**Supplementary material**

**Appendix**

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**Supplementary Table 1. Parental and neonatal characteristics according to maternal birth weight**

| **Variables** | **Maternal birth weight** |
| --- | --- |
| **<2,500 g(N=1,808)** | **2,500－2,999 g(N=10,971)** | **3,000－3,499 g(N=18,373)** | **3,500－3,999 g(N=5,497)** | **≥4,000 g(N=855)** |
| **Maternal age at MT1, years** | 30.5 (5.1) | 30.7 (4.9) | 30.9 (4.8) | 31.2 (4.8) | 31.4 (4.7) |
| **Category of maternal age at MT1, N (%)** |  |  |  |  |  |
| <25 years | 237 (13.1) | 1,157 (10.5) | 1,643 (8.9) | 445 (8.1) | 63 (7.4) |
| 25－29.9 years | 541 (29.9) | 3,421 (31.2) | 5,556 (30.2) | 1,622 (29.5) | 226 (26.4) |
| 30－34.9 years | 621 (34.3) | 3,877 (35.3) | 6,672 (36.3) | 1,984 (36.1) | 338 (39.5) |
| 35－39.9 years | 334 (18.5) | 2,097 (19.1) | 3,815 (20.8) | 1,218 (22.2) | 194 (22.7) |
| ≥40 years | 70 (3.9) | 389 (3.5) | 607 (3.3) | 207 (3.8) | 32 (3.7) |
| Missing | 5 (0.3) | 30 (0.3) | 80 (0.4) | 21 (0.4) | 2 (0.2) |
| **Pre-pregnancy height, cm** | 155.7 (5.4) | 156.8 (5.1) | 158.5 (5.2) | 160.1 (5.2) | 161.1 (5.2) |
| **Pre-pregnancy body weight, kg** | 51.0 (8.8) | 51.6 (8.3) | 53.4 (8.6) | 55.2 (9.0) | 57.2 (10.1) |
| **Pre-pregnancy BMI, kg/m2** | 21.0 (3.4) | 21.0 (3.2) | 21.2 (3.2) | 21.6 (3.3) | 22.1 (3.7) |
| **Category of pre-pregnancy BMI, N (%)** |  |  |  |  |  |
| Underweight (<18.5 kg/m2) | 378 (20.9) | 2,043 (18.6) | 2,769 (15.1) | 651 (11.8) | 80 (9.4) |
| Normal range (18.5－24.9 kg/m2) | 1,240 (68.6) | 7,913 (72.1) | 13,644 (74.3) | 4,208 (76.6) | 643 (75.2) |
| Overweight (25.0－29.9 kg/m2) | 153 (8.5) | 784 (7.1) | 1,540 (8.4) | 481 (8.8) | 96 (11.2) |
| Obese (≥30.0 kg/m2) | 37 (2.0) | 228 (2.1) | 419 (2.3) | 157 (2.9) | 36 (4.2) |
| Missing | 0 (0.0) | 3 (0.0) | 1 (0.0) | 0 (0.0) | 0 (0.0) |
| **Gestational weight gain, kg** | 9.9 (4.0) | 10.0 (3.8) | 10.2 (4.0) | 10.5 (4.1) | 10.8 (4.2) |
| **Parity, N (%)** |  |  |  |  |  |
| Primipara | 897 (49.6) | 5,267 (48.0) | 8,533 (46.4) | 2,565 (46.7) | 391 (45.7) |
| Multipara | 911 (50.4) | 5,704 (52.0) | 9,840 (53.6) | 2,932 (53.3) | 464 (54.3) |
| **Conception method, N (%)** |  |  |  |  |  |
| Spontaneous pregnancy | 1,661 (91.9) | 10,177 (92.8) | 17,017 (92.6) | 5,042 (91.7) | 779 (91.1) |
| Non-ART | 78 (4.3) | 422 (3.8) | 727 (4.0) | 222 (4.0) | 38 (4.4) |
| ART | 56 (3.1) | 339 (3.1) | 563 (3.1) | 216 (3.9) | 37 (4.3) |
| Missing | 13 (0.7) | 33 (0.3) | 66 (0.4) | 17 (0.3) | 1 (0.1) |
| **History of hypertension, N (%)** |  |  |  |  |  |
| Yes | 12 (0.7) | 49 (0.4) | 75 (0.4) | 19 (0.3) | 3 (0.4) |
| No | 1,791 (99.1) | 10,892 (99.3) | 18,218 (99.2) | 5,457 (99.3) | 850 (99.4) |
| Missing | 5 (0.3) | 30 (0.3) | 80 (0.4) | 21 (0.4) | 2 (0.2) |
| **History of type 1 or 2 diabetes, N (%)** |  |  |  |  |  |
