Supplementary Materials

Urinary concentrations of bisphenol analogues among school-aged children in South China: exposure characterization and risk assessment

Pan Zhu[1,#], Lingchuan Guo[2,#], Guangning Su[1], Jing Deng[1], Senyuan Huang[1,3], Xiuhua Zhong[1], Lin Lu[1], Min Li[1], Jing Cao[3], Chaoyang Long[1], Shengbing Yu[1]

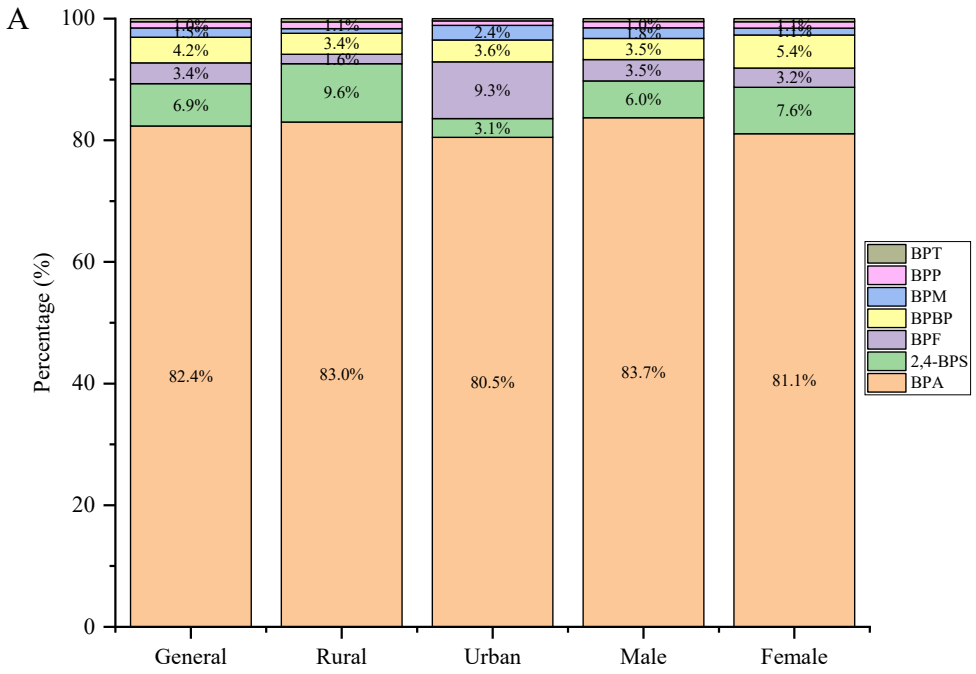
[1]Guangdong Provincial Center for Disease Control and Prevention, Guangzhou 511430, Guangdong, China.

[2]State Key Laboratory of Environmental Criteria and Risk Assessment, State Environmental Protection Key Laboratory of Ecological Effect and Risk Assessment of Chemicals, Chinese Research Academy of Environmental Sciences, Beijing 100012, China.

[3]Guangdong-Hong Kong-Macao Joint Laboratory for Contaminants Exposure and Health, Guangdong Key Laboratory of Environmental Catalysis and Health Risk Control, Institute of Environmental Health and Pollution Control, Guangdong University of Technology, Guangzhou 510006, Guangdong, China.

[#]These authors contributed equally to this work.

Correspondence to: Dr. Shengbing Yu, Guangdong Provincial Center for Disease Control and Prevention, Guangzhou 511430, Guangdong, China. E-mail: shengbingyu@sina.com



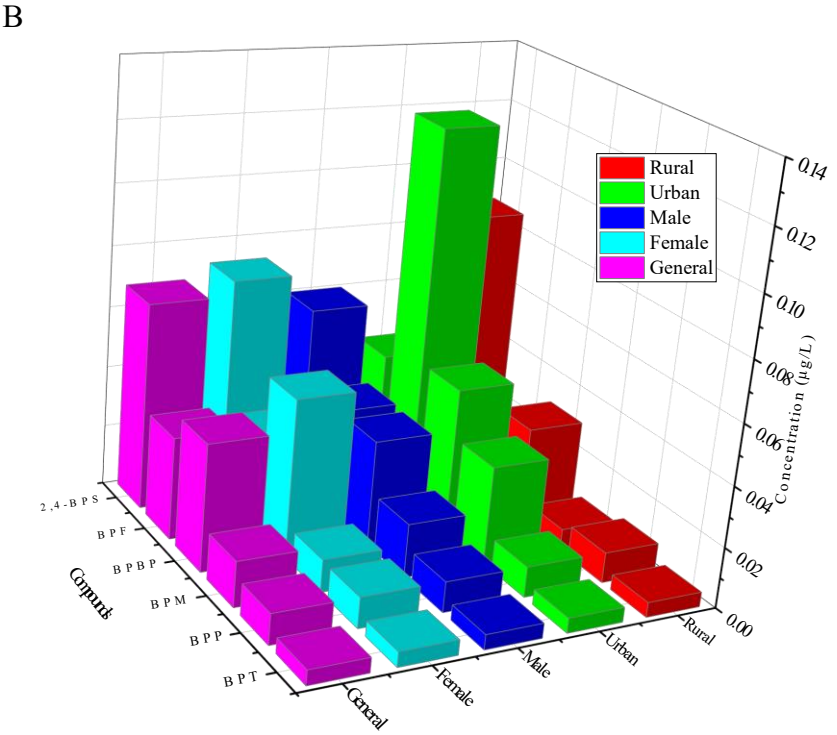


Figure S1. The composition profiles (A) and the median concentrations of the major BPs (B) in urine.

