

Gestational exposure to organophosphate esters and glucose levels during pregnancy: a cohort study from China

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Table S1 The distribution of gestational week at glucose measurement for the included pregnant women.

FPG (n=703)		1h-PG (n=578)	
Gestational week	n (%)	Gestational week	n (%)
13	36 (5.12)	21	10 (1.74)
14	98 (13.94)	22	51 (8.87)
15	337 (47.94)	23	143 (24.74)
16	521 (74.11)	24	341 (59.00)
17	641 (91.18)	25	495 (85.64)
18	683 (97.16)	26	560 (96.89)
19	696 (99)	27	571 (98.79)
20	703 (100)	28	578 (100)

FPG: fasting plasma glucose; 1h-PG: 1h-plasma glucose after a 50g glucose change test.

Table S2. distribution of urine OPE metabolites concentrations ^a.

	n	Undetected	LOD	> LOD	Min	P25	Median	P75	Max	GM (GSD)
OPE metabolites ($\mu\text{g/L}^{\text{b}}$, $\mu\text{mol/L}^{\text{c}}$)										
BCEP	733	149	0.11	79.67	<LOD	0.14	0.29	0.54	23.9	0.30 (2.83)
BCIPP	733	224	0.015	69.44	<LOD	<LOD	0.19	0.39	21.4	0.11 (5.61)
BDCPP	733	63	0.042	91.41	<LOD	0.06	0.11	0.25	9.4	0.12 (2.76)
DPP	733	75	0.004	89.77	<LOD	0.12	0.22	0.42	11.66	0.17 (4.97)
DCP	733	5	0.002	99.32	<LOD	0.03	0.05	0.08	0.47	0.05 (2.65)
BBOEP	733	128	0.015	82.54	<LOD	0.02	0.06	0.1	0.93	0.05 (2.47)
DBP	733	7	0.02	99.05	<LOD	0.12	0.19	0.34	13.47	0.20 (2.42)
BEHP	733	104	0.003	85.81	<LOD	0.08	0.2	0.38	12.72	0.12 (6.66)
$\Sigma\text{Cl-OPE}^{\text{d}}$	733	-	-	-	0.47	1.65	2.92	5.26	108.7	3.02 (2.47)
$\Sigma\text{Ary-OPE}^{\text{e}}$	733	-	-	-	0.02	0.62	1.14	1.99	47.1	1.05 (3.01)
$\Sigma\text{Alk-OPE}^{\text{f}}$	733	-	-	-	0.34	1.34	2.02	3.15	64.2	2.11 (2.02)
Creatinine-corrected OPE metabolites ($\mu\text{g/g}$, $\mu\text{mol/g}$)										
BCIPP	733	-	-	-	0.00	0.03	0.20	0.48	85.60	0.13 (5.73)
BCEP	733	-	-	-	0.02	0.17	0.33	0.70	49.02	0.36 (3.18)
BDCPP	733	-	-	-	0.01	0.08	0.14	0.29	9.77	0.15 (2.85)
DPP	733	-	-	-	0.00	0.13	0.23	0.51	9.55	0.21 (4.50)
DCP	733	-	-	-	0.00	0.03	0.05	0.09	0.62	0.05 (2.25)
BBOEP	733	-	-	-	0.00	0.03	0.06	0.12	1.66	0.06 (3.00)
BEHP	733	-	-	-	0.00	0.06	0.21	0.67	55.50	0.14(10.29)
DBP	733	-	-	-	0.01	0.11	0.22	0.49	68.66	0.24 (3.12)
$\Sigma\text{Cl-OPE}^{\text{d}}$	733	-	-	-	0.31	1.90	3.48	6.94	348.17	3.62 (2.97)
$\Sigma\text{Ary-OPE}^{\text{e}}$	733	-	-	-	0.01	0.71	1.18	2.32	38.30	1.25 (2.79)
$\Sigma\text{Alk-OPE}^{\text{f}}$	733	-	-	-	0.11	1.14	2.09	5.22	382.54	2.52 (3.17)

a: Value below LOD were replaced with $\text{LOD}/\sqrt{2}$ to calculate geometric mean (GM) and geometric standard deviation (GSD).

b: For individual OPE metabolite concentration.

c: For molar sum of OPE metabolite concentrations.

d: Molar sum of BCEP, BCIPP and BDCPP.

e: Molar sum of DPP and DCP.

f: Molar sum of BBOEP, BEHP and DBP.

