|  |
| --- |
| Table S1. Demographic characteristics of the study population, CHAMACOS Study, Salinas, CA (N=532 singletons and one twin from twinsetsfollowed through delivery) |
|  |  | **N (%)included in analysis1N=345** | **N (%)not included in analysis1N=187** |
| **Maternal Characteristics at time of pregnancy** |  |  |
|  |  |  |  |
| **Race/Ethnicity** |  |  |
|  | Latina | 339 (98.3) | 175 (93.6) |
|  | Non-Latina, White | 3 (0.9) | 5 (2.7) |
|  | Other | 3 (0.9) | 7 (3.7) |
|  |  |  |  |
| **Age** |  |  |  |
|  | 18-24 | 149 (43.2) | 111 (59.4) |
|  | 25-29 | 111 (32.2) | 47 (25.1) |
|  | 30-34 | 55 (15.9) | 23 (12.3) |
|  | 35+ | 30 (8.7) | 6 (3.2) |
|  |  |  |  |
| **Marital Status** |  |  |
|  | Married/Living as married | 284 (82.3) | 146 (78.1) |
|  | Single | 61 (17.7) | 41 (21.9) |
|  |  |  |  |
| **Education** |  |  |
|  | ≤ 6th grade | 153 (44.4) | 78 (41.7) |
|  | 7-12th grade | 118 (34.2) | 75 (40.1) |
|  | ≥ High school graduate | 74 (21.5) | 34 (18.2) |
|  |  |  |  |
| **Years of Residence in the USA** |  |  |
|  | ≤ 5 years | 162 (47.0) | 110 (58.8) |
|  | 6-10 years | 88 (25.5) | 28 (15.0) |
|  | 11+ years | 56 (16.2) | 28 (15.0) |
|  | Entire life | 39 (11.3) | 21 (11.2) |
|  |  |  |  |
| **Household income** |  |  |
|  | Below or equal to poverty | 213 (61.7) | 116 (62.0) |
|  | Above poverty | 132 (38.3) | 71 (38.0) |
|  |  |  |  |
| **Prepregnancy Body Mass Index (BMI)** |  |  |
|  | Underweight | 2 (0.6) | 1 (0.5) |
|  | Normal  | 120 (34.8) | 88 (47.1) |
|  | Overweight | 133 (38.6) | 71 (38.0) |
|  | Obese | 90 (26.1) | 27 (14.4) |
|  |  |  |  |
| **Child Characteristics** |  |  |
|  |  |  |  |
| **Birth Weight** |  |  |
|  | <2500 g | 330 (95.7) | 177 (94.7) |
|  | ³2500 g | 15 (4.4) | 10 (5.4) |
|  |   |   |   |
|  |  |  |  |
| 1 Children were included in analyses if they had phthalate measurements andat least one anthropomorphic measurement |

|  |
| --- |
| Table S2. Summary outcome statistics by sex of child |
|   | 5yr | 7yr | 9yr | 10.5yr | 12yr |
|   | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) |
| Boys |  |  |  |  |  |
|  BMI (kg/m2) | 17.8 (3.0) | 18.9 (3.8) | 20.8 (4.4) | 22.3 (5.1) | 23.5 (5.3) |
|  Waist circumference (cm) | 57.5 (7.1) | 65.9 (9.2) | 73.7 (11.3) | 75.9 (12.0) | 80.1 (12.6) |
