**Timing of Infant Formula Introduction and Early Childhood Overweight:** **the Born in Guangzhou Cohort Study (BIGCS)**

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**Table S1 The variance information between imputed data sets for outcomes at 1 year of age**

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Variance | Relative Increase in Variance | Fraction Missing Information (FMI)a |
| 　 | Between | Within | Total |
| **Abdomen circumference** |  |  |  |  |  |
| Maternal age ≤ 25 years | 0.00221 | 0.052899 | 0.05533 | 0.046 | 0.044 |
| Maternal age 26-30 years | 0.001964 | 0.05283 | 0.05499 | 0.041 | 0.04 |
| Maternal age 31-35 years | 0.011256 | 0.087838 | 0.100219 | 0.141 | 0.126 |
| Maternal education: high school or below | 0.001262 | 0.034785 | 0.036173 | 0.04 | 0.039 |
| Maternal education: vocational/technical college | 0.000341 | 0.027575 | 0.02795 | 0.014 | 0.013 |
| Maternal education: undergraduate | 0.002006 | 0.06049 | 0.062697 | 0.036 | 0.035 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.007476 | 0.168916 | 0.17714 | 0.049 | 0.047 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.009814 | 0.195594 | 0.206389 | 0.055 | 0.053 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.006738 | 0.177189 | 0.184601 | 0.042 | 0.04 |
| Parity | 0.000594 | 0.029807 | 0.03046 | 0.022 | 0.022 |
| Delivery mode | 0.000409 | 0.012067 | 0.012517 | 0.037 | 0.036 |
| Smoking during pregnancy | 0.003351 | 0.464849 | 0.468536 | 0.008 | 0.008 |
| Passive smoking during pregnancy | 0.000368 | 0.012435 | 0.01284 | 0.033 | 0.032 |
| Paternal BMI<18.5 kg/m2 | 0.003156 | 0.039325 | 0.042797 | 0.088 | 0.082 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.004732 | 0.042796 | 0.048 | 0.122 | 0.111 |
| Paternal BMI: 24-27.9 kg/m2 | 0.042296 | 0.096341 | 0.142867 | 0.483 | 0.341 |
| Child's gender | 0.000292 | 0.010559 | 0.01088 | 0.03 | 0.03 |
| Duration of any breastfeeding ≤6 m | 0.00252 | 0.014652 | 0.017423 | 0.189 | 0.164 |
| Timing of solid food introduction 0-3 m | 0.017692 | 0.116286 | 0.135748 | 0.167 | 0.147 |
| Timing of solid food introduction 4-6 m | 0.015104 | 0.14 | 0.156614 | 0.119 | 0.108 |
| **Upper arm circumference** |  |  |  |  |  |
| Maternal age ≤ 25 years | 6.855E-06 | 0.004331 | 0.004339 | 0.002 | 0.002 |
| Maternal age 26-30 years | 3.807E-06 | 0.00433 | 0.004334 | 0.001 | 0.001 |
| Maternal age 31-35 years | 0.00001668 | 0.007254 | 0.007272 | 0.003 | 0.003 |
| Maternal education: high school or below | 3.951E-06 | 0.002907 | 0.002912 | 0.001 | 0.001 |
| Maternal education: vocational/technical college | 3.96E-07 | 0.002311 | 0.002311 | 0 | 0 |
| Maternal education: undergraduate | 0.00000419 | 0.005016 | 0.005021 | 0.001 | 0.001 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.00061 | 0.013675 | 0.014346 | 0.049 | 0.047 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.000822 | 0.015921 | 0.016825 | 0.057 | 0.054 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.000542 | 0.014354 | 0.01495 | 0.041 | 0.04 |
| Parity | 2.579E-06 | 0.002463 | 0.002465 | 0.001 | 0.001 |
| Delivery mode | 2.471E-06 | 0.000996 | 0.000998 | 0.003 | 0.003 |
| Smoking during pregnancy | 0.000529 | 0.03679 | 0.037372 | 0.016 | 0.016 |
| Passive smoking during pregnancy | 1.1731E-05 | 0.001021 | 0.001034 | 0.013 | 0.013 |
| Paternal BMI<18.5 kg/m2 | 0.000397 | 0.003257 | 0.003693 | 0.134 | 0.121 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.000377 | 0.003542 | 0.003957 | 0.117 | 0.107 |
| Paternal BMI: 24-27.9 kg/m2 | 0.00113 | 0.008039 | 0.009282 | 0.155 | 0.137 |
| Child's gender | 6.16E-07 | 0.000872 | 0.000873 | 0.001 | 0.001 |
| Duration of any breastfeeding ≤6 m | 5.9147E-05 | 0.001216 | 0.001281 | 0.054 | 0.051 |
| Timing of solid food introduction 0-3 m | 8.695E-06 | 0.009652 | 0.009662 | 0.001 | 0.001 |
| Timing of solid food introduction 4-6 m | 2.3401E-05 | 0.011593 | 0.011619 | 0.002 | 0.002 |
| **BMI z-score** |  |  |  |  |  |
| Maternal age ≤ 25 years | 6.982E-06 | 0.003027 | 0.003034 | 0.003 | 0.003 |
| Maternal age 26-30 years | 7.413E-06 | 0.003021 | 0.003029 | 0.003 | 0.003 |
| Maternal age 31-35 years | 2.0498E-05 | 0.005047 | 0.00507 | 0.004 | 0.004 |
| Maternal education: high school or below | 0.00000064 | 0.001997 | 0.001997 | 0 | 0 |
| Maternal education: vocational/technical college | 4.73E-07 | 0.001582 | 0.001582 | 0 | 0 |
| Maternal education: undergraduate | 3.743E-06 | 0.003463 | 0.003467 | 0.001 | 0.001 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.000146 | 0.009658 | 0.009819 | 0.017 | 0.016 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.000255 | 0.011195 | 0.011476 | 0.025 | 0.025 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.000169 | 0.010132 | 0.010318 | 0.018 | 0.018 |
| Parity | 6.761E-06 | 0.001707 | 0.001714 | 0.004 | 0.004 |
| Delivery mode | 1.978E-06 | 0.000695 | 0.000697 | 0.003 | 0.003 |
| Smoking during pregnancy | 0.000514 | 0.026479 | 0.027044 | 0.021 | 0.021 |
| Passive smoking during pregnancy | 7.766E-06 | 0.000715 | 0.000723 | 0.012 | 0.012 |
| Paternal BMI<18.5 kg/m2 | 0.000262 | 0.00226 | 0.002548 | 0.127 | 0.116 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.000371 | 0.002458 | 0.002866 | 0.166 | 0.146 |
| Paternal BMI: 24-27.9 kg/m2 | 0.000261 | 0.0056 | 0.005888 | 0.051 | 0.049 |
| Child's gender | 5.27E-07 | 0.000607 | 0.000607 | 0.001 | 0.001 |
| Duration of any breastfeeding ≤6 m | 2.6885E-05 | 0.000843 | 0.000873 | 0.035 | 0.034 |
| Timing of solid food introduction 0-3 m | 4.2882E-05 | 0.00665 | 0.006697 | 0.007 | 0.007 |
| Timing of solid food introduction 4-6 m | 4.4204E-05 | 0.008013 | 0.008062 | 0.006 | 0.006 |
