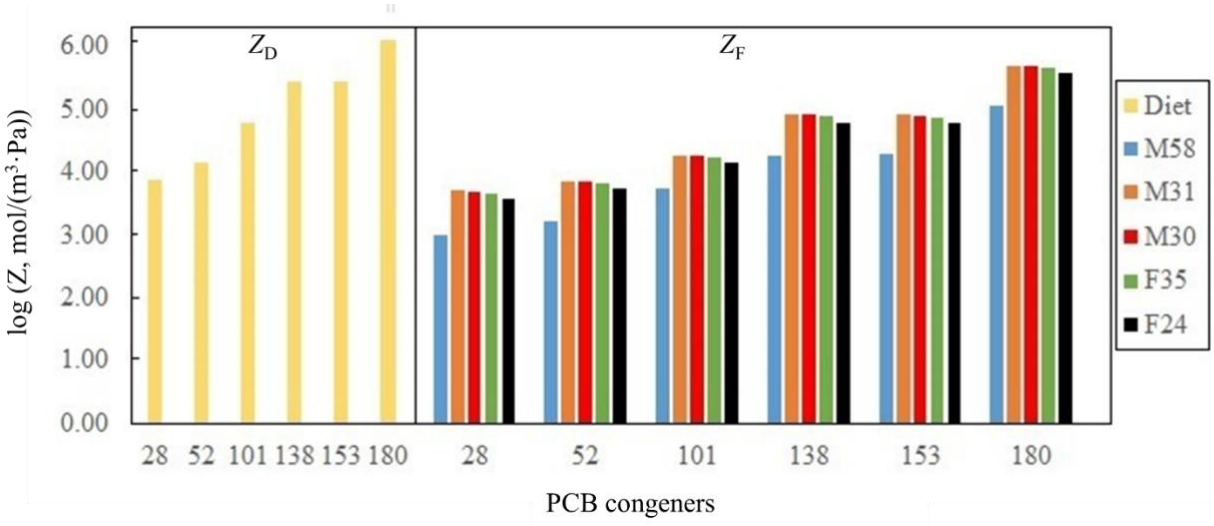


Figure S5. Average logarithm of the fugacity capacity of the diet (Z_D) and feces (Z_F) of five participants.

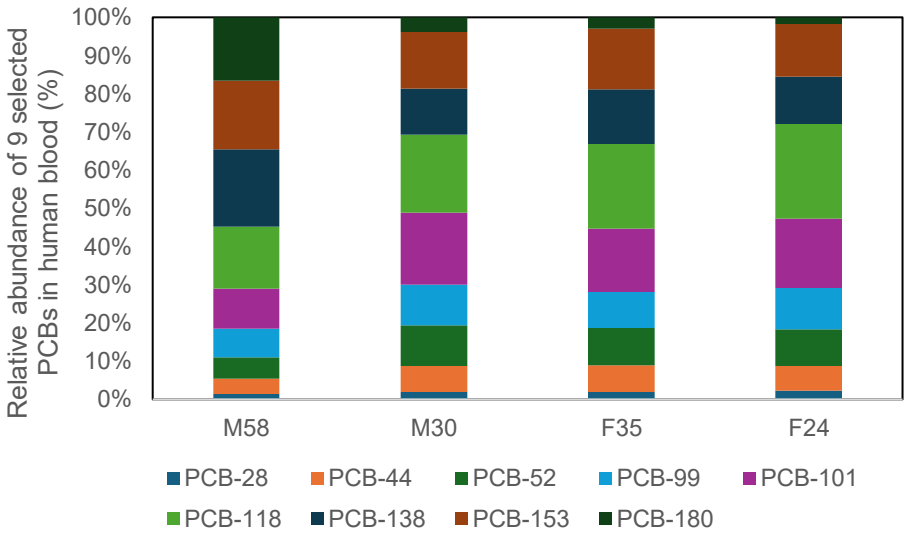


Figure S6. Relative abundance of 9 selected PCB congeners in the blood of 4 participants.