Table S3 Spearman correlation coefficients of urine OPEs metabolite concentrations (corrected by creatinine) ^a.

	BCEP	BCIPP	BDCPP	DPP	DCP	BBOEP	DBP	BEHP
BCEP	1	-	-	-	-	-	-	-
BCIPP	0.24	1	-	-	-	-	-	-
BDCPP	0.34	0.25	1	-	-	-	-	-
DPP	0.29	0.15	0.24	1	-	-	-	-
DCP	0.31	0.16	0.33	0.22	1	-	-	-
BBOEP	0.24	0.16	0.22	0.29	0.27	1	-	-
DBP	0.34	0.23	0.36	0.23	0.35	0.33	1	-
BEHP	0.31	0.16	0.31	0.13	0.28	0.35	0.54	1

a: Values below LOD were replaced with LOD/ $\sqrt{2}$ to calculate spearman correlation coefficients.

Table S4. The distribution of FPG and 1 h-PG (mmol/L) according to participant's demographic characteristics.

	FPG (n=703)		1h-PG (n=578)	
	Mean (SD)	P-value	Mean (SD)	P-value
Total	4.04 (0.44)		6.4 (1.35)	
Parity (%)		0.433		0.973
Nulliparous	4.07 (0.44)		6.4 (1.34)	
Multiparous	4.04 (0.44)		6.39 (1.35)	
Passive smoking before pregnancy (%)		0.784		0.327
No	4.05 (0.48)		6.32 (1.29)	
Yes	4.04 (0.42)		6.44 (1.37)	
Activity (%)		0.858		0.821
no	4.04 (0.43)		6.41 (1.28)	
yes	4.05 (0.44)		6.39 (1.40)	
Pre-pregnancy BMI (%)		0.963		0.0075
< 18.5	4.05 (0.44)		6.07 (1.34)	
18.5–24.9	4.04 (0.44)		6.46 (1.34)	
≥ 25.0	4.05 (0.48)		6.69 (1.28)	
Household income (%)		0.745		0.263
< 4000	4.04 (0.41)		6.48 (1.28)	
4000–8000	4.06 (0.45)		6.28 (1.36)	
> 8000	4.03 (0.45)		6.47 (1.36)	
Maternal education (%)		0.855		0.0186
High school or below	4.06 (0.47)		6.21 (1.38)	
College or university	4.04 (0.43)		6.40 (1.34)	
Graduate	4.04 (0.44)		6.83 (1.20)	
Maternal intake of fruit (%)		0.378		0.321
Daily	4.01 (0.47)		6.26 (1.31)	
Less than daily	4.05 (0.44)		6.42 (1.35)	
Maternal intake of vegetables (%)		0.214		0.237
Daily	4.01 (0.44)		6.29 (1.32)	
Less than daily	4.06 (0.44)		6.44 (1.36)	

FPG: fast plasma glucose, 1h-PG: 1 h-plasma glucose tested by 50g GCT.

Table S5 Likelihood ratio test for the interaction terms between OPE exposure group and maternal characteristics in general linear models.

