

Supplementary material

Targeted screening of 11 bisphenols and 7 plasticizers in food composites from Canada and South Africa

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Table S1. Food sampling information (Canada)

Food category		November 2017		May 2018		November 2018		May 2019		Total number (n)	
		P	NP	P	NP	P	NP	P	NP	P	NP
Fish	Tilapia	6	3	6	1	6	4	6	4	24	12
	Rainbow Trout	6	2	5	1	6	2	6	4	23	9
	Basa	5	N/A	5	2	5	N/A	3	2	18	4
	Hake	N/A	N/A	1	N/A	N/A	N/A	1	N/A	2	0
	Haddock	2	1	4	2	5	2	4	1	15	6
	Cod	6	4	6	4	6	2	6	3	24	13
	Salmon	6	4	5	2	6	2	6	3	23	11
	Halibut	1	1	1	N/A	N/A	N/A	N/A	2	2	3
Sole	3	3	5	2	3	3	5	3	16	11	
Vegetable	Spinach	6	6	6	1	6	1	6	3	24	11
	Arugula	4	6	5	N/A	4	1	6	1	19	8
	Romaine Lettuce	6	6	6	5	6	3	6	6	24	20
	Watercress	1	6	3	1	N/A	1	3	N/A	7	8
Bread	White loaf	6	N/A	6	N/A	6	N/A	6	N/A	24	0
	Brown loaf	6	N/A	6	N/A	6	N/A	6	N/A	24	0
Butter	Salted butter	6	N/A	6	N/A	6	N/A	6	N/A	24	0
	Non-salted butter	6	N/A	6	N/A	6	N/A	6	N/A	24	0
Chicken	Chicken breast	6	N/A	6	N/A	6	N/A	6	N/A	24	0
Canned tuna	Canned tuna in oil	6	N/A	6	N/A	6	N/A	6	N/A	24	0
	Canned tuna in water	5	N/A	6	N/A	6	N/A	6	N/A	23	0

Note: P=packaged; NP=non-packaged; N/A=not available during sampling. The numbers in the table indicate the sample sum of each type of food in each sampling round.

Table S2. Food sampling information (South Africa)

Food category		Pretoria		Vhembe		Total number (n)	
		P	NP	P	NP	P	NP
Fish	Tilapia	5	N/A	1	1	6	1
	Bass	N/A	N/A	N/A	1	0	1
	Hake	4	2	3	N/A	7	2
	Haddock	2	N/A	N/A	N/A	2	0
	Salmon	N/A	6	N/A	N/A	0	6
	Anchovy	2	N/A	N/A	N/A	2	0
	Mackerel	13	N/A	2	N/A	15	0
	Bream	N/A	N/A	1	1	1	1
	Catfish	N/A	N/A	N/A	2	0	2
Vegetable	Spinach	N/A	8	1	6	1	14
	Arugula	N/A	N/A	N/A	N/A	0	0
	Romaine Lettuce	7	N/A	1	N/A	8	0
Bread	White loaf	N/A	N/A	2	2	2	2
	Brown loaf	7	N/A	5	6	12	6
Canned tuna	Canned tuna in oil	7	N/A	6	N/A	13	0
	Canned tuna in water	8	N/A	5	N/A	13	0

Note: P=packaged; NP=non-packaged; N/A=not available during sampling. The numbers in the table indicate the sample sum of each type of food sampled in South Africa.

Table S3. LC-QTOF-MS parameters

Item	Parameters
Column	Poroshell 120 Phenyl Hexyl column (2.7 μm 3.0 mm 100 mm) fitted with a Poroshell 120 Phenyl Hexyl guard column (2.7 μm 3.0 mm 10 mm) (Agilent Technologies)
Mobile phase	Water (A) and methanol (B), both containing 10 mM ammonium acetate
Mobile phase gradients	Mobile phase B increased linearly and the gradient times were as follows: initially at 5% for 1 min, then increased to 100% over 1–15 min, and maintained at 100% during 15–20 min; at 20 min, the eluent was restored to the initial conditions for 5 min to re-equilibrate the column for the next injection
Flow rate	0.2 mL min ⁻¹
Injection volume	10 μL
Column temperature	20 °C
ESI mode	negative
Drying gas	Nitrogen gas (325 °C)
Acquisition mode	All Ions MS/MS mode at four collision energies (0; 10; 20; 40 V)
Fragmentor energy	150 V
Mass range	MS data were acquired in the m/z 50–1700 range