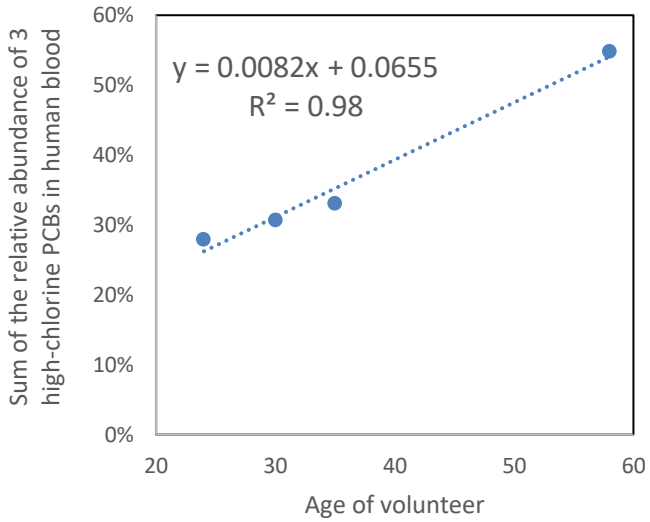


Figure S7. Relationship between the sum of the relative abundance of PCB congeners 138, 153 and 180, and the age.

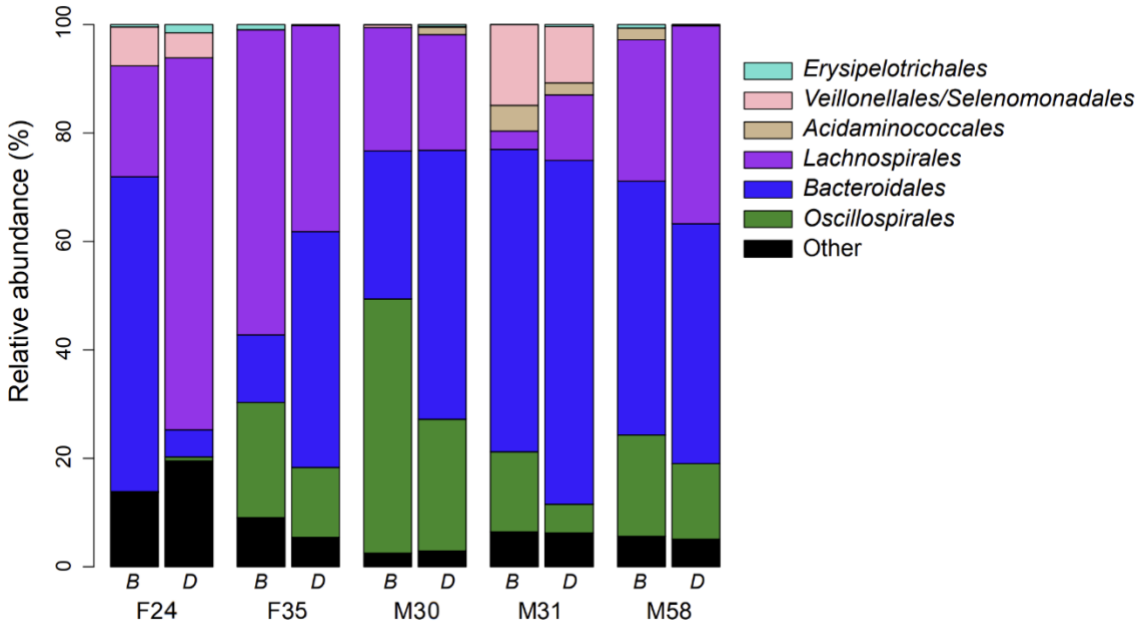


Figure S8. Comparison of the gut microbiomes from each volunteer before (B) and during (D) the experiment.