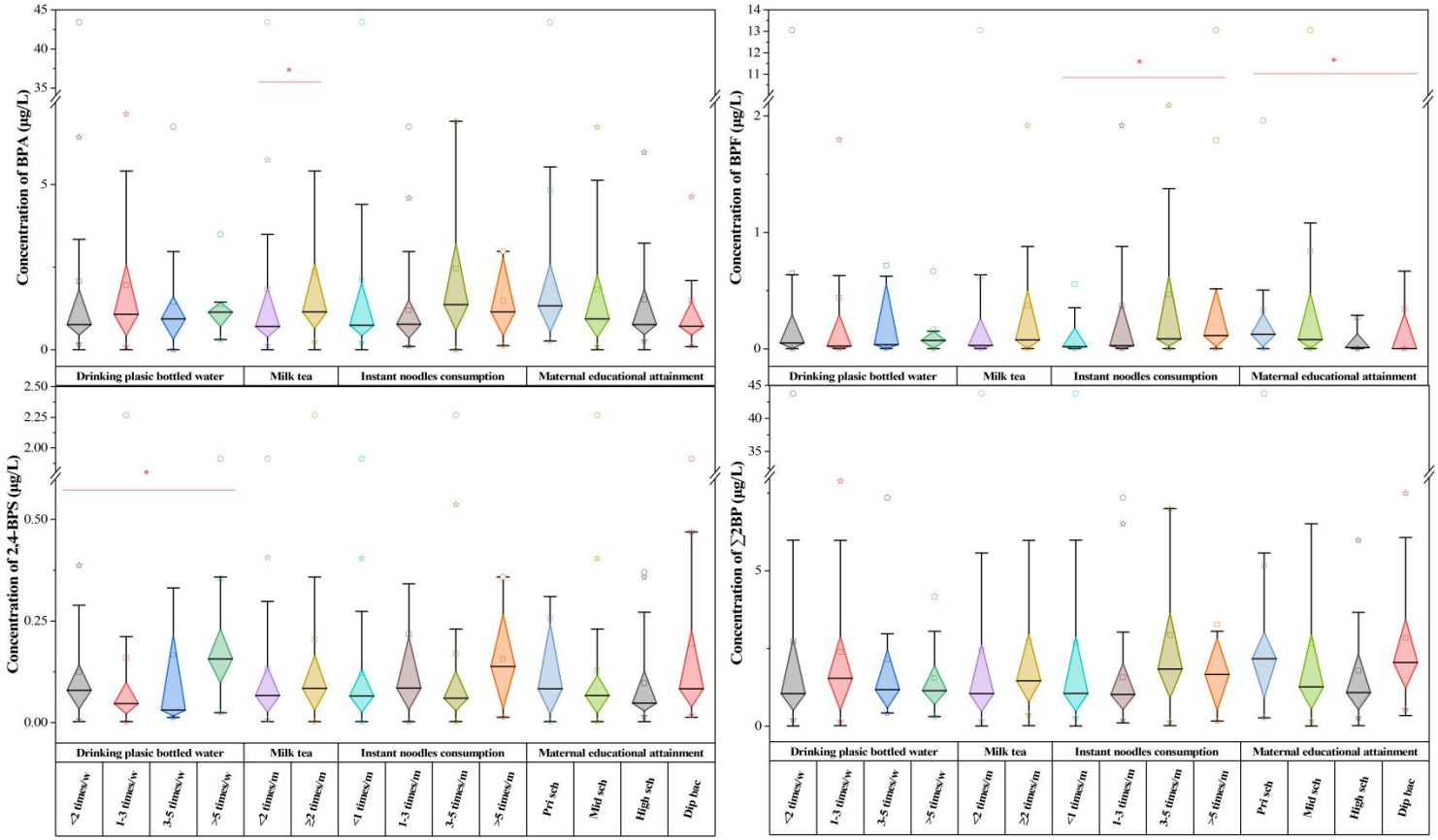


Figure S2. Comparison among urinary BPs concentrations across different demographic characteristics.

*$p < 0.05$ (two-tailed); **$p < 0.01$ (two-tailed).

33

34 **Table S1. Retention times, MS/MS parameters, liner, method detection limit (MDL) and quantitation limit (MQL) for BPs in sMRM mode**