| Yes | 4 (0.2) | 29 (0.3) | 35 (0.2) | 9 (0.2) | 2 (0.2) |
| No | 1,799 (99.5) | 10,913 (99.5) | 18,262 (99.4) | 5,467 (99.5) | 851 (99.5) |
| Missing | 5 (0.3) | 29 (0.3) | 76 (0.4) | 21 (0.4) | 2 (0.2) |
| **History of kidney disorder, N (%)** |  |  |  |  |  |
| Yes | 12 (0.7) | 50 (0.5) | 70 (0.4) | 22 (0.4) | 5 (0.6) |
| No | 1,791 (99.1) | 10,891 (99.3) | 18,223 (99.2) | 5,454 (99.2) | 848 (99.2) |
| Missing | 5 (0.3) | 30 (0.3) | 80 (0.4) | 21 (0.4) | 2 (0.2) |
| **History of hyperthyroidism, N (%)** |  |  |  |  |  |
| Yes | 21 (1.2) | 110 (1.0) | 209 (1.1) | 55 (1.0) | 4 (0.5) |
| No | 1,782 (98.6) | 10,831 (98.7) | 18,084 (98.4) | 5,421 (98.6) | 849 (99.3) |
| Missing | 5 (0.3) | 30 (0.3) | 80 (0.4) | 21 (0.4) | 2 (0.2) |
| **History of hypothyroidism, N (%)** |  |  |  |  |  |
| Yes | 19 (1.1) | 116 (1.1) | 177 (1.0) | 45 (0.8) | 17 (2.0) |
| No | 1,784 (98.7) | 10,825 (98.7) | 18,116 (98.6) | 5,431 (98.8) | 836 (97.8) |
| Missing | 5 (0.3) | 30 (0.3) | 80 (0.4) | 21 (0.4) | 2 (0.2) |
| **History of SLE and/or APS, N (%)** |  |  |  |  |  |
| Yes | 6 (0.3) | 30 (0.3) | 43 (0.2) | 11 (0.2) | 2 (0.2) |
| No | 1,802 (99.7) | 10,941 (99.7) | 18,330 (99.8) | 5,486 (99.8) | 853 (99.8) |
| **History of mental diseases, N (%)** |  |  |  |  |  |
| Yes | 160 (8.8) | 862 (7.9) | 1,472 (8.0) | 457 (8.3) | 73 (8.5) |
| No | 1,643 (90.9) | 10,079 (91.9) | 16,821 (91.6) | 5,019 (91.3) | 780 (91.2) |
| Missing | 5 (0.3) | 30 (0.3) | 80 (0.4) | 21 (0.4) | 2 (0.2) |
| **Maternal smoking history, N (%)** |  |  |  |  |  |
| Never | 1,062 (58.7) | 6,545 (59.7) | 10,875 (59.2) | 3,296 (60.0) | 479 (56.0) |
| Previously did, but quit before realizing current pregnancy | 340 (18.8) | 2,247 (20.5) | 3,917 (21.3) | 1,180 (21.5) | 200 (23.4) |
| Previously did, but quit after realizing current pregnancy | 205 (11.3) | 1,155 (10.5) | 1,877 (10.2) | 530 (9.6) | 91 (10.6) |
| Smoking in only the MT1 questionnaire | 14 (0.8) | 65 (0.6) | 81 (0.4) | 20 (0.4) | 5 (0.6) |
| Smoking in only the MT2 questionnaire | 11 (0.6) | 56 (0.5) | 73 (0.4) | 24 (0.4) | 4 (0.5) |
| Smoking in both MT1 and MT2 questionnaire | 65 (3.6) | 315 (2.9) | 489 (2.7) | 129 (2.3) | 24 (2.8) |
| Missing | 111 (6.1) | 588 (5.4) | 1,061 (5.8) | 318 (5.8) | 52 (6.1) |
| **Maternal alcohol consumption, N (%)** |  |  |  |  |  |
| Never | 570 (31.5) | 3,272 (29.8) | 5,379 (29.3) | 1,531 (27.9) | 227 (26.5) |
| Quit drinking before awareness of conception | 236 (13.1) | 1,446 (13.2) | 2,389 (13.0) | 745 (13.6) | 126 (14.7) |
| Quit drinking after awareness of conception | 639 (35.3) | 3,979 (36.3) | 6,710 (36.5) | 2,115 (38.5) | 330 (38.6) |
| Drinking in only the MT1 questionnaire | 115 (6.4) | 806 (7.3) | 1,394 (7.6) | 375 (6.8) | 63 (7.4) |
| Drinking in only the MT2 questionnaire | 25 (1.4) | 121 (1.1) | 197 (1.1) | 58 (1.1) | 9 (1.1) |