|  Body fat (%) | -- | -- | 27.3 (10.4) | 27.3 (10.7) | 26.7 (11.3) |
| Girls |  |  |  |  |  |
|  BMI (kg/m2) | 17.9 (3.2) | 19.0 (3.8) | 20.7 (4.8) | 22.2 (5.6) | 23.9 (6.1) |
|  Waist circumference (cm) | 59.3 (8.0) | 67.5 (10.1) | 74.8 (13.4) | 74.1 (15.1) | 78.7 (14.2) |
|  Body fat (%) | -- | -- | 28.0 (10.2) | 29.8 (10.5) | 32.0 (10.2) |

|  |
| --- |
| Table S3. Association of log2 prenatal urinary phthalate metabolite concentrations with BMI z-score, waist circumference |
| z-score, and percent body fat in all children and separately by boys and girls. |  |  |
|   |   | 5yr | 7yr | 9yr | 10.5yr | 12yr | Sex Interaction |
|   |   | β (95% CI) | β (95% CI) | β (95% CI) | β (95% CI) | β (95% CI) | p-value |
|  |  |  |  |  |  |  |  |
| BMI z-score (n=341 children, 1551 obs) |
| MEP | Boys | 0.14 (0.06, 0.22) | 0.13 (0.06, 0.21) | 0.12 (0.05, 0.19) | 0.12 (0.05, 0.19) | 0.12 (0.04, 0.19) |  |
|  | Girls | 0.10 (0.02, 0.19) | 0.09 (0.01, 0.17) | 0.08 (0.00, 0.17) | 0.08 (0.00, 0.16) | 0.08 (-0.01, 0.16) | 0.49 |
|  |  |  |  |  |  |  |  |
| MBP | Boys | 0.17 (0.05, 0.28) | 0.15 (0.04, 0.25) | 0.13 (0.03, 0.24) | 0.13 (0.03, 0.23) | 0.13 (0.02, 0.24) |  |
|  | Girls | 0.03 (-0.10, 0.15) | 0.01 (-0.12, 0.13) | -0.01 (-0.13, 0.12) | -0.01 (-0.13, 0.12) | -0.01 (-0.14, 0.12) | 0.08 |
|  |  |  |  |  |  |  |  |
| MiBP | Boys | 0.05 (-0.05, 0.15) | 0.03 (-0.06, 0.12) | 0.03 (-0.06, 0.11) | 0.04 (-0.05, 0.12) | 0.05 (-0.04, 0.14) |  |
|  | Girls | 0.08 (-0.03, 0.19) | 0.05 (-0.05, 0.16) | 0.05 (-0.06, 0.16) | 0.06 (-0.05, 0.18) | 0.07 (-0.04, 0.19) | 0.73 |
|  |  |  |  |  |  |  |  |
| MBzP | Boys | 0.06 (-0.05, 0.18) | 0.06 (-0.05, 0.16) | 0.06 (-0.05, 0.16) | 0.07 (-0.04, 0.17) | 0.08 (-0.03, 0.19) |  |
|  | Girls | 0.09 (-0.04, 0.21) | 0.08 (-0.05, 0.20) | 0.08 (-0.05, 0.20) | 0.09 (-0.04, 0.22) | 0.10 (-0.03, 0.23) | 0.78 |
|  |  |  |  |  |  |  |  |
| ∑DEHP | Boys | 0.05 (-0.10, 0.20) | 0.07 (-0.07, 0.22) | 0.09 (-0.05, 0.23) | 0.08 (-0.06, 0.22) | 0.07 (-0.06, 0.21) |  |
|  | Girls | 0.07 (-0.06, 0.20) | 0.09 (-0.04, 0.22) | 0.11 (-0.03, 0.24) | 0.10 (-0.04, 0.24) | 0.09 (-0.05, 0.24) | 0.85 |
|  |  |  |  |  |  |  |  |
| MCPP | Boys | 0.08 (-0.05, 0.22) | 0.06 (-0.06, 0.19) | 0.06 (-0.06, 0.18) | 0.07 (-0.05, 0.19) | 0.08 (-0.04, 0.20) |  |