No.	Full Name	Abbreviation	CAS	Retention time (min)	Q1 mass (Da)	Q3 mass (Da)	DP (V)	EP (V)	CE (V)	EXP (V)	Calibration Curve	R	MDL (μg/L)	MQL (μg/L)
Native standards														
1	2,2-bis(4-hydroxyphenyl)propane	BPA	80-05-7	7.44	227.1	133.1	-55	-10	-34	-6	y=0.327x+0.062	0.9994	0.008	0.023
						211.9	-55	-10	-28	-23				
2	4-[2-(4-hydroxyphenyl)butan-2-yl]phenol	BPB	77-40-7	8.05	241.0	212.0	-30	-10	-27	-23	y=0.642x+0.021	0.9995	0.005	0.014
						222.0	-30	-10	-69	-14				
3	2,2-bis(4-hydroxy-3-methylphenyl)propane	BPC	79-97-0	8.46	254.8	147.0	-35	-10	-32	-27	y=0.048x+0.002	0.9993	0.023	0.070
						239.2	-35	-10	-45	-14				
4	4,4'-hexafluoroisopropylidene) diphenol	BPF	620-92-8	6.38	199.0	93.0	-30	-10	-30	-6	y=0.573x-0.00292	0.9991	0.004	0.011
						77.0	-30	-10	-33	-24				
5	Bis(4-hydroxyphenyl) sulfone	BPS	80-09-1	5.19	248.8	108.0	-55	-10	-34	-4	y=0.414x+0.001	0.9998	0.003	0.009
						92.0	-55	-10	-34	-5				
6	Bisphenol AF	BPAF	1478-61-1	8.35	334.8	265.0	-120	-10	-26	-5	y=2.620x+0.001	0.9999	0.002	0.006
						315.0	-120	-10	-25	-6				
7	4,4'-(1-phenylethylidene)bisphenol	BPAP	1571-75-1	8.41	289.0	274.0	-110	-10	-26	-5	y=0.415x+0.001	0.9998	0.004	0.013
						211.0	-110	-10	-36	-4				
8	tetrachlorobisphenol A	TCBPA	79-95-8	9.37	365.0	314.0	-100	-10	-38	-30	y=0.531x+0.001	0.9994	0.005	0.016
						286.0	-100	-10	-44	-51				
9	4,4'-dihydroxytetraphenylmethane	BPBP	1844-01-5	9.17	351.0	258.0	-110	-10	-35	-39	y=0.364x+0.001	0.9991	0.004	0.012
						274.0	-110	-10	-34	-4				
10	α,α'-Bis(4-hydroxyphenyl)-1,4-diisopropylbenzene	BPP	2167-51-3	9.74	345.2	315.2	-155	-10	-54	-19	y=0.259x+0.202	0.9995	0.005	0.014
						330.1	-155	-10	-39	-17				
11	1,3-Bis[2-(4-hydroxyphenyl)-2-propyl]benzene	BPM	13595-25-0	9.67	345.2	251.1	-155	-10	-41	-5	y=0.217x+0.002	0.9996	0.003	0.010
						330.1	-155	-10	-39	-17				
12	9,9-bis(4-hydroxyphenyl)	BPFL	3236-71-3	8.72	349.0	256.0	-100	-10	-38	-5	y=1.230x-0.015	0.9992	0.003	0.08

	fluorene					215.0	-100	-10	-30	-18				
13	4-benzyloxyphenyl 4-hydroxyphenyl sulfone	BPS-MPE	63134-33-8	8.24	339.2	248.0	-150	-10	-28	-9	y=1.037x+0.004	0.9998	0.002	0.005
						156.1	-150	-10	-32	-9				
14	1,1-bis(4-hydroxyphenyl) cyclohexane	BPZ	843-55-0	8.74	267.0	173.0	-110	-10	-38	-12	y=0.242x-0.003	0.9994	0.005	0.014
						224.0	-110	-10	-36	-17				
15	2-chloro-4-[2-(4-hydroxyphenyl)-2-propanyl]phenol	MCBPA(3-chlorobisphenol A)	74192-35-1	8.09	261.0	182.0	-35	-10	-45	-12	y=0.847x+0.002	0.9995	0.004	0.013
						210.0	-35	-10	-34	-12				
16	2,4’-dihydroxydiphenyl sulfone	2,4-BPS	5397-34-2	4.58	249.0	156.1	-40	-10	-27	-13	y=0.145x+0.001	0.9995	0.003	0.010
						184.0	-40	-10	-34	-12				
17	4-Hydroxy-4'-isopropoxydiphenyl sulfone	BPS-IP	95235-30-6	7.44	290.6	248.0	-30	-10	-30	-13	y=14.803x+0.010	0.9995	0.004	0.011
						184.0	-30	-10	-46	-14				
18	4,4'-ethylidenebisphenol	BPE	2081-08-5	6.96	213.1	198.0	-75	-10	-25	-10	y=1.192x+0.023	0.9991	0.006	0.017
						197.0	-75	-10	-38	-2				
19	4,4’-thiobis-phenol	BPT	2664-63-3	6.99	217.0	124.0	-30	-10	-32	-6	y=7.974x+0.008	0.9995	0.002	0.007
						185.0	-30	-10	-24	-8				
20	4-hydrokybenzolc acid benzyl	PHBB（benzylparaben）	94-18-8	8.07	227.0	136.0	-55	-10	-18	-9	y=7.247x+0.009	0.9991	0.005	0.016
						92.0	-55	-10	-36	-5				
21	1,1-bis(4-hydroxyphenyl)-3,3,5-trimethylcyclohexane	BPTMC	129188-99-4	9.78	309.1	215.2	-115	-10	-38	-1	y=0.900x-0.010	0.9993	0.002	0.007
						200.2	-115	-10	-48	-33				
22	3.3',5-Trichloro bisphenol	TricBPA	40346-55-2	7.81	329.0	132.0	-170	-10	-39	-30	y=3.351x-0.042	0.9994	0.004	0.012
						148.0	-170	-10	-39	-5				
23	4-Allyloxy-4'-hydroxydiphenyl sulfone	BPS-MAE	97042-18-7	7.20	289.1	248.0	-115	-10	-25	-4	y=7.046x-0.023	0.9998	0.004	0.011
						184.1	-115	-10	-34	-6				
24	3,3’-dichlorobisphenol A	3,3'-DCBPA	79-98-1	8.63	295.0	244.0	-160	-10	-33	-31	y=0.211x-0.002	0.9998	0.004	0.013
						216.0	-160	-10	-43	-31				
25	tetrabromobisphenol A	TBBPA	79-94-7	9.70	542.8	418.0	-30	-10	-59	-20	y=0.087x+0.0008	0.9996	0.004	0.012
						420.0	-30	-10	-56	-3				
26	4,4’’-sulfonylbis[2-(2-propenyl)-phenol	TGSH	41481-66-7	7.81	329.0	132.0	-45	-10	-44	-6	y=7.646x+0.007	0.9996	0.004	0.012
						148.0	-45	-10	-36	-14				