| **Length-for-age z-score** |  |  |  |  |  |
| Maternal age ≤ 25 years | 6.756E-06 | 0.002733 | 0.002741 | 0.003 | 0.003 |
| Maternal age 26-30 years | 7.494E-06 | 0.002724 | 0.002733 | 0.003 | 0.003 |
| Maternal age 31-35 years | 9.532E-06 | 0.00457 | 0.004581 | 0.002 | 0.002 |
| Maternal education: high school or below | 2.969E-06 | 0.001811 | 0.001814 | 0.002 | 0.002 |
| Maternal education: vocational/technical college | 2.397E-06 | 0.001431 | 0.001434 | 0.002 | 0.002 |
| Maternal education: undergraduate | 1.0152E-05 | 0.003143 | 0.003154 | 0.004 | 0.004 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.000275 | 0.008809 | 0.009112 | 0.034 | 0.033 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.000235 | 0.010194 | 0.010453 | 0.025 | 0.025 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.000207 | 0.009231 | 0.009459 | 0.025 | 0.024 |
| Parity | 3.76E-08 | 6.28E-06 | 6.32E-06 | 0.007 | 0.007 |
| Delivery mode | 4.618E-06 | 0.001526 | 0.001531 | 0.003 | 0.003 |
| Smoking during pregnancy | 1.857E-06 | 0.000631 | 0.000633 | 0.003 | 0.003 |
| Passive smoking during pregnancy | 5.9167E-05 | 0.024278 | 0.024343 | 0.003 | 0.003 |
| Paternal BMI<18.5 kg/m2 | 0.00000225 | 0.000642 | 0.000644 | 0.004 | 0.004 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.00023 | 0.002049 | 0.002302 | 0.124 | 0.113 |
| Paternal BMI: 24-27.9 kg/m2 | 0.000351 | 0.002226 | 0.002612 | 0.173 | 0.152 |
| Child's gender | 0.000822 | 0.005025 | 0.00593 | 0.18 | 0.157 |
| Duration of any breastfeeding ≤6 m | 6.58E-08 | 5.32E-06 | 5.39E-06 | 0.014 | 0.013 |
| Timing of solid food introduction 0-3 m | 9.87E-07 | 0.000546 | 0.000547 | 0.002 | 0.002 |
| Timing of solid food introduction 4-6 m | 2.7001E-05 | 0.000759 | 0.000789 | 0.039 | 0.038 |
| Maternal age ≤ 25 years | 0.00000843 | 0.005988 | 0.005998 | 0.002 | 0.002 |
| Maternal age 26-30 years | 1.6539E-05 | 0.007217 | 0.007235 | 0.003 | 0.003 |
| **Weight-for-age z-score** |  |  |  |  |  |
| Maternal age ≤ 25 years | 1.2689E-05 | 0.002882 | 0.002896 | 0.005 | 0.005 |
| Maternal age 26-30 years | 9.276E-06 | 0.002878 | 0.002888 | 0.004 | 0.004 |
| Maternal age 31-35 years | 1.1638E-05 | 0.004786 | 0.004799 | 0.003 | 0.003 |
| Maternal education: high school or below | 0.00000312 | 0.001894 | 0.001898 | 0.002 | 0.002 |
| Maternal education: vocational/technical college | 2.196E-06 | 0.001503 | 0.001505 | 0.002 | 0.002 |
| Maternal education: undergraduate | 4.137E-06 | 0.003298 | 0.003303 | 0.001 | 0.001 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.000349 | 0.009285 | 0.00967 | 0.041 | 0.04 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.00039 | 0.01074 | 0.011169 | 0.04 | 0.039 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.00044 | 0.00974 | 0.010224 | 0.05 | 0.048 |
| Parity | 8.835E-06 | 0.001623 | 0.001633 | 0.006 | 0.006 |
| Delivery mode | 1.414E-06 | 0.000658 | 0.000659 | 0.002 | 0.002 |
| Smoking during pregnancy | 0.000395 | 0.025188 | 0.025622 | 0.017 | 0.017 |
| Passive smoking during pregnancy | 8.695E-06 | 0.000678 | 0.000687 | 0.014 | 0.014 |
| Paternal BMI<18.5 kg/m2 | 0.000247 | 0.002145 | 0.002417 | 0.127 | 0.115 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.000205 | 0.002337 | 0.002562 | 0.097 | 0.09 |
| Paternal BMI: 24-27.9 kg/m2 | 0.000625 | 0.005259 | 0.005947 | 0.131 | 0.118 |
| Child's gender | 1.239E-06 | 0.000575 | 0.000577 | 0.002 | 0.002 |
| Duration of any breastfeeding ≤6 m | 0.00004338 | 0.000799 | 0.000847 | 0.06 | 0.057 |
| Timing of solid food introduction 0-3 m | 1.4072E-05 | 0.006341 | 0.006356 | 0.002 | 0.002 |
| Timing of solid food introduction 4-6 m | 2.0002E-05 | 0.007634 | 0.007656 | 0.003 | 0.003 |
| **Weight-for-length z-score** |  |  |  |  |  |
| Maternal age ≤ 25 years | 7.191E-06 | 0.002952 | 0.00296 | 0.003 | 0.003 |
| Maternal age 26-30 years | 9.031E-06 | 0.002943 | 0.002952 | 0.003 | 0.003 |
| Maternal age 31-35 years | 1.5895E-05 | 0.004925 | 0.004942 | 0.004 | 0.004 |
| Maternal education: high school or below | 3.879E-06 | 0.001953 | 0.001958 | 0.002 | 0.002 |
| Maternal education: vocational/technical college | 1.973E-06 | 0.001543 | 0.001545 | 0.001 | 0.001 |
| Maternal education: undergraduate | 0.00000344 | 0.003396 | 0.0034 | 0.001 | 0.001 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.000571 | 0.009358 | 0.009987 | 0.067 | 0.064 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.000708 | 0.010847 | 0.011626 | 0.072 | 0.068 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.000657 | 0.009821 | 0.010544 | 0.074 | 0.07 |
| Parity | 6.49E-08 | 6.77E-06 | 6.85E-06 | 0.011 | 0.01 |
| Delivery mode | 0.00000432 | 0.001661 | 0.001665 | 0.003 | 0.003 |
| Smoking during pregnancy | 1.224E-06 | 0.000681 | 0.000683 | 0.002 | 0.002 |
| Passive smoking during pregnancy | 0.000494 | 0.025806 | 0.026349 | 0.021 | 0.021 |
| Paternal BMI<18.5 kg/m2 | 1.0752E-05 | 0.000695 | 0.000707 | 0.017 | 0.017 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.000203 | 0.002228 | 0.002452 | 0.1 | 0.093 |
| Paternal BMI: 24-27.9 kg/m2 | 0.000256 | 0.002418 | 0.0027 | 0.117 | 0.107 |
| Child's gender | 0.000677 | 0.005381 | 0.006126 | 0.138 | 0.125 |
| Duration of any breastfeeding ≤6 m | 2.45E-07 | 5.74E-06 | 6.01E-06 | 0.047 | 0.045 |
| Timing of solid food introduction 0-3 m | 1.839E-06 | 0.00059 | 0.000592 | 0.003 | 0.003 |
| Timing of solid food introduction 4-6 m | 1.9848E-05 | 0.00082 | 0.000842 | 0.027 | 0.026 |
| Maternal age ≤ 25 years | 7.504E-06 | 0.006485 | 0.006493 | 0.001 | 0.001 |
| Maternal age 26-30 years | 1.1337E-05 | 0.007812 | 0.007824 | 0.002 | 0.002 |