Table S4. Average recoveries of plasticizers in different matrices (n=3, %)

Food	Salmon*	Cod*	Romaine lettuce**	Chicken	Brown bread	White bread	Canned tuna in water	Canned tuna in oil	Butter
DBP	92 ± 11	106 ± 6	127 ± 10	75 ± 16	112 ± 10	90 ± 5	81 ± 7	79 ± 10	70 ± 8
DEP	128 ± 7	122 ± 10	107 ± 11	72 ± 6	88 ± 9	79 ± 11	122 ± 9	98 ± 11	71 ± 13
DEHP	90 ± 5	89 ± 8	87 ± 9	120 ± 9	117 ± 4	109 ± 6	105 ± 8	107 ± 6	129 ± 12
DINP	113 ± 10	112 ± 10	126 ± 15	100 ± 11	128 ± 11	129 ± 10	98 ± 10	88 ± 11	72 ± 14
DEHA	79 ± 6	80 ± 4	103 ± 5	121 ± 9	129 ± 9	118 ± 11	98 ± 4	90 ± 5	80 ± 7
DIDA	84 ± 7	87 ± 6	104 ± 8	124 ± 12	114 ± 5	100 ± 5	104 ± 9	98 ± 10	121 ± 13
DINCH	81 ± 5	91 ± 7	72 ± 12	88 ± 14	116 ± 13	117 ± 9	79 ± 6	81 ± 8	121 ± 5

Notes: * Salmon and cod represents the high-fat fish (fat content $\geq 3\%$, fresh weight) and low-fat fish (fat content $< 1\%$, fresh weight) in this study, respectively. The fat content was measured by Soxhlet extraction in this study (data not shown here).

** Romaine lettuce represents the four types of vegetables in this study, as they have similar moisture ($\geq 92\%$) and fat content ($< 0.5\%$, fresh weight) (data not shown here).

Table S5. MDL (ng g^{-1} , fresh weight) and inter-day precision (RSD, %)

Plasticizers	MDL	RSD
DBP	0.1	4.2
DEP	0.2	11.5
DEHP	0.1	7.6
DINP	0.1	11.4
DEHA	0.1	9.4
DIDA	0.1	2.6
DINCH	0.3	9.8

Table S6. Concentration ranges for key contaminants (ng g⁻¹, fresh weight) in food composites from markets in South Africa

Food category	Sample name	Type	N [#]	BPA	BPS	DBP	DEP	DEHA	DEHP	DINP	DINCH	DIDA
Fish	Hake	P	2	ND	ND	ND	ND	ND	ND	<MDL-1.50	ND	ND
	Mackerel	P	3	ND	ND	<MDL-20.14	<MDL-22.5	<MDL-25.32	ND	ND	<MDL-4.45	ND
	Tilapia	P	2	ND	ND	ND	<MDL-43.11	<MDL-0.65	ND	<MDL-0.39	ND	ND
Vegetable	Romaine lettuce	P	2	<MDL-3.10	ND	ND	17.67-17.90	<MDL-107.61	<MDL-0.88	<MDL-0.98	<MDL-5.30	ND
	Spinach	NP	2	<MDL-9.18	ND	ND	<MDL-21.29	<MDL-2.93	2.01-2.28	4.61-6.41	ND	ND
Bread	Whole wheat bread	P*	2	ND	ND	ND	<MDL-160.38	<MDL-6.58	ND	14.70-17.52	69.37-177.29	ND
	Whole wheat bread	P-C*	2	ND	ND	ND	<MDL-159.32	ND	ND	2.03-5.04	70.64-77.46	ND
Canned tuna	Canned tuna in oil	P	2	<MDL-29.38	ND	ND	<MDL-126.96	ND	ND	12.82-13.67	ND	<MDL-1.43
	Canned tuna in water	P	2	9.83-13.61	ND	1.16±1.56	<MDL-55.82	ND	1.01-3.26	8.43-12.75	ND	ND

Note: [#] N is the number of composites for each type of food. P: packaged; NP: non-packaged. * For bread samples, P indicates the samples that have direct contact with packaging (outside layer), while P-C indicates the samples that did not have direct contact with packaging (e.g. the core of packaged bread); NP indicates the outside layer of non-packaged breads, while NP-C indicates the core of non-packaged breads. ND: not detected. MDL: method detection limit. ND represents cases where the contaminant levels were all below MDL for all food homogenates within the same category.