Internal Standards

28	BPF-$^{13}C_6$	1410794-06-7	6.37	205.0	93.0	-35	-10	-30	-15
					99.0	-35	-10	-31	-13
29	BPE-$^{13}C_6$	NA	6.98	219.0	125.0	-25	-10	-31	-14
					204.0	-25	-10	-26	-16
30	BPA-d_{16}	96210-87-6	7.37	241.0	142.0	-25	-10	-37	-17
					223.0	-25	-10	-29	-19
31	2,4-BPS-d_8	NA	5.13	257.0	96.0	-35	-10	-36	-7
					112.0	-35	-10	-31	-6
32	BPS-$^{13}C_{12}$	1991267-29-8	4.58	261.0	98.0	-45	-10	-44	-7
					114.0	-45	-10	-35	-10
33	BPZ-d_6	NA	8.71	273.0	179.0	-25	-10	-38	-19
					199.0	-25	-10	-35	-14
34	BPB-d_8	NA	8.02	249.0	219.0	-110	-10	-40	-11
					220.0	-110	-10	-28	-17
35	BPAP-$^{13}C_6$	1571-75-1	8.40	295.0	201.0	-115	-10	-33	-11
					211.0	-115	-10	-33	-2
36	BPAF-d_4	NA	8.33	339.0	69.0	-105	-10	-82	-11
					269.0	-105	-10	-33	-15
37	BPP-$^{13}C_4$	2167-51-3	9.73	349.0	135.0	-105	-10	-47	-7
					317.0	-105	-10	-51	-15
38	TBBPA-d_4	79-94-7	9.68	547.0	79.0	-35	-10	-149	-8
					293.0	-35	-10	-49	-14
39	TCBPA-$^{13}C_{12}$	79-95-8	9.37	375.0	324.0	-100	-10	-38	-30
					295.0	-100	-10	-44	-51

36

37 **Table S2. Recoveries and precision of BPs in urine samples (*n* = 8)**

No.	Compounds	Spiked at 0.10 ng		Spiked at 1.0 ng		Spiked at 5.0 ng	
		Recovery%	RSD%	Recovery%	RSD%	Recovery%	RSD%
1	BPA	92.5	7.7	94.3	6.0	96.4	4.3
2	BPB	107.6	8.1	111.3	8.0	112.7	2.4
3	BPC	81.5	9.9	81.2	9.5	88.5	4.7
4	BPF	88.5	7.7	92.6	5.5	103.2	3.4
5	BPS	110.5	5.0	111.3	2.5	114.7	2.9
6	BPAF	75.5	5.5	73.6	4.3	80.5	2.1
7	BPAP	88.5	7.6	89.1	8.2	96.1	8.1
8	TCBPA	117.5	5.0	117.0	3.9	114.5	2.7
9	BPBP	87.5	7.9	89.7	7.6	93.5	6.0
10	BPP	99.5	8.1	93.4	3.5	101.9	3.1
11	BPM	99.5	4.0	95.0	4.5	97.2	2.6
12	BPFL	78.5	5.5	78.8	4.9	81.7	3.4
13	BPS-MPE	66.5	8.9	62.2	4.7	61.6	3.7
14	BPZ	82.5	7.7	77.1	5.1	81.5	2.0
15	MCBPA	87.5	7.4	86.1	5.6	92.8	3.7
16	2,4-BPS	79.5	5.7	76.2	4.6	84.9	3.0
17	BPS-IP	95.5	3.9	92.6	4.9	101.9	5.0
18	BPE	89.5	8.7	85.5	8.7	102.9	7.1
19	BPT	63.5	6.6	74.4	8.5	74.6	6.9
20	PHBB	108.5	7.5	107.2	5.7	101.8	2.9
21	BPTMC	90.5	4.6	89.4	3.3	93.7	3.4
22	TricBPA	81.5	11.0	79.9	8.6	87.6	7.9
23	BPS-MAE	86.5	7.8	81.1	4.7	91.3	5.4
24	3,3'-DCBPA	82.5	9.0	77.1	6.8	75.0	7.3
25	TBBPA	86.5	8.1	91.1	5.9	95.1	2.8
26	TGSH	106.5	6.5	93.0	6.3	112.4	6.7

38

39 **Table S3. Demographic characteristics of the study population (*n* = 184)**

		Number	Proportion (%)
Regions			
	Urban	99	53.8
	Rural	85	46.2
Age (years)			
	9	91	49.5
	10	93	50.5
Gender			
	Mela	107	58.2
	Female	77	41.8
BMI[a]			
Male			
	≤18.9	95	88.8
	>18.9	12	11.2
Female			
	≤19.0	64	83.1
	>19.0	13	16.9
Family income (yuan)			
	<1500	35	19.0
	1500-3000	36	19.6
	3000-5000	73	39.7
	>5000	40	21.7
Drinking plastic bottled water			
	<2 times/month	100	54.3
	1-3 times/week	63	34.2
	3-5 times/week	12	6.5
	>5 times/week	9	4.9
Drinking milk tea			
	<2 times/month	140	76.1
	⩾2 times/month	44	23.9
Instant noodles consumption			
	<1 times/month	110	59.8

	1-3 times/month	37	20.1
	3-5 times/month	29	15.8
	>5 times/month	8	4.3
Maternal educational attainment			
	Primary school and below	17	9.2
	Middle school	86	46.7
	Senior High School	37	20.1
	Diploma and bachelor's degree	44	23.9

[a] Classified by overweight as 18.9 kg/m²for male and 19.0 kg/m²for female at the age of 9.5 years (Chinese hygiene standards WS/T 586—2018, Screening for overweight and obesity among school-aged children and adolescents).