aFMI: range between 0-1, a large FMI (close to 0) indicates low variability between imputed data sets

**Table S2 The variance information between imputed data sets for outcomes at 3 years of age**

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Variance | Relative Increase in Variance | Fraction Missing Information (FMI)a |
| 　 | Between | Within | Total |
| **Abdomen circumference** |  |  |  |  |  |
| Maternal age ≤ 25 years | 0.00221 | 0.052899 | 0.05533 | 0.046 | 0.044 |
| Maternal age 26-30 years | 0.001964 | 0.05283 | 0.05499 | 0.041 | 0.04 |
| Maternal age 31-35 years | 0.011256 | 0.087838 | 0.100219 | 0.141 | 0.126 |
| Maternal education: high school or below | 0.001262 | 0.034785 | 0.036173 | 0.04 | 0.039 |
| Maternal education: vocational/technical college | 0.000341 | 0.027575 | 0.02795 | 0.014 | 0.013 |
| Maternal education: undergraduate | 0.002006 | 0.06049 | 0.062697 | 0.036 | 0.035 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.007476 | 0.168916 | 0.17714 | 0.049 | 0.047 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.009814 | 0.195594 | 0.206389 | 0.055 | 0.053 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.006738 | 0.177189 | 0.184601 | 0.042 | 0.04 |
| Parity | 0.000594 | 0.029807 | 0.03046 | 0.022 | 0.022 |
| Delivery mode | 0.000409 | 0.012067 | 0.012517 | 0.037 | 0.036 |
| Smoking during pregnancy | 0.003351 | 0.464849 | 0.468536 | 0.008 | 0.008 |
| Passive smoking during pregnancy | 0.000368 | 0.012435 | 0.01284 | 0.033 | 0.032 |
| Paternal BMI<18.5 kg/m2 | 0.003156 | 0.039325 | 0.042797 | 0.088 | 0.082 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.004732 | 0.042796 | 0.048 | 0.122 | 0.111 |
| Paternal BMI: 24-27.9 kg/m2 | 0.042296 | 0.096341 | 0.142867 | 0.483 | 0.341 |
| Child's gender | 0.000292 | 0.010559 | 0.01088 | 0.03 | 0.03 |
| Duration of any breastfeeding ≤6 m | 0.00252 | 0.014652 | 0.017423 | 0.189 | 0.164 |
| Timing of solid food introduction 0-3 m | 0.017692 | 0.116286 | 0.135748 | 0.167 | 0.147 |
| Timing of solid food introduction 4-6 m | 0.015104 | 0.14 | 0.156614 | 0.119 | 0.108 |
| **Upper arm circumference** |  |  |  |  |  |
| Maternal age ≤ 25 years | 6.855E-06 | 0.004331 | 0.004339 | 0.002 | 0.002 |
| Maternal age 26-30 years | 3.807E-06 | 0.00433 | 0.004334 | 0.001 | 0.001 |
| Maternal age 31-35 years | 0.00001668 | 0.007254 | 0.007272 | 0.003 | 0.003 |
| Maternal education: high school or below | 3.951E-06 | 0.002907 | 0.002912 | 0.001 | 0.001 |
| Maternal education: vocational/technical college | 3.96E-07 | 0.002311 | 0.002311 | 0 | 0 |
| Maternal education: undergraduate | 0.00000419 | 0.005016 | 0.005021 | 0.001 | 0.001 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.00061 | 0.013675 | 0.014346 | 0.049 | 0.047 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.000822 | 0.015921 | 0.016825 | 0.057 | 0.054 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.000542 | 0.014354 | 0.01495 | 0.041 | 0.04 |
| Parity | 2.579E-06 | 0.002463 | 0.002465 | 0.001 | 0.001 |
| Delivery mode | 2.471E-06 | 0.000996 | 0.000998 | 0.003 | 0.003 |
| Smoking during pregnancy | 0.000529 | 0.03679 | 0.037372 | 0.016 | 0.016 |
| Passive smoking during pregnancy | 1.1731E-05 | 0.001021 | 0.001034 | 0.013 | 0.013 |
| Paternal BMI<18.5 kg/m2 | 0.000397 | 0.003257 | 0.003693 | 0.134 | 0.121 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.000377 | 0.003542 | 0.003957 | 0.117 | 0.107 |
| Paternal BMI: 24-27.9 kg/m2 | 0.00113 | 0.008039 | 0.009282 | 0.155 | 0.137 |
| Child's gender | 6.16E-07 | 0.000872 | 0.000873 | 0.001 | 0.001 |
| Duration of any breastfeeding ≤6 m | 5.9147E-05 | 0.001216 | 0.001281 | 0.054 | 0.051 |
| Timing of solid food introduction 0-3 m | 8.695E-06 | 0.009652 | 0.009662 | 0.001 | 0.001 |