|  | Girls | -0.03 (-0.16, 0.10) | -0.05 (-0.17, 0.07) | -0.05 (-0.18, 0.07) | -0.04 (-0.17, 0.08) | -0.03 (-0.15, 0.09) | 0.18 |
|  |  |  |  |  |  |  |  |
| MCOP | Boys | 0.12 (-0.03, 0.28) | 0.10 (-0.04, 0.24) | 0.09 (-0.04, 0.23) | 0.10 (-0.04, 0.23) | 0.11 (-0.02, 0.25) |  |
|  | Girls | 0.03 (-0.10, 0.17) | 0.01 (-0.12, 0.14) | 0.00 (-0.13, 0.13) | 0.01 (-0.12, 0.14) | 0.02 (-0.11, 0.16) | 0.33 |
|  |  |  |  |  |  |  |  |
| MCNP | Boys | 0.19 (0.00, 0.37) | 0.15 (-0.02, 0.32) | 0.12 (-0.04, 0.29) | 0.10 (-0.06, 0.27) | 0.12 (-0.05, 0.28) |  |
|  | Girls | 0.11 (-0.03, 0.24) | 0.07 (-0.06, 0.20) | 0.04 (-0.09, 0.18) | 0.02 (-0.11, 0.16) | 0.03 (-0.11, 0.17) | 0.43 |
|  |  |  |  |  |  |  |  |
| Percent Body Fat (n=289 children, 801 obs) |
| MEP | Boys | 0.12 (0.05, 0.19) | 0.16 (0.09, 0.22) | 0.16 (0.10, 0.22) | 0.12 (0.06, 0.18) | 0.12 (0.06, 0.19) |  |
|  | Girls | 0.07 (0.00, 0.14) | 0.11 (0.04, 0.18) | 0.11 (0.04, 0.19) | 0.07 (0.00, 0.15) | 0.08 (-0.01, 0.16) | 0.34 |
|  |  |  |  |  |  |  |  |
| MBP | Boys | 0.13 (0.03, 0.22) | 0.18 (0.09, 0.27) | 0.18 (0.09, 0.26) | 0.11 (0.02, 0.20) | 0.10 (0.01, 0.20) |  |
|  | Girls | -0.01 (-0.12, 0.10) | 0.04 (-0.06, 0.15) | 0.04 (-0.06, 0.15) | -0.03 (-0.14, 0.08) | -0.03 (-0.15, 0.08) | 0.04 |
|  |  |  |  |  |  |  |  |
| MiBP | Boys | -0.03 (-0.11, 0.05) | 0.08 (0.01, 0.16) | 0.10 (0.03, 0.18) | 0.01 (-0.08, 0.09) | 0.02 (-0.07, 0.10) |  |
|  | Girls | 0.00 (-0.09, 0.09) | 0.11 (0.03, 0.20) | 0.13 (0.04, 0.22) | 0.04 (-0.07, 0.14) | 0.05 (-0.06, 0.15) | 0.64 |
|  |  |  |  |  |  |  |  |
| MBzP | Boys | 0.01 (-0.08, 0.11) | 0.11 (0.02, 0.20) | 0.13 (0.04, 0.21) | 0.06 (-0.03, 0.15) | 0.07 (-0.02, 0.16) |  |
|  | Girls | 0.01 (-0.09, 0.11) | 0.11 (0.01, 0.21) | 0.13 (0.02, 0.23) | 0.05 (-0.05, 0.16) | 0.07 (-0.04, 0.18) | 0.99 |
|  |  |  |  |  |  |  |  |
| ∑DEHP | Boys | 0.13 (0.01, 0.25) | 0.00 (-0.12, 0.12) | -0.01 (-0.12, 0.11) | 0.09 (-0.03, 0.21) | 0.09 (-0.04, 0.21) |  |
|  | Girls | 0.14 (0.02, 0.25) | 0.01 (-0.11, 0.12) | 0.00 (-0.12, 0.12) | 0.10 (-0.03, 0.23) | 0.09 (-0.04, 0.23) | 0.94 |
|  |  |  |  |  |  |  |  |
| MCPP | Boys | 0.02 (-0.10, 0.13) | 0.15 (0.04, 0.25) | 0.17 (0.06, 0.27) | 0.04 (-0.07, 0.14) | 0.05 (-0.06, 0.17) |  |
|  | Girls | -0.10 (-0.20, 0.00) | 0.03 (-0.07, 0.13) | 0.05 (-0.05, 0.15) | -0.08 (-0.18, 0.02) | -0.06 (-0.17, 0.04) | 0.09 |