44

45 **Table S4. Comparison of urinary BPs from previous studies (median, μg/L)**

Participants	Site	BPA	BPS	BPAF	BPAP	BPB	BPF	BPP	∑BPs	EDI- median (μg/kg bw/d)	EDI-mean(μg/kg bw/d)	Reference
school-aged children	South China	0.803 (0.887[a])	<MDL (0.005[a])	<MDL (0.003[a])	0.003 (0.029[a])	<MDL (<MDL[a])	0.033 (0.039[a])	0.010 (0.010[a])	2.142 (2.191[a])	0.035(BPA) 0.080(sum)	0.080(BPA) 0.139(sum) 0.088(sum)[a]	this study
Childhood (4y)	Shanghai, China	0.09 (0.23[a])	0.00 (0.00[a])	0.02 (0.03[a])	/	/	0.10 (0.24[a])	/	/	/	/	[1]
Preschool-aged children (4-6y)	Guangzhou, China	0.48 (0.76[a])	/	/	/	/	/	/	/	/	/	[2]
Infant	Hangzhou, China	0.67 (0.93[a])	/	/	/	/	/	/	/	/	/	[3]
School-aged Children (6-11y)	Jingyang, China	0.938 (0.862[a])	0.016 (0.009[a])	/	/	/	/	/	/	0.0662(BPA)	0.0615(BPA)[a]	[4]
Children (7y)	Odense, Denmark	0.94	0.23	<LOD	/	/	0.14	/	6.32	/	/	[5]
Mother		1.29	/	/	/	/	/	/	/			
Children (7y)	Jiangsu, China	1.41	/	/	/	/	/	/	/	/	/	[6]
Children (3y)		1.04	/	/	/	/	/	/	/	/	/	
Children (6-10y)	Prekmufje, Solvenia	1.9 (2.1[a])	<LOQ (0.3[a])	/	/	/	0.085 (0.11[a])	/	/	/	/	[7]
Adolescents (12-15y)		1.6 (1.9[a])	<LOQ (0.36[a])	/	/	/	0.11 (0.17[a])	/	/	/	/	
Children (0.75-6y)	Guangzhou, China	2.43	0.23	<LOD	<LOD	<LOD	<LOQ	<LOD	/	0.0538(BPA) 0.157(sum)	/	[8]
school-aged children	Poland	2.5 (2.6[a])	<LOD (<LOD[a])	/	/	/	1.0 (1.0[a])	/	/	0.0459(BPA)	/	[9]
Children (0-5y)	Nanjing, China	4.87	0.019	0.10	0.28	0.05	2.47	0.32	7.83	0.478(BPA)	/	[10]
Genaral residents (3-86y)	Wuxi, China	0.072[a]	/	0.031[a]	0.079[a]	0.081[a]	1.04[a]	0.146[a]	2.45[a]	/	0.116(sum)[a]	[11]
	Taishun, China	0.081[a]	/	0.065[a]	0.084[a]	0.098[a]	0.534[a]	0.119[a]	1.70[a]	/	0.121(sum)[a]	

Pregnant women	Japan	0.40	<LOD	<LOD	/	/	<LOD	/	/	0.009	/	[12]
Genaral residents	Chengdu, China	0.686 (0.267[a])	0.0565 (0.048[a])	0.381 (0.098[a])	0.079 (0.046[a])	0.851 (0.535[a])	2.40 (0.271[a])	0.325 (0.101[a])	4.89 (2.55[a])	0.0851(sum)	0.209(sum)	
Genaral residents	Nantong, China	0.765 (0.398[a])	1.64 (0.167[a])	0.111 (0.037[a])	0.070 (0.051[a])	0.897 (0.427[a])	1.07 (0.584[a])	0.061 (0.060[a])	4.64 (2.97[a])	0.0888(sum)	0.157(sum)	[13]
Genaral residents	Shehong, China	0.409 (0.243[a])	0.082 (0.051[a])	0.083 (0.030[a])	0.074 (0.066[a])	0.603 (0.347[a])	1.34 (0.453[a])	0.061 (0.060[a])	2.69 (1.76[a])	0.0551(sum)	0.110(sum)	
Pregnant women (>18y）	Guangzhou, China	0.624 (0.644[a])	0.063 (0.089[a])	0.010 (0.008[a])	<LOD (<LOD[a])	/	<LOD (0.056[a])	<LOD (<LOD[a])	0.451 (0.561[a])	/	/	[14]
Adults (22-79y)	Liege, Belgium	0.79	<LOQ	/	/	/	0.12	<LOQ	/	/	/	[15]
Genaral population	26 cities in China	1.07	0.04	<LOD	<LOD	<LOD	<LOD	<LOD	1.64	0.036(BPA)	/	[16]
Adult	Chengdu, China	1.127 (1.010[a])	0.080 (0.085[a])	<LOD (0.016[a])	<LOD (<LOD[a])	/	0.035 (0.032[a])	/	/	/	0.027(BPA)[a]	[17]
General residents in rural area	Longtang town, Qingyuan, China	0.648 (0.589[a])	0.398 (0.388[a])	<LOQ (0.034[a])	<LOQ (0.071[a])	<LOQ (0.329[a])	0.050 (0.089[a])	<LOQ (0.044[a])	8.55 (6.84[a])	/	/	[18]
General residents in urban area		1.42 (0.952[a])	0.835 (0.652[a])	<LOQ (0.013[a])	<LOQ (0.024[a])	<LOQ (<LOQ[a])	0.484 (0.556[a])	<LOQ (0.021[a])	6.55 (7.31[a])	/	/	
General residents in e-waste region		3.00 (2.99[a])	0.364 (0.361[a])	<LOQ (0.017[a])	<LOQ (0.06[a])	<LOQ (0.028[a])	0.365 (0.349[a])	<LOQ (0.029[a])	8.67 (8.00[a])	/	/	
General residents	Northern Europe	1.22-2.10[a]	/	/	/	/	/	/	/	/	/	
General residents	Southern Europe	1.97-2.39[a]	/	/	/	/	/	/	/	/	/	[19]
General residents	Western Europe	0.73-2.28[a]	/	/	/	/	/	/	/	/	/	
General residents (5-77y)	Guangzhou, China	3.88	<LOD	0.012	<LOD	/	<LOD	<LOD	4.52	/	/	[20]

/: not detected in the study; [a] geometric mean.