| Timing of solid food introduction 4-6 m | 2.3401E-05 | 0.011593 | 0.011619 | 0.002 | 0.002 |
| **BMI z-score** |  |  |  |  |  |
| Maternal age ≤ 25 years | 6.982E-06 | 0.003027 | 0.003034 | 0.003 | 0.003 |
| Maternal age 26-30 years | 7.413E-06 | 0.003021 | 0.003029 | 0.003 | 0.003 |
| Maternal age 31-35 years | 2.0498E-05 | 0.005047 | 0.00507 | 0.004 | 0.004 |
| Maternal education: high school or below | 0.00000064 | 0.001997 | 0.001997 | 0 | 0 |
| Maternal education: vocational/technical college | 4.73E-07 | 0.001582 | 0.001582 | 0 | 0 |
| Maternal education: undergraduate | 3.743E-06 | 0.003463 | 0.003467 | 0.001 | 0.001 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.000146 | 0.009658 | 0.009819 | 0.017 | 0.016 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.000255 | 0.011195 | 0.011476 | 0.025 | 0.025 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.000169 | 0.010132 | 0.010318 | 0.018 | 0.018 |
| Parity | 6.761E-06 | 0.001707 | 0.001714 | 0.004 | 0.004 |
| Delivery mode | 1.978E-06 | 0.000695 | 0.000697 | 0.003 | 0.003 |
| Smoking during pregnancy | 0.000514 | 0.026479 | 0.027044 | 0.021 | 0.021 |
| Passive smoking during pregnancy | 7.766E-06 | 0.000715 | 0.000723 | 0.012 | 0.012 |
| Paternal BMI<18.5 kg/m2 | 0.000262 | 0.00226 | 0.002548 | 0.127 | 0.116 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.000371 | 0.002458 | 0.002866 | 0.166 | 0.146 |
| Paternal BMI: 24-27.9 kg/m2 | 0.000261 | 0.0056 | 0.005888 | 0.051 | 0.049 |
| Child's gender | 5.27E-07 | 0.000607 | 0.000607 | 0.001 | 0.001 |
| Duration of any breastfeeding ≤6 m | 2.6885E-05 | 0.000843 | 0.000873 | 0.035 | 0.034 |
| Timing of solid food introduction 0-3 m | 4.2882E-05 | 0.00665 | 0.006697 | 0.007 | 0.007 |
| Timing of solid food introduction 4-6 m | 4.4204E-05 | 0.008013 | 0.008062 | 0.006 | 0.006 |
| **Length-for-age z-score** |  |  |  |  |  |
| Maternal age ≤ 25 years | 6.756E-06 | 0.002733 | 0.002741 | 0.003 | 0.003 |
| Maternal age 26-30 years | 7.494E-06 | 0.002724 | 0.002733 | 0.003 | 0.003 |
| Maternal age 31-35 years | 9.532E-06 | 0.00457 | 0.004581 | 0.002 | 0.002 |
| Maternal education: high school or below | 2.969E-06 | 0.001811 | 0.001814 | 0.002 | 0.002 |
| Maternal education: vocational/technical college | 2.397E-06 | 0.001431 | 0.001434 | 0.002 | 0.002 |
| Maternal education: undergraduate | 1.0152E-05 | 0.003143 | 0.003154 | 0.004 | 0.004 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.000275 | 0.008809 | 0.009112 | 0.034 | 0.033 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.000235 | 0.010194 | 0.010453 | 0.025 | 0.025 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.000207 | 0.009231 | 0.009459 | 0.025 | 0.024 |
| Parity | 3.76E-08 | 6.28E-06 | 6.32E-06 | 0.007 | 0.007 |
| Delivery mode | 4.618E-06 | 0.001526 | 0.001531 | 0.003 | 0.003 |
| Smoking during pregnancy | 1.857E-06 | 0.000631 | 0.000633 | 0.003 | 0.003 |
| Passive smoking during pregnancy | 5.9167E-05 | 0.024278 | 0.024343 | 0.003 | 0.003 |
| Paternal BMI<18.5 kg/m2 | 0.00000225 | 0.000642 | 0.000644 | 0.004 | 0.004 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.00023 | 0.002049 | 0.002302 | 0.124 | 0.113 |
| Paternal BMI: 24-27.9 kg/m2 | 0.000351 | 0.002226 | 0.002612 | 0.173 | 0.152 |
| Child's gender | 0.000822 | 0.005025 | 0.00593 | 0.18 | 0.157 |
| Duration of any breastfeeding ≤6 m | 6.58E-08 | 5.32E-06 | 5.39E-06 | 0.014 | 0.013 |
| Timing of solid food introduction 0-3 m | 9.87E-07 | 0.000546 | 0.000547 | 0.002 | 0.002 |
| Timing of solid food introduction 4-6 m | 2.7001E-05 | 0.000759 | 0.000789 | 0.039 | 0.038 |
| Maternal age ≤ 25 years | 0.00000843 | 0.005988 | 0.005998 | 0.002 | 0.002 |