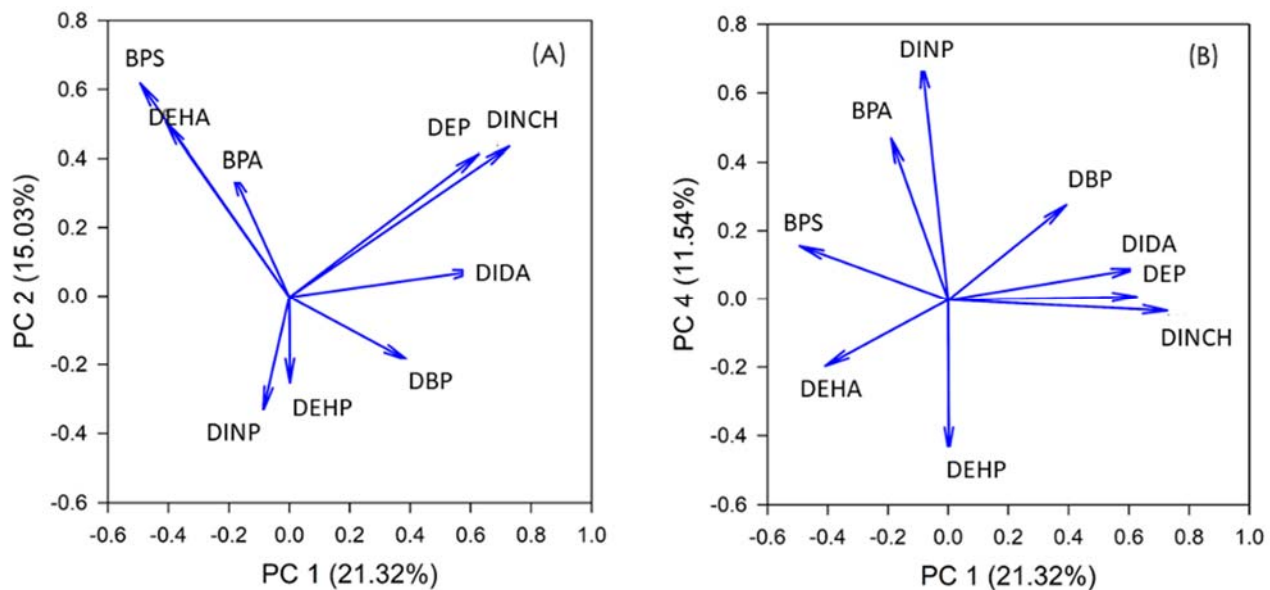


Figure S1. PCA loading plot for all contaminants and all food matrices from Montreal, assuming a value of MDL/2 for non-detects (PC2 vs. PC1 in Fig. A, and PC4 vs. PC1 in Fig. B).