Table S5. Spearman's correlation coefficient of major BPs

	BPA	BPF	BPBP	BPP	BPM	2,4-BPS	BPT	$\sum_2$BP	∑BPs
BPA	1								
BPF	0.188*	1							
BPBP	0.024	-0.066	1						
BPP	0.057	0.135	0.262**	1					
BPM	0.202**	0.204**	0.112	-0.073	1				
2,4-BPS	0.226**	-0.023	0.093	0.260**	-0.003	1			
BPT	0.319**	0.087	0.033	0.02	0.281**	0.108	1		
$\sum_2$BP	0.872**	0.496**	-0.0070	0.1400	0.305**	0.185*	0.280**	1	
∑BPs	0.811**	0.422**	0.0560	0.238**	0.243**	0.312**	0.249**	0.920**	1

** $p < 0.01$ (2-tailed); * $p < 0.05$ (2-tailed); $\sum_2$BP: the sum concentration of BPA and BPF; ∑BPs: the sum concentration of 26 BPs.

Table S6. Urinary concentrations of major BPs among school-aged children with different demographic characteristics and lifestyle habits.

Analyte	Regions	Sex	Age	Incomes	Drinking plasic bottled water	Milk tea	Instant noodle consumption	Maternal educational attainment
BPA	0.480	0.719	0.195	0.041*	0.910	0.037*	0.321	0.576
2,4-BPS	0.000**	0.632	0.500	0.041*	0.021*	0.612	0.492	0.175
BPF	0.000**	0.675	0.179	0.292	0.983	0.375	0.024*	0.028*
BPBP	0.076	0.134	0.778	0.077	0.709	0.5260	0.127	0.875
BPP	0.008**	0.063	0.049*	0.563	0.755	0.2330	0.606	0.616
BPM	0.000**	0.030*	0.001**	0.215	0.495	0.007**	0.022*	0.029*
BPT	0.253	0.254	0.557	0.761	0.009**	0.056	0.340	0.165
$\sum_2$BP	0.023*	0.351	0.022*	0.022*	0.948	0.058	0.238	0.365
∑BPs	0.733	0.173	0.173	0.045*	0.619	0.096	0.504	0.499

** $p < 0.01$ (2-tailed); * $p < 0.05$ (2-tailed); $\sum_2$BP: the sum concentration of BPA and BPF; ∑BPs: the sum concentration of 26 BPs.

Table S7. Effects of demographic characteristics and lifestyle habits on urinary concentrations of BPs (μg/L)

	BPA				BPF				2,4-BPS			
	Median	Mean	P95	*p*	Median	Mean	P95	*p*	Median	Mean	P95	*p*
Regions												
Urban	0.752	1.398	4.786	0.480	0.014	0.320	2.219	< 0.001	0.087	0.179	0.762	0.001
Rural	1.075	2.613	9.898		0.125	0.838	3.237		0.041	0.116	0.381	
Age (years)												
9	1.144	1.905	7.137	0.195	0.072	0.836	3.663	0.179	0.080	0.145	0.469	0.500
10	0.739	2.012	5.976		0.029	0.288	1.429		0.060	0.155	0.762	
Gender												

Male	0.833	1.597	5.536	0.719	0.035	0.473	1.917	0.675	0.060	0.133	0.404	0.632
Female	0.771	2.463	9.898		0.030	0.679	3.663		0.073	0.173	1.113	
BMI*												
Normal	0.778	1.965	6.916	0.787	0.033	0.615	3.144	0.959	0.069	0.157	0.537	0.912
Innormal	1.091	1.926	5.213		0.081	0.201	0.553		0.065	0.103	0.298	
Family income (yuan)												
<1500	0.687	1.230	5.536	0.041	0.029	0.483	3.144	0.292	0.041	0.086	0.359	0.041
1500-3000	0.863	1.710	6.750		0.077	0.871	7.866		0.079	0.227	1.250	
3000-5000	1.391	2.325	7.137		0.079	0.592	2.219		0.052	0.147	0.537	
>5000	0.666	2.154	7.268		0.008	0.285	2.328		0.099	0.142	0.373	
Drinking plastic bottled water												
<2 times/month	0.761	2.077	6.435	0.910	0.051	0.650	3.120	0.983	0.080	0.124	0.387	0.021
1-3 times/week	1.075	1.953	7.137		0.023	0.441	1.798		0.047	0.159	0.762	
3-5 times/week	0.937	1.440	6.750		0.038	0.717	6.516		0.031	0.167	1.046	
>5 times/week	1.144	1.387	3.496		0.072	0.167	0.667		0.157	0.354	1.911	
Milk tea												
<2 times/month	0.705	1.836	5.745	0.037	0.030	0.618	3.166	0.375	0.067	0.133	0.407	0.612
≥2 times/month	1.149	2.353	8.665		0.076	0.371	1.917		0.084	0.205	1.046	
Instant noodles consumption												
<1 times/month	0.746	2.117	8.665	0.321	0.018	0.556	3.096	0.024	0.066	0.122	0.404	0.492
1-3 times/month	0.774	1.200	4.591		0.027	0.372	1.917		0.085	0.217	1.250	
3-5 times/month	1.368	2.461	6.916		0.086	0.469	2.092		0.060	0.170	0.537	
>5 times/month	1.149	1.482	2.981		0.114	1.793	13.052		0.138	0.156	0.358	
Maternal educational attainment												
Primary school and below	1.333	4.829	43.400	0.576	0.125	0.330	1.960	0.028	0.083	0.256	1.288	0.175
Middle school	0.938	1.822	6.750		0.081	0.839	6.516		0.067	0.129	0.404	
Senior High School	0.765	1.518	5.976		0.011	0.272	2.219		0.048	0.097	0.358	
Diploma and bachelor's degree	0.711	1.489	4.638		0.003	0.341	2.858		0.084	0.195	0.469	

∑$_2$BP: the sum concentration of BPA and BPF; ∑BPs: the sum concentration of 26 BPs.