|  |  |  |  |  |  |  |  |
| MCOP | Boys | 0.05 (-0.07, 0.17) | 0.18 (0.07, 0.29) | 0.20 (0.09, 0.31) | 0.06 (-0.06, 0.17) | 0.08 (-0.04, 0.20) |  |
|  | Girls | -0.05 (-0.15, 0.05) | 0.08 (-0.02, 0.18) | 0.10 (-0.01, 0.20) | -0.04 (-0.16, 0.08) | -0.02 (-0.14, 0.10) | 0.18 |
|  |  |  |  |  |  |  |  |
| MCNP | Boys | 0.05 (-0.10, 0.21) | 0.19 (0.04, 0.33) | 0.20 (0.06, 0.34) | 0.01 (-0.13, 0.16) | 0.05 (-0.10, 0.19) |  |
|  | Girls | -0.01 (-0.12, 0.10) | 0.13 (0.02, 0.23) | 0.14 (0.03, 0.24) | -0.05 (-0.17, 0.07) | -0.02 (-0.14, 0.11) | 0.46 |
|  |  |  |  |  |  |  |  |
| Waist Circumference z-score (n=341 children, 1551 obs) |
| MEP | Boys | -- | -- | 1.4 (0.4, 2.3) | 1.3 (0.4, 2.3) | 1.2 (0.1, 2.2) |  |
|  | Girls | -- | -- | 1.0 (0.2, 1.9) | 1.0 (0.1, 1.8) | 0.8 (-0.1, 1.7) | 0.59 |
|  |  |  |  |  |  |  |  |
| MBP | Boys | -- | -- | 1.2 (-0.1, 2.5) | 1.3 (-0.0, 2.6) | 1.1 (-0.3, 2.5) |  |
|  | Girls | -- | -- | 0.2 (-1.1, 1.6) | 0.3 (-1.1, 1.6) | 0.1 (-1.3, 1.5) | 0.29 |
|  |  |  |  |  |  |  |  |
| MiBP | Boys | -- | -- | 0.1 (-1.1, 1.3) | 0.5 (-0.7, 1.8) | 0.2 (-1.1, 1.5) |  |
|  | Girls | -- | -- | 0.2 (-1.1, 1.5) | 0.6 (-0.7, 1.8) | 0.3 (-0.9, 1.5) | 0.95 |
|  |  |  |  |  |  |  |  |
| MBzP | Boys | -- | -- | 1.1 (-0.2, 2.4) | 1.3 (-0.1, 2.6) | 1.0 (-0.5, 2.4) |  |
|  | Girls | -- | -- | 0.6 (-0.8, 1.9) | 0.8 (-0.6, 2.1) | 0.5 (-0.9, 1.8) | 0.58 |
|  |  |  |  |  |  |  |  |
| ∑DEHP | Boys | -- | -- | 0.8 (-0.9, 2.5) | 0.8 (-0.9, 2.5) | 0.9 (-0.9, 2.7) |  |
|  | Girls | -- | -- | 1.0 (-0.5, 2.5) | 1.0 (-0.5, 2.5) | 1.1 (-0.5, 2.6) | 0.86 |
|  |  |  |  |  |  |  |  |
| MCPP | Boys | -- | -- | 0.5 (-0.9, 1.8) | 0.8 (-0.5, 2.2) | 0.3 (-1.1, 1.7) |  |
|  | Girls | -- | -- | -0.1 (-1.2, 1.0) | 0.3 (-0.9, 1.4) | -0.3 (-1.4, 0.9) | 0.50 |
|  |  |  |  |  |  |  |  |
| MCOP | Boys | -- | -- | 0.7 (-1.0, 2.4) | 1.1 (-0.6, 2.8) | 0.8 (-1.0, 2.6) |  |
|  | Girls | -- | -- | -0.3 (-1.6, 1.0) | 0.1 (-1.2, 1.5) | -0.2 (-1.5, 1.2) | 0.34 |
|  |  |  |  |  |  |  |  |
| MCNP | Boys | -- | -- | 0.6 (-1.4, 2.6) | 0.7 (-1.3, 2.8) | 0.5 (-1.6, 2.6) |  |
|  | Girls | -- | -- | 0.1 (-1.2, 1.4) | 0.2 (-1.1, 1.5) | -0.0 (-1.4, 1.3) | 0.65 |
|   |   |   |   |   |   |   |   |
| Separate models created for each phthalate metabolite; coefficients for boys and girls obtained from model with sex interaction term. |