| Maternal age 26-30 years | 1.6539E-05 | 0.007217 | 0.007235 | 0.003 | 0.003 |
| **Weight-for-age z-score** |  |  |  |  |  |
| Maternal age ≤ 25 years | 1.2689E-05 | 0.002882 | 0.002896 | 0.005 | 0.005 |
| Maternal age 26-30 years | 9.276E-06 | 0.002878 | 0.002888 | 0.004 | 0.004 |
| Maternal age 31-35 years | 1.1638E-05 | 0.004786 | 0.004799 | 0.003 | 0.003 |
| Maternal education: high school or below | 0.00000312 | 0.001894 | 0.001898 | 0.002 | 0.002 |
| Maternal education: vocational/technical college | 2.196E-06 | 0.001503 | 0.001505 | 0.002 | 0.002 |
| Maternal education: undergraduate | 4.137E-06 | 0.003298 | 0.003303 | 0.001 | 0.001 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.000349 | 0.009285 | 0.00967 | 0.041 | 0.04 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.00039 | 0.01074 | 0.011169 | 0.04 | 0.039 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.00044 | 0.00974 | 0.010224 | 0.05 | 0.048 |
| Parity | 8.835E-06 | 0.001623 | 0.001633 | 0.006 | 0.006 |
| Delivery mode | 1.414E-06 | 0.000658 | 0.000659 | 0.002 | 0.002 |
| Smoking during pregnancy | 0.000395 | 0.025188 | 0.025622 | 0.017 | 0.017 |
| Passive smoking during pregnancy | 8.695E-06 | 0.000678 | 0.000687 | 0.014 | 0.014 |
| Paternal BMI<18.5 kg/m2 | 0.000247 | 0.002145 | 0.002417 | 0.127 | 0.115 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.000205 | 0.002337 | 0.002562 | 0.097 | 0.09 |
| Paternal BMI: 24-27.9 kg/m2 | 0.000625 | 0.005259 | 0.005947 | 0.131 | 0.118 |
| Child's gender | 1.239E-06 | 0.000575 | 0.000577 | 0.002 | 0.002 |
| Duration of any breastfeeding ≤6 m | 0.00004338 | 0.000799 | 0.000847 | 0.06 | 0.057 |
| Timing of solid food introduction 0-3 m | 1.4072E-05 | 0.006341 | 0.006356 | 0.002 | 0.002 |
| Timing of solid food introduction 4-6 m | 2.0002E-05 | 0.007634 | 0.007656 | 0.003 | 0.003 |
| **Weight-for-length z-score** |  |  |  |  |  |
| Maternal age ≤ 25 years | 7.191E-06 | 0.002952 | 0.00296 | 0.003 | 0.003 |
| Maternal age 26-30 years | 9.031E-06 | 0.002943 | 0.002952 | 0.003 | 0.003 |
| Maternal age 31-35 years | 1.5895E-05 | 0.004925 | 0.004942 | 0.004 | 0.004 |
| Maternal education: high school or below | 3.879E-06 | 0.001953 | 0.001958 | 0.002 | 0.002 |
| Maternal education: vocational/technical college | 1.973E-06 | 0.001543 | 0.001545 | 0.001 | 0.001 |
| Maternal education: undergraduate | 0.00000344 | 0.003396 | 0.0034 | 0.001 | 0.001 |
| pre-pregnancy BMI<18.5 kg/m2 | 0.000571 | 0.009358 | 0.009987 | 0.067 | 0.064 |
| pre-pregnancy BMI 18.5-23.9 kg/m2 | 0.000708 | 0.010847 | 0.011626 | 0.072 | 0.068 |
| pre-pregnancy BMI 24-27.9 kg/m2 | 0.000657 | 0.009821 | 0.010544 | 0.074 | 0.07 |
| Parity | 6.49E-08 | 6.77E-06 | 6.85E-06 | 0.011 | 0.01 |
| Delivery mode | 0.00000432 | 0.001661 | 0.001665 | 0.003 | 0.003 |
| Smoking during pregnancy | 1.224E-06 | 0.000681 | 0.000683 | 0.002 | 0.002 |
| Passive smoking during pregnancy | 0.000494 | 0.025806 | 0.026349 | 0.021 | 0.021 |
| Paternal BMI<18.5 kg/m2 | 1.0752E-05 | 0.000695 | 0.000707 | 0.017 | 0.017 |
| Paternal BMI: 18.5-23.9 kg/m2 | 0.000203 | 0.002228 | 0.002452 | 0.1 | 0.093 |
| Paternal BMI: 24-27.9 kg/m2 | 0.000256 | 0.002418 | 0.0027 | 0.117 | 0.107 |
| Child's gender | 0.000677 | 0.005381 | 0.006126 | 0.138 | 0.125 |
| Duration of any breastfeeding ≤6 m | 2.45E-07 | 5.74E-06 | 6.01E-06 | 0.047 | 0.045 |
| Timing of solid food introduction 0-3 m | 1.839E-06 | 0.00059 | 0.000592 | 0.003 | 0.003 |
| Timing of solid food introduction 4-6 m | 1.9848E-05 | 0.00082 | 0.000842 | 0.027 | 0.026 |
| Maternal age ≤ 25 years | 7.504E-06 | 0.006485 | 0.006493 | 0.001 | 0.001 |
| Maternal age 26-30 years | 1.1337E-05 | 0.007812 | 0.007824 | 0.002 | 0.002 |