| Drinking in both MT1 and MT2 questionnaire | 20 (1.1) | 151 (1.4) | 275 (1.5) | 78 (1.4) | 15 (1.8) |
| Missing | 203 (11.2) | 1,196 (10.9) | 2,029 (11.0) | 595 (10.8) | 85 (9.9) |
| **Maternal highest level of education, N (%)** |  |  |  |  |  |
| Junior high school | 67 (3.7) | 352 (3.2) | 579 (3.2) | 135 (2.5) | 29 (3.4) |
| High school | 608 (33.6) | 3,233 (29.5) | 5,260 (28.6) | 1,477 (26.9) | 256 (29.9) |
| Technical junior college | 34 (1.9) | 180 (1.6) | 284 (1.5) | 78 (1.4) | 14 (1.6) |
| Technical/vocational college | 446 (24.7) | 2,640 (24.1) | 4,292 (23.4) | 1,304 (23.7) | 208 (24.3) |
| Associate degree | 300 (16.6) | 1,978 (18.0) | 3,387 (18.4) | 1,075 (19.6) | 138 (16.1) |
| Bachelor's degree | 319 (17.6) | 2,335 (21.3) | 4,092 (22.3) | 1,282 (23.3) | 183 (21.4) |
| Graduate degree (Master's/Doctor's) | 17 (0.9) | 159 (1.4) | 300 (1.6) | 96 (1.7) | 16 (1.9) |
| Missing | 17 (0.9) | 94 (0.9) | 179 (1.0) | 50 (0.9) | 11 (1.3) |
| **HDP, N (%)** |  |  |  |  |  |
| Yes | 81 (4.5) | 408 (3.7) | 567 (3.1) | 167 (3.0) | 19 (2.2) |
| No | 1,722 (95.2) | 10,533 (96.0) | 17,728 (96.5) | 5,310 (96.6) | 834 (97.5) |
| Missing | 5 (0.3) | 30 (0.3) | 78 (0.4) | 20 (0.4) | 2 (0.2) |
| **GDM, N (%)** |  |  |  |  |  |
| Yes | 69 (3.8) | 292 (2.7) | 433 (2.4) | 108 (2.0) | 24 (2.8) |
| No | 1,739 (96.2) | 10,679 (97.3) | 17,940 (97.6) | 5,389 (98.0) | 831 (97.2) |
| **Preterm delivery at less than 37 weeks of gestation, N (%)** | 101 (5.6) | 536 (4.9) | 682 (3.7) | 187 (3.4) | 26 (3.0) |
| **Delivery week, weeks** | 39.1 (1.5) | 39.2 (1.5) | 39.3 (1.4) | 39.4 (1.4) | 39.5 (1.4) |
| **Paternal birth weight, N (%)** |  |  |  |  |  |
| <2,500 g | 100 (5.5) | 415 (3.8) | 633 (3.4) | 168 (3.1) | 36 (4.2) |
| 2,500－2,999 g | 360 (19.9) | 2,380 (21.7) | 3,267 (17.8) | 1,037 (18.9) | 144 (16.8) |
| 3,000－3,499 g | 944 (52.2) | 5,938 (54.1) | 10,461 (56.9) | 2,504 (45.6) | 387 (45.3) |
| 3,500－3,999 g | 320 (17.7) | 1,796 (16.4) | 3,168 (17.2) | 1,496 (27.2) | 245 (28.7) |
| ≥4,000 g | 84 (4.6) | 442 (4.0) | 844 (4.6) | 292 (5.3) | 43 (5.0) |
| **Paternal age at FT1, years** | 32.3 (6.0) | 32.6 (5.7) | 32.9 (5.6) | 33.1 (5.6) | 33.3 (5.8) |
| **Category of paternal age at FT1, N (%)** |  |  |  |  |  |
| <25 years | 139 (7.7) | 729 (6.6) | 1,035 (5.6) | 280 (5.1) | 42 (4.9) |
| 25－29.9 years | 470 (26.0) | 2,569 (23.4) | 4,297 (23.4) | 1,226 (22.3) | 168 (19.6) |
| 30－34.9 years | 568 (31.4) | 3,700 (33.7) | 6,050 (32.9) | 1,803 (32.8) | 306 (35.8) |
| 35－39.9 years | 390 (21.6) | 2,607 (23.8) | 4,560 (24.8) | 1,401 (25.5) | 209 (24.4) |
| ≥40 years | 211 (11.7) | 1,214 (11.1) | 2,168 (11.8) | 702 (12.8) | 116 (13.6) |
| Missing | 30 (1.7) | 152 (1.4) | 263 (1.4) | 85 (1.5) | 14 (1.6) |
| **Paternal height, cm** | 171.6 (5.7) | 171.8 (5.7) | 172.0 (5.7) | 172.2 (5.6) | 172.1 (5.8) |