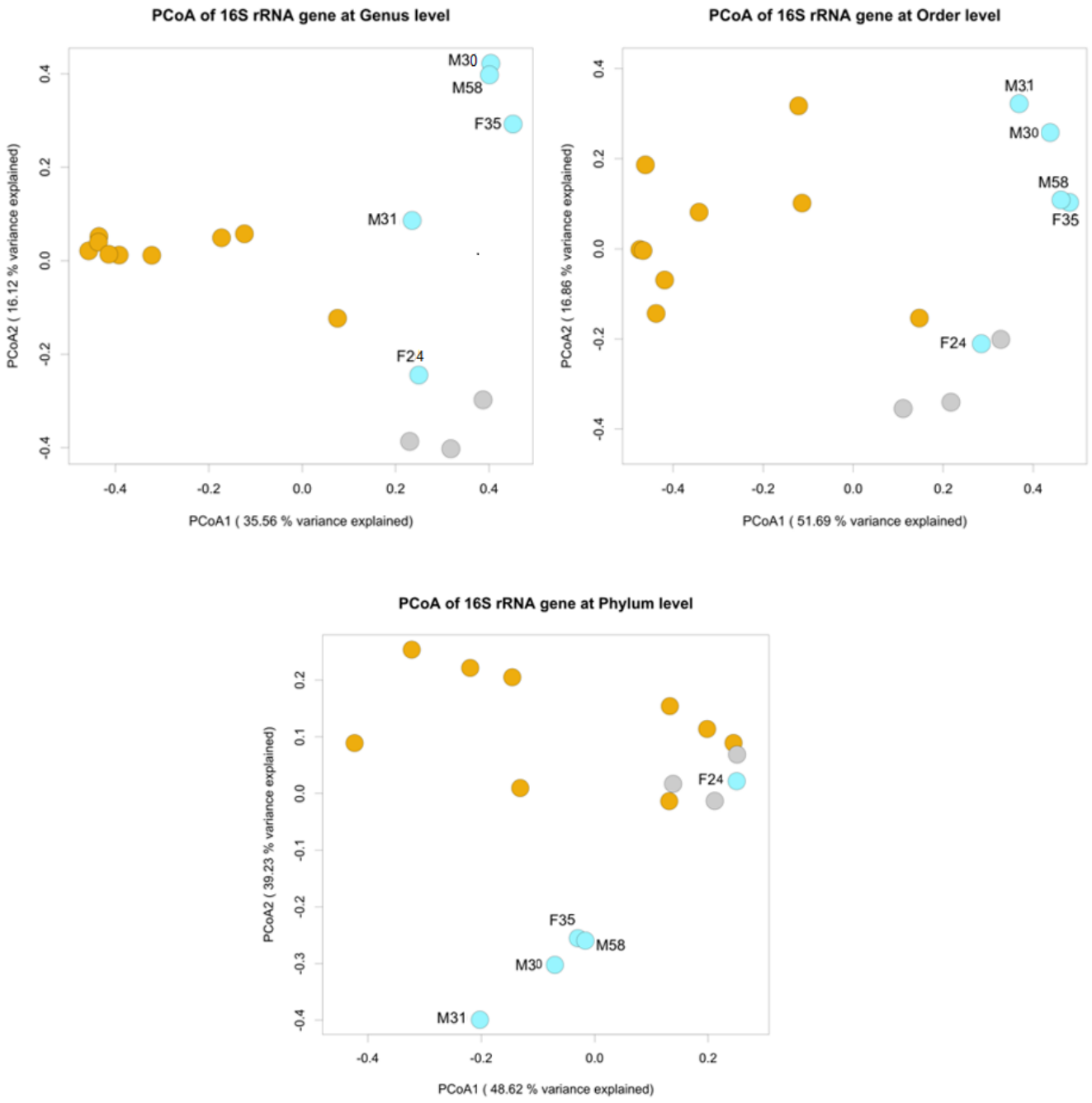


Figure S9. Comparison of human gut microbiomes following a shared diet relative to microbiomes from other organisms (three polar bears at three time points, two dogs, and a wolf). Principle coordinates analysis was conducted with taxa agglomerated at phylum, order and genus levels. Colour legend: human = turquoise; polar bear = gold; canine = grey.