aFMI: range between 0-1, a large FMI (close to 0) indicates low variability between imputed data sets

**Table S3 Baseline characteristics of participants in different timing of infant formula introduction groups in the BIGCS study ( children for 3 years analysis)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristics**  | **Timing of any infant formulas introduction, months** | *P*-Value | **No. of cases missing out of 3574 (%)** |
| ≤3 m (n=2955) | 4-6 m (n=327) | > 6 ma(n=292) |
| **Mother** |  |  |  |  |  |
| Age at delivery (y), mean (SD) | 29.5 (3.3) | 29.2 (3.1) | 29.2 (3.0) | 0.130  | 0 (0) |
| Educational level,n (%) |  |  |  | 0.019  | 0 (0) |
| High school or below | 200 (6.8) | 23 (7.0) | 15 (5.1) |  |  |
| Vocational/technical college | 701 (23.7) | 69 (21.1) | 59 (20.2) |  |  |
| Undergraduate | 1710 (57.9) | 184 (56.3) | 165 (56.5) |  |  |
| Postgraduate | 344 (11.6) | 51 (15.6) | 53 (18.2) |  |  |
| Pre-pregnancy BMI, n (%) |  |  |  | 0.498  | 72 (2.0) |
| <18.5 kg/m2 | 717 (24.7) | 78 (24.5) | 57 (19.9) |  |  |
| 18.5-23.9 kg/m2 | 1896 (65.4) | 209 (65.7) | 203 (71.0) |  |  |
| 24-27.9 kg/m2 | 242 (8.4) | 24 (7.6) | 23 (8.0) |  |  |
| ≥28kg/m2 | 43 (1.5) | 7 (2.2) | 3 (1.1) |  |  |
| Height (cm), mean (SD) | 159.9 (4.8) | 159.9 (5.1) | 160.5 (4.7) | 0.088  | 0 (0) |
| Parity, n (%) |  |  |  | 0.010  | 1 (0.0) |
| Primiparous | 2649 (89.7) | 291 (89.0) | 245 (83.9) |  |  |
| Multiparous | 305 (10.3) | 36 (11.0) | 47 (16.1) |  |  |
| Delivery mode, n (%) |  |  |  | 0.068  | 1 (0.0) |
| Vaginal labor | 1966 (66.6) | 236 (72.2) | 205 (70.2) |  |  |
| Cesarean delivery | 988 (33.5) | 91 (27.8) | 87 (29.8) |  |  |
| Smoking during pregnancy, n (%) | 12 (0.4) | 2 (0.6) | 2 (0.7) | 0.714  | 17 (0.5) |
| Passive smoking during pregnancy, n (%) | 847 (28.8) | 109 (33.5) | 71 (24.3) | 0.041  | 14 (0.4) |
| **Father** |  |  |  |  |  |
| BMI, n (%) |  |  |  | 0.476  | 386 (10.8) |
| <18.5 kg/m2 | 114 (4.3) | 11 (3.9) | 5 (1.9) |  |  |
| 18.5-23.9 kg/m2 | 1482 (56.2) | 161 (56.3) | 144 (54.1) |  |  |
| 24-27.9 kg/m2 | 845 (32.1) | 92 (32.2) | 98 (36.8) |  |  |
| ≥28kg/m2 | 195 (7.4) | 22 (7.7) | 19 (7.1) |  |  |
| Height (cm), mean (SD) | 172.6 (5.3) | 173.0 (5.1) | 172.4 (7.9) | 0.389  | 0 (0) |
| **Child** |  |  |  |  |  |
| Child's gender, n (%) |  |  |  | 0.059  |  |
| Male | 1567 (53.0) | 152 (46.5) | 146 (50.0) |  | 0 (0) |
| Female | 1388 (47.0) | 175 (53.5) | 146 (50.0) |  |  |
| Birth weight (g), mean (SD) | 3216.9 (327.3) | 3178.0 (339.1) | 3216.4 (306.3) | 0.122 | 0 (0) |
| Duration of any breastfeeding, n (%) |  |  |  | <0.001 | 86 (2.4) |
| ≤6 months | 774 (27.0) | 59 (18.0) | 0 (0.0) |  |  |
| > 6 months | 2095 (73.0) | 268 (82.0) | 292 (100.0) |  |  |
| Timing of complementary food introduction |  |  | 0.003  | 20 (0.6) |
| ≤3 m | 298 (10.2) | 15 (4.6) | 17 (5.8) |  |  |
| 4-6 m | 2587 (88.1) | 307 (94.2) | 271 (92.8) |  |  |
| > 6 m | 51 (1.7) | 4 (1.2) | 4 (1.4) | 　 | 　 |