OPE metabolites	OPE*intake of vegetables		OPE*intake of fruit		OPE*pre-pregnancy BMI		OPE*maternal age at recruitment	
	FPG	1h-PG	FPG	1h-PG	FPG	1h-PG	FPG	1h-PG
BCEP	0.555	0.767	0.613	0.700	0.807	0.246	0.273	0.368
BCIPP	0.813	0.701	0.669	0.831	0.406	0.715	0.943	0.270
BDCPP	0.383	0.982	0.94	0.929	0.224	0.369	0.819	0.355
DPP	0.762	0.317	0.842	0.237	0.799	0.412	0.648	0.201
DCP	0.024 *	0.271	0.352	0.075 *	0.406	0.801	0.434	0.160
BBOEP	0.982	0.845	0.729	0.847	0.627	0.719	0.74	0.291
DBP	0.487	0.951	0.844	0.605	0.466	0.448	0.506	0.480
BEHP	0.565	0.516	0.952	0.401	0.566	0.462	0.264	0.814
\sum Cl-OPE	0.955	0.497	0.975	0.205	0.566	0.959	0.132	0.930
\sum Ary-OPE	0.716	0.443	0.894	0.923	0.279	0.329	0.525	0.291
\sum Alk-OPE	0.871	0.547	0.704	0.895	0.214	0.924	0.192	0.546

* $P \leq 0.1$

Table S6. Associations between OPEs and FPG and 1h-PG after excluding pregnant women diagnosed with GDM.

Chemicals	FPG level		1h-PG level	
		β (95%CI)		β (95%CI)
BCEP	Middle	0.002 (-0.079~0.083)		0.146 (-0.126~0.419)
	Highest	-0.025 (-0.105~0.056)		-0.028 (-0.299~0.242)
BCIPP	Middle	-0.041 (-0.122~0.04)		0.105 (-0.171~0.382)
	Highest	-0.086 (-0.166~-0.006) **		0.118 (-0.15~0.387)
BDCPP	Middle	-0.063 (-0.144~-0.018)		-0.043 (-0.312~0.226)
	Highest	-0.108 (-0.189~-0.027) **		-0.043 (-0.311~0.226)
DPP	Middle	-0.04 (-0.12~0.04)		0.196 (-0.077~0.468)
	Highest	-0.104 (-0.184~-0.024) **		0.066 (-0.209~0.341)
DCP	Middle	-0.008 (-0.088~0.072)		0.055 (-0.216~0.326)
	Highest	0.054 (-0.026~0.135)		-0.104 (-0.375~0.167)
BBOEP	Middle	-0.05 (-0.13~0.031)		-0.031 (-0.304~0.242)
	Highest	-0.063 (-0.143~0.017)		-0.097 (-0.366~0.172)
DBP	Middle	-0.011 (-0.091~0.07)		0.05 (-0.221~0.321)
	Highest	-0.094 (-0.174~-0.015) **		-0.038 (-0.308~0.233)
BEHP	Middle	-0.006 (-0.087~0.075)		0.194 (-0.079~0.466)
	Highest	-0.07 (-0.15~0.01) *		-0.056 (-0.326~0.214)
Σ Cl-OPE	Middle	-0.042 (-0.123~0.039)		0.256 (-0.019~0.531) *
	Highest	-0.128 (-0.208~-0.047) **		-0.105 (-0.377~0.166)
Σ Ary-OPE	Middle	0.012 (-0.068~0.092)		0.054 (-0.215~0.322)
	Highest	-0.099 (-0.179~-0.019) **		-0.025 (-0.292~0.242)
Σ Alk-OPE	Middle	0.014 (-0.067~0.094)		0.177 (-0.094~0.448)
	Highest	-0.06 (-0.14~0.02)		-0.014 (-0.282~0.255)

All models were adjusted for maternal age at delivery, gestational age at the time of plasma glucose measurement, parity, passive smoking before pregnancy, activity, pre-pregnancy BMI, household income, maternal education, maternal intake of fruit, and maternal intake of vegetables.