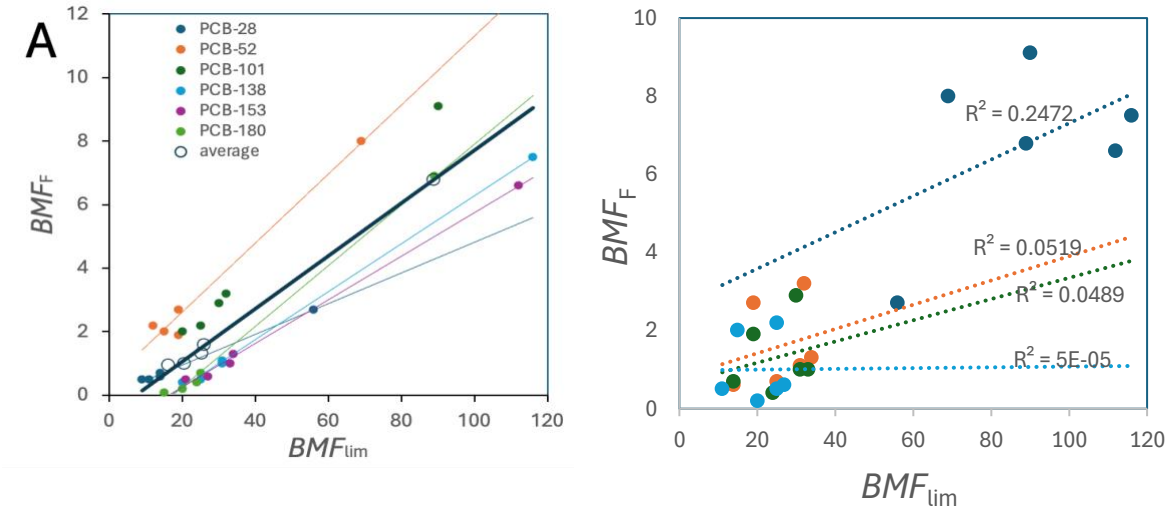


Figure S10. Relationship between average BMF_F and BMF_{lim} for (A) different PCB congeners and (B) different participants.

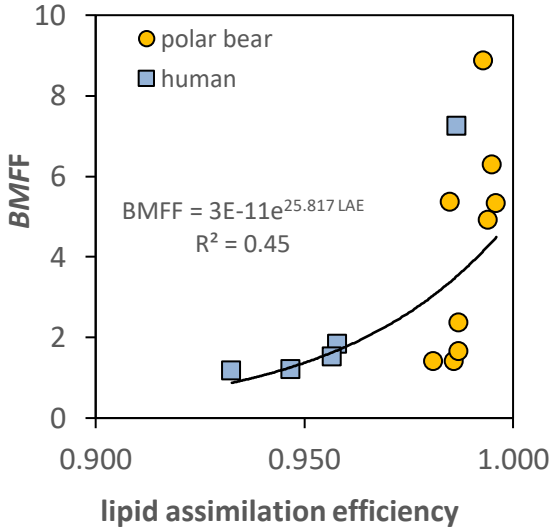


Figure S11. Relationship between the average BMF_F and the lipid assimilation efficiencies.

References

(1) Chen, Y.; Lei, Y. D.; Wensvoort, J.; Wania, F. Quantifying the Biomagnification Capability of Arctic Wolf and Domestic Dog by Equilibrium Sampling. *Environ. Sci. Technol.* **2020**, *54* (11), 6842–6849. DOI: 10.1021/acs.est.0c00157.

(2) Chen, Y.; Lei, Y. D.; Wensvoort, J.; Gourlie, S.; Wania, F. Probing the Thermodynamics of Biomagnification in Zoo-Housed Polar Bears by Equilibrium Sampling of Dietary and Fecal Samples. *Environ. Sci. Technol.* **2022**, *56* (13), 9497–9504. DOI: 10.1021/acs.est.2c00310.

(3) Ryan, J. J.; Levesque, D.; Panopio, L. G.; Sun, W. F.; Masuda, Y.; Kuroki, H. Elimination of Polychlorinated Dibenzofurans (PCDFs) and Polychlorinated Biphenyls (PCBs) from Human Blood in the Yusho and Yu-Cheng Rice Oil Poisonings. *Arch Env. Contam Toxicol* **1993**, *24*, 504–512. DOI: 10.1007/BF01146170.

(4) Reichenberg, F.; Smedes, F.; Jönsson, J.-Å.; Mayer, P. Determining the chemical activity of hydrophobic organic compounds in soil using polymer coated vials. *Chem. Cent. J.* **2008**, *2* (1), 8. DOI: 10.1186/1752-153X-2-8.

(5) Apprill, A.; McNally, S.; Parsons, R.; Weber, L. Minor revision to V4 region SSU rRNA 806R gene primer greatly increases detection of SAR11 bacterioplankton. *Aquat. Microb. Ecol.* **2015**. *75*(2), 129-137. DOI: 10.3354/ame01753.

(6) Parada, A.E.; Needham, D.M.; Fuhrman, J.A. Every base matters: Assessing small subunit rRNA primers for marine microbiomes with mock communities, time series and global field samples. *Environ. Microbiol.* **2016**. *18*(6), 1403-1414. DOI: 10.1111/1462-2920.13023.

(7) Callahan, B. J.; McMurdie, P. J.; Rosen, M. J.; Han, A. W.; Johnson, A. J. A.; Holmes, S. P. DADA2: High-Resolution Sample Inference from Illumina Amplicon Data. *Nat. Methods*. **2016**, *13* (7), 581. DOI: 10.1038/nmeth.3869.