aThe children who had never received infant formula during the study period were combined in to > 6 months group.

**Table S4 Baseline characteristics of participants with and without anthropometry information at 1 and 3 years of age**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **With Anthropometry Data at 1 year of age (N=5246)** | **No Anthropometry Dataat 1 year of age (N=3146)** | **P-value** | **With Anthropometry Data at 3 years of age (N=2499)** | **No Anthropometry Dataat 3 years of age (N=2635)** | **P-value** |
| **Mother** |  |  |  |  |  |  |
| Age at delivery (y), mean ± SD | 29.4 ± 3.4 | 29.1 ± 3.4 | <0.001 | 29.5 ± 3.3 | 29.1 ± 3.4 | <0.001 |
| Educational level, n (%) |  |  | <0.001 |  |  | <0.001 |
| High school or below | 400 (7.6) | 366 (11.6) |  | 153 (6.1) | 303 (11.5) |  |
| Vocational/technical college | 1295 (24.7) | 804 (25.6) |  | 566 (22.7) | 694 (26.3) |  |
| Undergraduate | 2938 (56) | 1587 (50.5) |  | 1487 (59.5) | 1346 (51.1) |  |
| Postgraduate | 613 (11.7) | 389 (12.4) |  | 293 (11.7) | 292 (11.1) |  |
| Pre-pregnancy BMI, n (%) |  |  | 0.024  |  |  | 0.555 |
| <18.5 kg/m2 | 1235 (24.1) | 834 (27.4) |  | 584 (23.9) | 646 (25.3) |  |
| 18.5-23.9 kg/m2 | 3393 (66.3) | 1921 (63.2) |  | 1620 (66.2) | 1677 (65.6) |  |
| 24-27.9 kg/m2 | 414 (8.1) | 236 (7.8) |  | 204 (8.3) | 191 (7.5) |  |
| ≥28kg/m2 | 79 (1.5) | 49 (1.6) |  | 40 (1.6) | 44 (1.7) |  |
| Parity, n (%) |  |  | <0.001 |  |  | <0.001 |
| Primiparous | 4666 (89.0) | 2582 (82.2) |  | 2245 (89.9) | 2251 (85.6) |  |
| Multiparous | 577 (11.0) | 560 (17.8) |  | 253 (10.1) | 379 (14.4) |  |
| Delivery mode, n (%) |  |  | 0.613  |  |  | 0.004 |
| Vaginal labor | 3430 (65.4) | 2040 (65.0) |  | 1664 (66.6) | 1678 (63.9) |  |
| Cesarean delivery | 1815 (34.6) | 1098 (35.0) |  | 834 (33.4) | 949 (36.1) |  |
| Smoking during pregnancy, n (%) | 32 (0.6) | 9 (0.3) | 0.071  | 13 (0.5) | 14 (0.5) | 0.636 |
| Passive smoking during pregnancy, n (%) | 1636 (31.4) | 860 (27.6) | <0.001 | 741 (29.8) | 791 (30.3) | 0.233 |
| **Father** |  |  |  |  |  |  |
| BMI, n (%) |  |  | 0.280  |  |  | 0.209  |
| <18.5 kg/m2 | 201 (4.3) | 116 (4.2) |  | 89 (4.0) | 108 (4.5) |  |
| 18.5-23.9 kg/m2 | 2640 (56.1) | 1623 (58.3) |  | 1251 (55.8) | 1365 (57.3) |  |
| 24-27.9 kg/m2 | 1508 (32.1) | 859 (30.9) |  | 735 (32.8) | 765 (32.1) |  |
| ≥28kg/m2 | 354 (7.5) | 186 (6.7) |  | 167 (7.5) | 145 (6.1) |  |
| **Child** |  |  |  |  |  |  |
| Child's gender, n (%) |  |  | 0.187  |  |  | 0.767  |
| Male | 2738 (52.2) | 1598 (50.8) |  | 1284 (51.4) | 1385 (52.6) |  |
| Female | 2508 (47.8) | 1548 (49.2) |  | 1215 (48.6) | 1250 (47.4) |  |
| Birth weight (g), mean (SD) | 3217.1 (327.7) | 3189.1 (435.5) | 0.001  | 3213.3 (326.8) | 3191.6 (426.9) | 0.023  |
| Duration of any breastfeeding, n (%) |  |  | <0.001 |  |  | <0.001 |
| ≤6 months | 1285 (25.2) | 905 (29.7) |  | 581 (23.9) | 710 (27.7) |  |
| > 6 months | 3818 (74.8) | 2146 (70.3) |  | 1853 (76.1) | 1855 (72.3) |  |
| Timing of solid food introduction |  | <0.001 |  |  | 0.083  |  |
| ≤3 m  | 518 (9.9) | 241 (7.7) |  | 232 (9.3) | 247 (9.8) |  |
| 4-6 m | 4608 (88.0) | 2850 (90.7) |  | 2219 (88.8) | 2214 (87.8) |  |
| > 6 m | 113 (2.2) | 51 (1.6) |  | 47 (1.9) | 61 (2.4) |  |
| Timing of infant formula introduction |  |  | <0.001 |  |  | 0.002  |
| ≤3 m  | 4313 (82.2) | 2169 (71.8) |  | 2104 (84.2) | 1967 (79.1) |  |
| 4-6 m | 463 (8.8) | 427 (14.1) |  | 207 (8.3) | 275 (11.1) |  |
| > 6 ma | 470 (9.0) | 426 (14.1) | 　 | 188 (7.5) | 245 (9.9) | 　 |