*P < 0.1, **P < 0.05

Table S7. Associations between OPEs and FPG, excluding pregnant women whose FPG was measured prior to urine collection

Chemicals	FPG level		
		β (95%CI)	<i>P</i> value
BCEP	Middle	0.00 (-0.083, 0.082)	0.993
	Highest	-0.028 (-0.11, 0.054)	0.496
BCIPP	Middle	-0.017 (-0.1, 0.066)	0.683
	Highest	-0.07 (-0.151, 0.012)	0.094
BDCPP	Middle	-0.059 (-0.141, 0.023)	0.349
	Highest	-0.097 (-0.18, -0.015)	0.011
DPP	Middle	-0.039 (-0.12, 0.042)	0.159
	Highest	-0.106 (-0.187, -0.024)	0.021
DCP	Middle	-0.006 (-0.088, 0.075)	0.876
	Highest	0.06 (-0.023, 0.143)	0.155
BBOEP	Middle	-0.05 (-0.133, 0.032)	0.232
	Highest	-0.073 (-0.155, 0.008)	0.077
DBP	Middle	-0.01 (-0.092, 0.072)	0.812
	Highest	-0.103 (-0.184, -0.022)	0.013
BEHP	Middle	-0.002 (-0.084, 0.081)	0.965
	Highest	-0.067 (-0.149, 0.014)	0.106
Σ Cl-OPE	Middle	-0.046 (-0.129, 0.036)	0.271
	Highest	-0.126 (-0.208, -0.044)	0.003
Σ Ary-OPE	Middle	0.024 (-0.057, 0.105)	0.560
	Highest	-0.098 (-0.179, -0.016)	0.019
Σ Alk-OPE	Middle	0.014 (-0.068, 0.096)	0.743
	Highest	-0.064 (-0.146, 0.017)	0.121

All models were adjusted for maternal age at delivery, gestational age at the time of plasma glucose measurement, parity, passive smoking before pregnancy, activity, pre-pregnancy BMI, household income, maternal education, maternal intake of fruit, and maternal intake of vegetables.

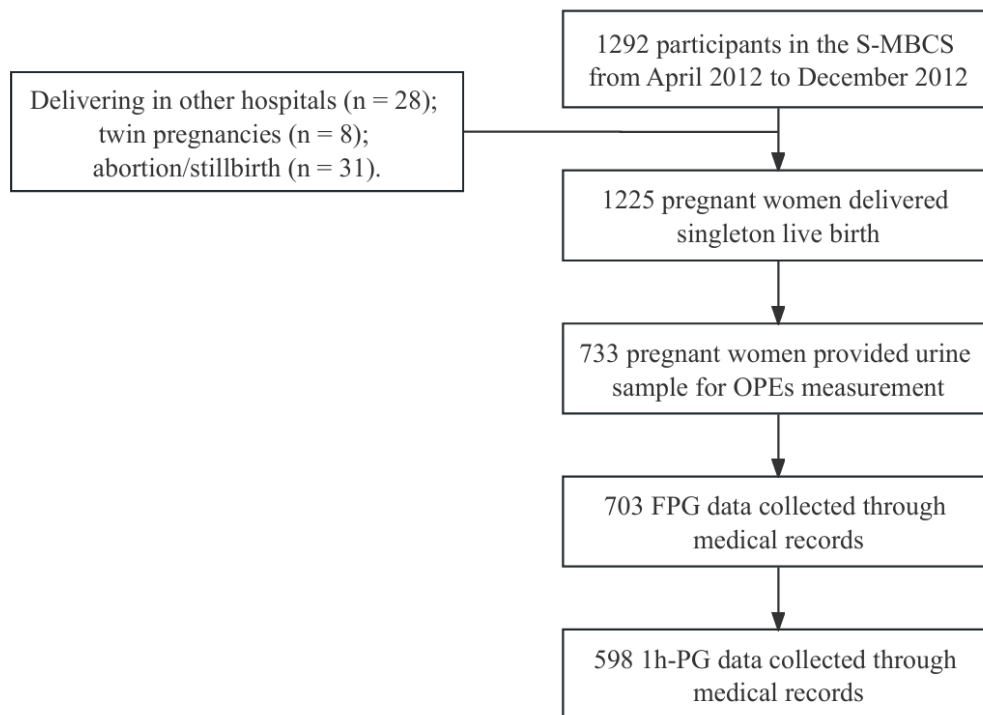


Figure S1. Study population of the present study from S-MBCS. FPG: fasting plasma glucose; 1h-PG: 1 hour plasma glucose after 50g glucose change test; S-MBCS: Shanghai Minhang Birth cohort study.