| Models control for maternal age, maternal education, marital status, years in us prior to delivery, smoking during pregnancy, |
| poverty status during pregnancy, child's food insecurity at each time point, child's fast food consumption at each time point,  |
| and log2 prenatal BPA |  |  |  |  |  |

|  |
| --- |
| Table S4. Sensitivity analyses of association of log 2 prenatal phthalate urinary concentration and obesity parameters at age 12: full model, plus additionally controlling for potential mediators (pre-pregnancy BMI, birth weight, age at onset of puberty) |
|  |
|   | BMI z-score (N=310) | Waist circ z-score (N=308) | Body fat % (N=272) | Overweight/Obese (Y/N) (N=310) |
| Phthalate | β (95% CI) | β (95% CI) | β (95% CI) | OR (95% CI) |
|  |  |  |  |  |
| Model 1: |  |  |  |  |
| MEP | 0.08 (0.01, 0.15)\* | 0.10 (0.04, 0.17)\*\* | 1.01 (0.24, 1.79)\* | 1.23 (1.06, 1.43)\*\* |
| MBP | 0.09 (0.00, 0.19)# | 0.08 (-0.02, 0.17) | 0.70 (-0.45, 1.85) | 1.31 (1.07, 1.60)\* |
| MiBP | 0.05 (-0.03, 0.13) | 0.05 (-0.03, 0.13) | 0.21 (-0.79, 1.20) | 1.12 (0.95, 1.32) |
| MBzP | 0.07 (-0.01, 0.16)# | 0.09 (0.00, 0.18)\* | 0.57 (-0.50, 1.64) | 1.17 (0.97, 1.42)# |
|  ƩDEHP | 0.10 (-0.01, 0.22)# | 0.10 (-0.01, 0.21)# | 1.08 (-0.22, 2.37) | 1.29 (1.01, 1.64)\* |
|  MCPP | 0.00 (-0.09, 0.09) | 0.02 (-0.08, 0.12) | 0.11 (-1.03, 1.25) | 1.08 (0.88, 1.33) |
|  MCOP | 0.01 (-0.10, 0.11) | 0.03 (-0.08, 0.14) | 0.62 (-0.69, 1.93) | 1.00 (0.79, 1.27) |
|  MCNP | 0.04 (-0.08, 0.15) | 0.05 (-0.07, 0.17) | 0.72 (-0.65, 2.09) | 1.04 (0.82, 1.34) |
|  |  |  |  |  |
| Model 2: Additionally adjusting for pre-pregnancy BMI |  |  |
| MEP | 0.06 (0.00, 0.13)# | 0.09 (0.02, 0.15)\*\* | 0.76 (0.01, 1.51)\* | 1.22 (1.05, 1.42)\* |
| MBP | 0.07 (-0.02, 0.16) | 0.06 (-0.03, 0.15) | 0.51 (-0.59, 1.61) | 1.28 (1.04, 1.58)\* |
| MiBP | 0.02 (-0.06, 0.09) | 0.03 (-0.05, 0.10) | -0.11 (-1.06, 0.84) | 1.07 (0.90, 1.27) |
| MBzP | 0.07 (-0.02, 0.16) | 0.07 (-0.02, 0.15) | 0.20 (-0.83, 1.23) | 1.12 (0.92, 1.37) |
|  ƩDEHP | 0.08 (-0.03, 0.18) | 0.08 (-0.03, 0.19) | 0.75 (-0.49, 2.00) | 1.24 (0.97, 1.58)# |
|  MCPP | 0.00 (-0.10, 0.09) | 0.00 (-0.09, 0.10) | -0.07 (-1.16, 1.02) | 1.03 (0.83, 1.28) |
| MCOP | 0.01 (-0.10, 0.12) | 0.03 (-0.08, 0.13) | 0.52 (-0.73, 1.77) | 0.97 (0.76, 1.24) |