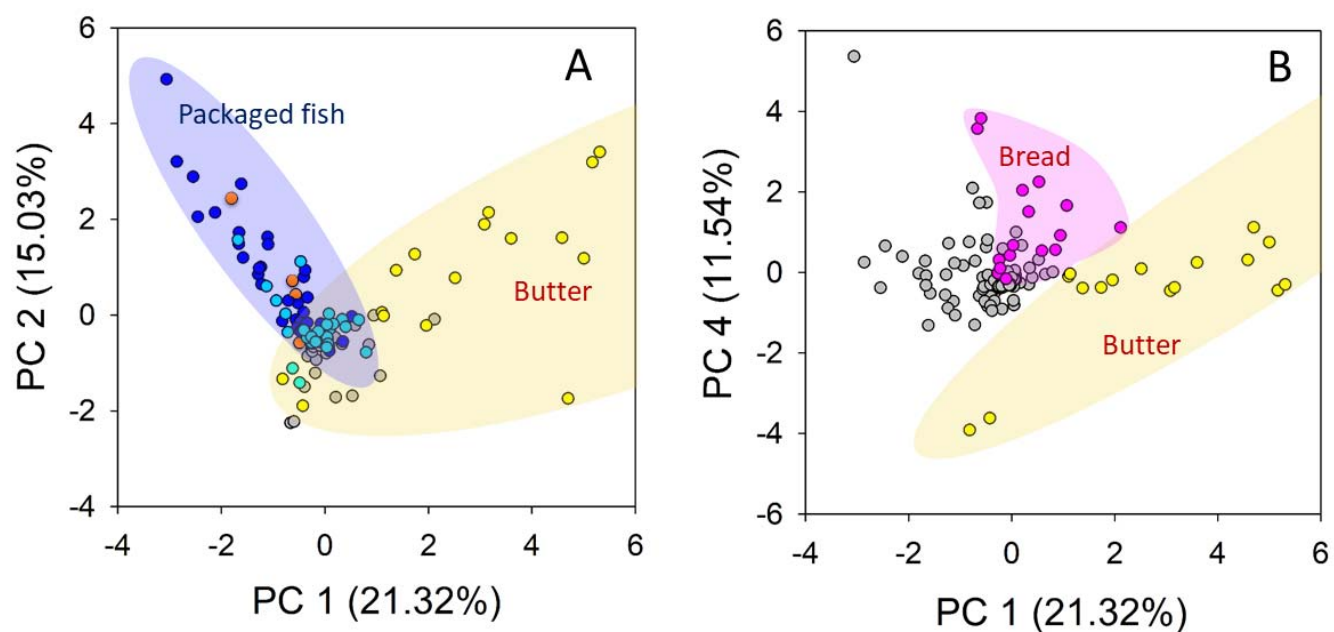


Figure S2. PCA plot for all contaminants and all food matrices from Montreal, assuming a value of $MDL/\sqrt{2}$ for non-detects. Figure A represents PC2 vs. PC1 with butter, chicken, packaged fish and non-packaged fish samples highlighted in yellow, orange, dark blue and light blue, respectively. Figure B represents PC4 vs. PC1 with butter and bread samples highlighted in yellow and pink, respectively.

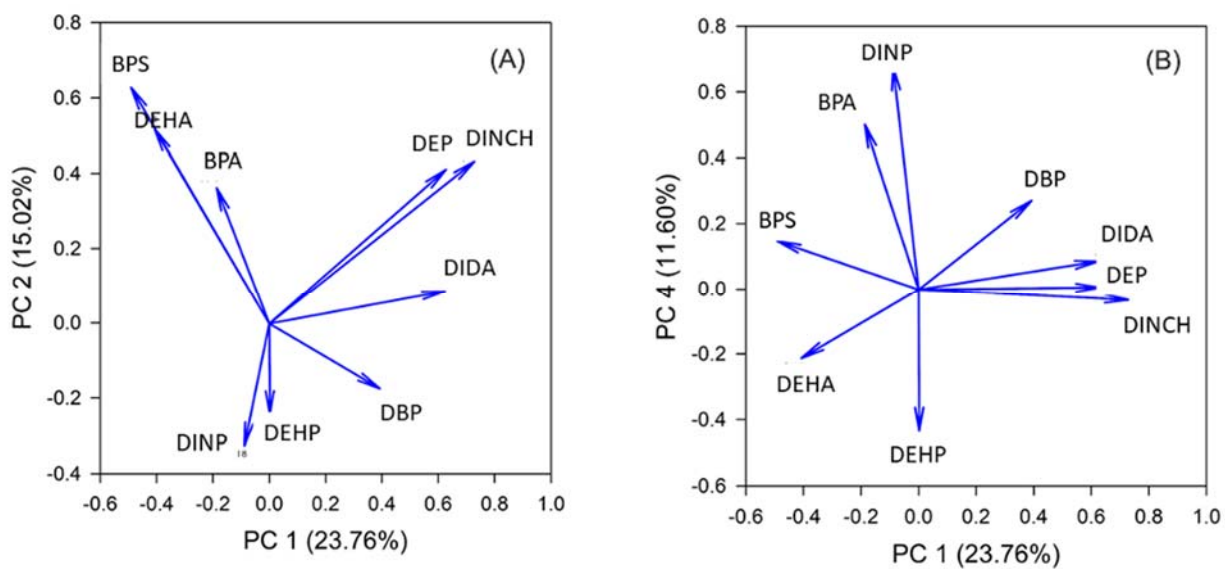


Figure S3. PCA loading plot for all contaminants and all food matrices from Montreal, assuming a value of $MDL/\sqrt{2}$ for non-detects (PC2 vs. PC1 in Fig. A, and PC4 vs. PC1 in Fig. B).