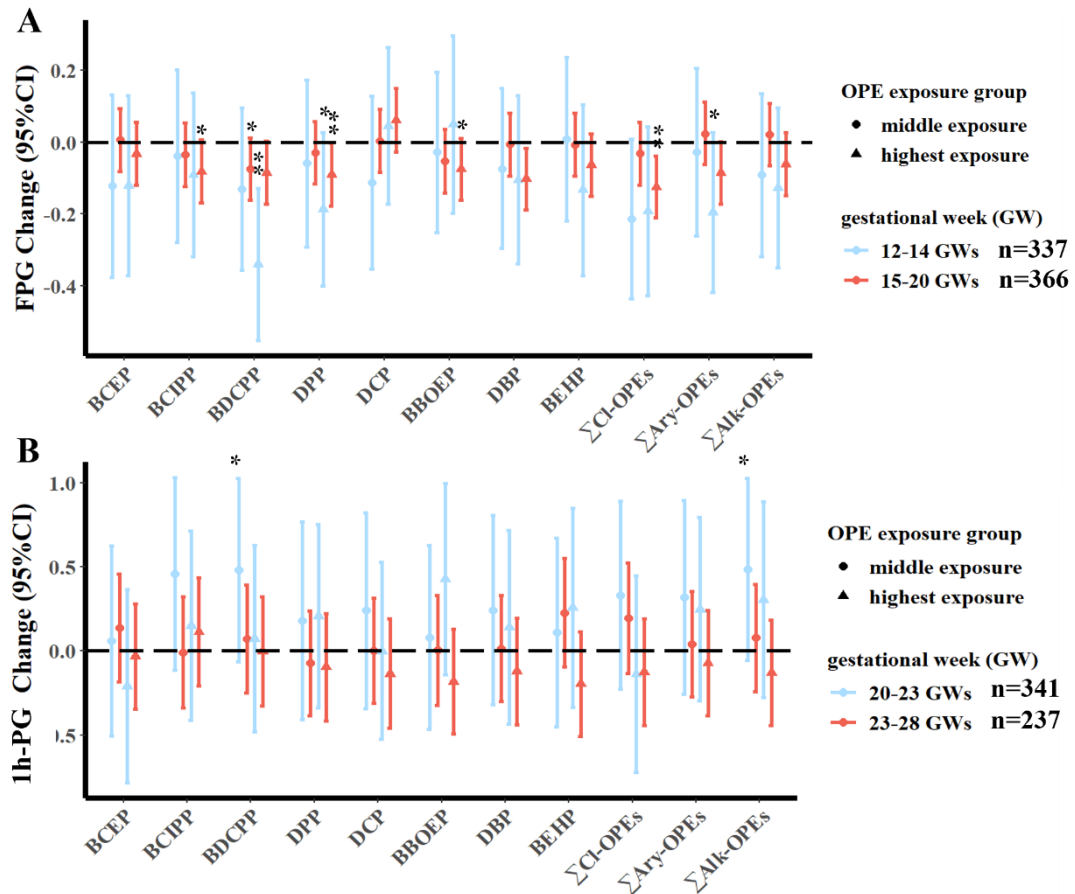


Figure S2. Results of subgroup analyses for different spans of GWs at glucose measurement (for FPG: A, for 1h-PG: B). All models were adjusted for maternal age at delivery, parity, passive smoking before pregnancy, activity, pre-pregnancy BMI, household income, maternal education, and maternal intake of vegetables. ** $P \leq 0.05$, * $P \leq 0.1$.