aThe children who had never received infant formula during the study period were combined in to > 6 months group.

**Table S5 The proportions of children were introduced to infant formula at each month after birth**

|  |  |  |
| --- | --- | --- |
| Timing of infant formula introduction | 1year groupN=5733 (%) | 3 years group N=3574(%) |
| at 0-1 month | 78.2  | 79.4  |
| at 1-2 month | 2.2  | 1.8  |
| at 2-3 month | 1.6  | 1.6  |
| at 3-4 month | 2.4  | 2.1  |
| at 4-5 month | 2.6  | 2.8  |
| at 5-6 month | 4.0  | 4.3  |
| at 6-7 month | 1.6  | 1.4  |
| at 7-8month | 1.4  | 1.3  |
| at 8-9 month | 0.9  | 0.7  |
| at 9-10 month | 1.1  | 1.2  |
| at 10-11 month | 0.9  | 0.9  |
| after 12 months | 1.1  | 1.2  |
| Never have infant formula | 1.9  | 1.4  |

**Table S6 Logistic regression models to evaluate the associations between timing of formula introduction and at risk overweight at 1 year and 3 years of age in children with longer breastfeeding duration (over 6 months)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Timing of introduction, months** | **Case （n%）** | **Crude OR (95% CI)** | **Adjusted before MIOR (95% CI)** | **Adjusted after MIOR (95% CI)** | ***p-*valuea** |
| **At-risk of overweight** |  |  |  |  |  |
| **1 year of age** |  | n=3899 | n=3431 | n=3899 |  |
| ≤3 m | 582 (19.3) | 1 | 1 | 1 |  |
| 4-6 m | 51 (12.8) | 0.62 (0.45-0.84) | 0.63 (0.45-0.89) | 0.63 (0.46-0.86) | 0.004  |
| > 6 mb | 86 (17.9) | 0.91 (0.71-1.17) | 0.91 (0.70-1.19) | 0.89 (0.69-1.15) | 0.370  |
| **3 years of age** |  | n=2528 | n=2204 | n=2528 |  |
| ≤3 m | 207 (10.4) | 1 | 1 | 1 |  |
| 4-6 m | 12 (4.6) | 0.42 (0.23-0.76) | 0.49 (0.26-0.93) | 0.43 (0.23-0.80) | 0.008  |
| > 6 mb | 25 (9.1) | 0.86 (0.56-1.33) | 0.79 (0.48-1.29) | 0.91 (0.58-1.42) | 0.680  |
| **Overweight** |  |  |  |  |  |
| **1 year of age** |  | n=4066 | n=3578 | n=4066 |  |
| ≤3 m | 134 (4.2) | 1 | 1 | 1 |  |
| 4-6 m | 7 (1.7) | 0.39 (0.18-0.85) | 0.41 (0.18-0.94) | 0.42 (0.19-0.91) | 0.027  |
| > 6 mb | 14 (2.8) | 0.65 (0.37-1.14) | 0.60 (0.33-1.10) | 0.60 (0.33-1.08) | 0.086  |
| **3 years of age** |  | n=2574 | n=2243 | n=2574 |  |
| ≤3 m | 40 (2.0) | 1 | 1 | 1 |  |
| 4-6 m | 1 (0.4) | 0.19 (0.03-1.41) | 0.22 (0.03-1.66) | 0.21 (0.03-1.56) | 0.128  |
| > 6 mb | 5 (1.8) | 0.90 (0.35-2.31) | 0.40 (0.10-1.72) | 1.03 (0.40-2.70) | 0.944  |

MI: multiple imputation

Adjusted for maternal age at delivery, maternal education, maternal pre-pregnancy BMI and paternal BMI, maternal smoking during pregnancy, passive smoking during pregnancy, parity, mode of delivery, infant sex, birth weight, and age at first introduction to solid foods.

a P-values for multiple imputation models

bThe children who had never received infant formula during the study period were combined in to > 6 months group.