|  MCNP | 0.06 (-0.05, 0.18) | 0.06 (-0.05, 0.17) | 0.78 (-0.53, 2.08) | 1.07 (0.83, 1.38) |
|  |  |  |  |  |
| Model 3: Additionally adjusting for birth weight |  |  |
| MEP | 0.07 (0.01, 0.14)\* | 0.10 (0.03, 0.16)\*\* | 0.99 (0.22, 1.77)\* | 1.23 (1.06, 1.43)\*\* |
| MBP | 0.08 (-0.01, 0.18)# | 0.07 (-0.03, 0.16) | 0.64 (-0.52, 1.79) | 1.29 (1.05, 1.58)\* |
| MiBP | 0.04 (-0.04, 0.12) | 0.05 (-0.03, 0.13) | 0.20 (-0.79, 1.19) | 1.12 (0.94, 1.32) |
| MBzP | 0.09 (0.00, 0.18)# | 0.08 (0.00, 0.17)# | 0.53 (-0.54, 1.60) | 1.16 (0.96, 1.40) |
|  ƩDEHP | 0.09 (-0.02, 0.20) | 0.09 (-0.02, 0.20) | 1.00 (-0.30, 2.31) | 1.25 (0.98, 1.59)# |
|  MCPP | 0.02 (-0.08, 0.12) | 0.02 (-0.08, 0.12) | 0.12 (-1.02, 1.26) | 1.08 (0.87, 1.33) |
|  MCOP | 0.02 (-0.09, 0.13) | 0.03 (-0.08, 0.14) | 0.61 (-0.69, 1.92) | 1.00 (0.79, 1.27) |
|  MCNP | 0.05 (-0.07, 0.17) | 0.05 (-0.07, 0.17) | 0.73 (-0.64, 2.09) | 1.04 (0.82, 1.34) |
|  |  |  |  |  |
| Model 4: Additionally adjusting for age at pubertal onset |  |  |
| MEP | 0.08 (0.01, 0.15)\* | 0.11 (0.04, 0.17)\*\* | 0.99 (0.23, 1.75)\* | 1.27 (1.09, 1.48)\*\* |
| MBP | 0.07 (-0.03, 0.17) | 0.05 (-0.04, 0.15) | 0.40 (-0.75, 1.56) | 1.28 (1.03, 1.59)\* |
| MiBP | 0.04 (-0.04, 0.12) | 0.04 (-0.04, 0.12) | -0.07 (-1.05, 0.91) | 1.11 (0.93, 1.31) |
| MBzP | 0.08 (-0.01, 0.17)# | 0.08 (-0.02, 0.17) | 0.39 (-0.66, 1.45) | 1.14 (0.94, 1.39) |
| ƩDEHP | 0.13 (0.01, 0.24)\* | 0.13 (0.02, 0.25)\* | 1.26 (-0.03, 2.55)# | 1.39 (1.08, 1.81)\* |
|  MCPP | 0.02 (-0.08, 0.12) | 0.02 (-0.08, 0.12) | 0.02 (-1.12, 1.15) | 1.12 (0.90, 1.39) |
|  MCOP | -0.01 (-0.13, 0.10) | 0.00 (-0.12, 0.11) | 0.25 (-1.04, 1.54) | 0.96 (0.75, 1.22) |
|  MCNP | 0.02 (-0.10, 0.14) | 0.02 (-0.10, 0.14) | 0.39 (-0.95, 1.73) | 1.02 (0.79, 1.32) |
|   |   |   |   |   |
| Separate models created for each phthalate metabolite |  |  |
| All models control for maternal age, maternal education, marital status, years in us prior to delivery, smoking during pregnancy, |
| poverty status during pregnancy, child's food insecurity, child's fast food consumption at 12Y, and log2 prenatal BPA |
| # p<0.1; \* p<0.05; \*\* p<0.01 |  |  |  |
|  |  |  |  |  |

Figure S1: DAG showing relationship of prenatal phthalates, BMI, and covariates

Legend