* Classified by overweight as 18.9 kg/m²for male and 19.0 kg/m²for female at the age of 9.5 years. (Chinese hygiene standards WS/T 586—2018, Screening for overweight and obesity among school-aged children and adolescents).

Table S7. Effects of demographic characteristics and lifestyle habits on urinary concentrations of BPs (μg/L, continued)

	∑$_2$BP				∑BPs			
	Median	**Mean**	**P95**	***p***	**Median**	**Mean**	P95	*p*
Regions								
Urban	0.910	1.718	5.985	0.023	2.100	2.820	7.731	0.733
Rural	1.803	3.451	11.600		2.194	3.991	12.174	
Age (years)								
9.000	1.517	2.741	10.514	0.022	2.388	3.497	11.511	0.173
10.000	0.841	2.300	6.997		1.793	3.228	8.270	

Gender								
Male	1.078	2.069	7.886	0.351	2.088	2.876	9.074	0.173
Female	1.351	3.142	11.600		2.294	4.035	12.174	
BMI*								
Normal	1.079	2.580	9.935	0.654	1.960	3.389	10.392	0.461
Innormal	1.539	2.126	5.216		2.753	3.183	7.731	
Family income (yuan)								
<1500	1.059	1.713	5.571	0.022	1.646	2.347	6.388	0.045
1500-3000	1.221	2.581	9.935		2.270	3.567	10.392	
3000-5000	1.803	2.917	10.528		2.631	3.732	11.597	
>5000	0.735	2.439	10.223		1.678	3.386	11.857	
Drinking plastic bottled water								
<2 times/month	1.047	2.727	10.846	0.948	2.009	3.519	11.615	0.619
1-3 times/week	1.539	2.394	7.886		2.426	3.248	9.074	
3-5 times/week	1.177	2.157	7.350		2.566	3.128	8.434	
>5 times/week	1.147	1.554	4.163		2.294	2.711	7.433	
Milk tea								
<2 times/month	1.047	2.454	9.083	0.058	2.009	3.299	9.955	0.096
⩾2 times/month	1.460	2.724	8.789		2.626	3.558	9.074	
Instant noodles consumption								
<1 times/month	1.055	2.673	10.514	0.238	2.009	3.490	11.511	0.504
1-3 times/month	1.023	1.572	6.509		2.102	2.608	7.496	
3-5 times/month	1.840	2.930	6.997		2.836	3.705	8.270	
>5 times/month	1.660	3.275	16.025		2.409	3.822	16.362	
Maternal educational attainment								
Primary school and below	2.170	5.160	43.755	0.365	3.152	6.181	45.332	0.499
Middle school	1.261	2.662	9.935		2.176	3.416	10.392	
Senior High School	1.078	1.789	5.978		1.901	2.551	6.300	
Diploma and bachelor's degree	0.788	1.831	5.374		2.048	2.846	7.496	

66 $\sum_2$BP: the sum concentration of BPA and BPF; ∑BPs: the sum concentration of 26 BPs.

67 *Classified by overweight as 18.9 kg/m²for male and 19.0 kg/m²for female at the age of 9.5 years (Chinese hygiene standards

68 WS/T 586—2018, Screening for overweight and obesity among school-aged children and adolescents).

69

Table S8. Non-carcinogenic risk (HQ) from urinary BPA exposure

	All				Region				Sex				Age			
	Median	Mean ± SD	Range	P95	Urban		Rural		Male		Female		9 years		10 years	
					Median	P95	Median	P95	Median	P95	Median	P95	Median	P95	Median	P95
HQ_TDI[a]	165.0	346.2 ± 468.6	2.85–3282.9	1239.7	155.0	1003.5	218.9	1727.0	176.3	1150.3	156.2	1700.7	231.5	1615.0	131.3	1216.0
HQ_t_TDI[b]	0.008	0.017 ± 0.023	0.000–0.164	0.062	0.008	0.050	0.011	0.086	0.009	0.058	0.008	0.085	0.012	0.081	0.007	0.061
HQ_RfD[c]	0.0001	0.001 ± 0.002	0.000–0.013	0.005	0.001	0.004	0.001	0.007	0.001	0.005	0.001	0.007	0.001	0.007	0.001	0.005

[a] The calculation of HQ was based on the TDI of BPA (0.2 ng/kg-bw/day) recommended by EFSA (EFSA, 2023);

[b] The calculation of HQ was based on the t-TDI of BPA (4 μg/kg-bw/day) recommended by EFSA (EFSA, 2015);

[c] The calculation of HQ was based on the RfD of BPA (50 μg/kg-bw/day) recommended by USEPA (USEPA, 1988).

REFERENCES

1. Su, H.; Xi, J.; Miao, M.; et al. Bisphenol analogs exposure in 4-year-old children and their intelligence quotient at 6 years: a prospective cohort study. *Environ. Res.* **2025**, *276*, 121528. DOI: 10.1016/j.envres.2025.121528
2. Cai, W.; Yan, Q.; Deng, Y.; Guo, Y. The correlation of bisphenol A exposure on inflammatory cytokines in preschool children. *Cytokine.* **2025**, *186*, 156835. DOI: 10.1016/j.cyto.2024.156835
3. Ji, Y.; Tian, Y.; Pan, Y.; et al. Exposure and potential risks of thirteen endocrine- disrupting chemicals in pharmaceuticals and personal care products for breastfed infants in China. *Environ. Int.* **2024**, *192*, 109032. DOI: 10.1016/j.envint.2024.109032
4. Hua, L.; Liu, W.; Liu, Y.; et al. Occurrence and profile characteristics of environmental phenols in human urine from a rural area in Northwestern China. *Environ. Pollut.* **2022**, *315*, 120405. DOI: 10.1016/j.envpol.2022.120405
5. Sigvaldsen, A.; Frederiksen, H.; Højsager, F. D.; et al. Prenatal and childhood exposure to bisphenols and bone mineral density in 7-year-old children from the Odense Child Cohort. *Int. J. Hyg. Environ. Health.* **2024**, *260*, 114408. DOI: 10.1016/j.ijheh.2024.114408
6. Guo, J.; Zhang, J.; Wu, C.; et al. Urinary bisphenol A concentrations and adiposity measures at age 7 years in a prospective birth cohort. *Chemosphere.* **2020**, *251*, 126340. DOI: 10.1016/j.chemosphere.2020.126340
7. Tkalec, Ž.; Kosjek, T.; Snoj Tratnik, J.; et al. Exposure of Slovenian children and adolescents to bisphenols, parabens and triclosan: urinary levels, exposure patterns, determinants of exposure and susceptibility. *Environ. Int.* **2021**, *146*, 106172. DOI: 10.1016/j.envint.2020.106172
8. Yang, Y.; Shi, Y.; Chen, D.; Chen, H.; Liu, X. Bisphenol A and its analogues in paired urine and house dust from South China and implications for children's exposure. *Chemosphere.* **2022**, *294*, 133701. DOI: 10.1016/j.chemosphere.2022.133701
9. Garí, M.; Bury, D.; Moos, R. K.; et al. Urinary concentrations of BPA and analogous bisphenols (BPF and BPS) among school children from Poland: exposure and risk

assessment in the REPRO_PL Cohort. *Expo. Health.* **2025**, *17*, 191–200. DOI: 10.1007/s12403-024-00654-4

10. Fan, D.; Liang, M.; Guo, M.; et al. Exposure of preschool-aged children to highly-concerned bisphenol analogues in Nanjing, East China. *Ecotoxicol. Environ. Saf.* **2022**, *234*, 113397. DOI: 10.1016/j.ecoenv.2022.113397
11. Wei, X.; Hu, Y.; Zhu, Q.; Gao, J.; Liao, C.; Jiang, G. Co-exposure and health risks of several typical endocrine disrupting chemicals in general population in eastern China. *Environ. Res.* **2022**, *204*, 112366. DOI: 10.1016/j.envres.2021.112366
12. Suwannarin, N.; Nishihama, Y.; Isobe, T.; Nakayama, S. F. Urinary concentrations of environmental phenol among pregnant women in the Japan environment and children's study. *Environ. Int.* **2024**, *183*, 108373. DOI: 10.1016/j.envint.2023.108373
13. Xu, L.; Hu, Y.; Zhu, Q.; Liao, C.; Jiang, G. Several typical endocrine-disrupting chemicals in human urine from general population in China: regional and demographic-related differences in exposure risk. *J. Hazard. Mater.* **2022**, *424*, 127489. DOI: 10.1016/j.jhazmat.2021.127489
14. Pan, Y.; Jia, C.; Zhu, Z.; et al. Occurrence and health risks of multiple emerging bisphenol S analogues in pregnant women from South China. *J. Hazard. Mater.* **2024**, *478*, 135431. DOI: 10.1016/j.jhazmat.2024.135431
15. Pirard, C.; Charlier, C. Urinary levels of parabens, phthalate metabolites, bisphenol A and plasticizer alternatives in a Belgian population: time trend or impact of an awareness campaign? *Environ. Res.* **2022**, *214*, 113852. DOI: 10.1016/j.envres.2022.113852
16. Huang, S.; Wang, D.; Qi, Z.; Long, C.; Li, G.; Yu, Y. A large-scale nationwide study of urinary phenols in the chinese population. *Sci. Total Environ.* **2023**, *894*, 164850. DOI: 10.1016/j.scitotenv.2023.164850
17. Pei, Z.; Zhang, L.; Bao, Y.; Li, J.; Zhuo, Q. The negative impacts of bisphenols on thyroid function in adults with bisphenol A exposure level exceeding the tolerable daily intake. *Ecotoxicol. Environ. Saf.* **2025**, *290*, 117790. DOI: 10.1016/j.ecoenv.2025.117790
18. Zhang, T.; Xue, J.; Gao, C.; et al. Urinary concentrations of bisphenols and their association with biomarkers of oxidative stress in people living near e-waste recycling facilities in China. *Environ. Sci. Technol.* **2016**, *50*, 4045–4053. DOI: 10.1021/acs.est.6b00032

19. Tagne-Fotso, R.; Riou, M.; Saoudi, A.; et al. Exposure to bisphenol A in European women from 2007 to 2014 using human biomonitoring data – The European Joint Programme HBM4EU. *Environ. Int.* **2024**, *190*, 108912. DOI: 10.1016/j.envint.2024.108912
20. Li, X.; Zhong, Y.; He, W.; et al. Co-exposure and health risks of parabens, bisphenols, triclosan, phthalate metabolites and hydroxyl polycyclic aromatic hydrocarbons based on simultaneous detection in urine samples from guangzhou, south China. *Environ. Pollut.* **2021**, *272*, 115990. DOI: 10.1016/j.envpol.2020.115990