| **Paternal body weight, kg** | 69.2 (11.6) | 69.0 (10.9) | 69.3 (10.8) | 70.0 (11.0) | 70.0 (11.5) |
| **Paternal BMI, kg/m2** | 23.5 (3.5) | 23.4 (3.3) | 23.4 (3.3) | 23.6 (3.3) | 23.6 (3.5) |
| **Category of paternal BMI, N (%)** |  |  |  |  |  |
| Underweight (<18.5 kg/m2) | 86 (4.8) | 376 (3.4) | 639 (3.5) | 149 (2.7) | 21 (2.5) |
| Normal range (18.5－24.9 kg/m2) | 1,160 (64.2) | 7,546 (68.8) | 12,598 (68.6) | 3,684 (67.0) | 561 (65.6) |
| Overweight (25.0－29.9 kg/m2) | 435 (24.1) | 2,388 (21.8) | 3,988 (21.7) | 1,301 (23.7) | 206 (24.1) |
| Obese (≥30.0 kg/m2) | 88 (4.9) | 431 (3.9) | 787 (4.3) | 234 (4.3) | 43 (5.0) |
| Missing | 39 (2.2) | 230 (2.1) | 361 (2.0) | 129 (2.3) | 24 (2.8) |
| **Paternal smoking history, N (%)** |  |  |  |  |  |
| Never | 549 (30.4) | 3,207 (29.2) | 5,228 (28.5) | 1,679 (30.5) | 255 (29.8) |
| Previously did, but quit before realizing their partner's pregnancy | 406 (22.5) | 2,511 (22.9) | 4,354 (23.7) | 1,312 (23.9) | 191 (22.3) |
| Previously did, but quit after realizing their partner's pregnancy | 75 (4.1) | 536 (4.9) | 855 (4.7) | 252 (4.6) | 46 (5.4) |
| Currently smoking | 719 (39.8) | 4,432 (40.4) | 7,402 (40.3) | 2,091 (38.0) | 338 (39.5) |
| Missing | 59 (3.3) | 285 (2.6) | 534 (2.9) | 163 (3.0) | 25 (2.9) |
| **Paternal alcohol consumption, N (%)** |  |  |  |  |  |
| Never | 437 (24.2) | 2,271 (20.7) | 3,769 (20.5) | 1,103 (20.1) | 189 (22.1) |
| Quit drinking | 72 (4.0) | 355 (3.2) | 628 (3.4) | 167 (3.0) | 33 (3.9) |
| Continue drinking | 1,266 (70.0) | 8,185 (74.6) | 13,700 (74.6) | 4,129 (75.1) | 619 (72.4) |
| Missing | 33 (1.8) | 160 (1.5) | 276 (1.5) | 98 (1.8) | 14 (1.6) |
| **Paternal highest level of education, N (%)** |  |  |  |  |  |
| Junior high school | 83 (4.6) | 552 (5.0) | 850 (4.6) | 238 (4.3) | 43 (5.0) |
| High school | 687 (38.0) | 3,891 (35.5) | 6,487 (35.3) | 1,869 (34.0) | 305 (35.7) |
| Technical junior college | 44 (2.4) | 238 (2.2) | 359 (2.0) | 123 (2.2) | 10 (1.2) |
| Technical/vocational college | 328 (18.1) | 2,157 (19.7) | 3,514 (19.1) | 1,103 (20.1) | 170 (19.9) |
| Associate degree | 45 (2.5) | 246 (2.2) | 402 (2.2) | 108 (2.0) | 15 (1.8) |
| Bachelor's degree | 510 (28.2) | 3,209 (29.2) | 5,622 (30.6) | 1,738 (31.6) | 261 (30.5) |
| Graduate degree (Master's/Doctor's) | 87 (4.8) | 567 (5.2) | 923 (5.0) | 267 (4.9) | 40 (4.7) |
| Missing | 24 (1.3) | 111 (1.0) | 216 (1.2) | 51 (0.9) | 11 (1.3) |
| **Marital status, N (%)** |  |  |  |  |  |
| Married | 1,732 (95.8) | 10,657 (97.1) | 17,870 (97.3) | 5,348 (97.3) | 835 (97.7) |
| Unmarried | 65 (3.6) | 258 (2.4) | 375 (2.0) | 114 (2.1) | 16 (1.9) |
| Missing | 11 (0.6) | 56 (0.5) | 128 (0.7) | 35 (0.6) | 4 (0.5) |
| **Annual household income (million, Japanese Yen), N (%)** |  |  |  |  |  |
| <2 | 74 (4.1) | 424 (3.9) | 655 (3.6) | 181 (3.3) | 34 (4.0) |
| 2－3.99 | 628 (34.7) | 3,500 (31.9) | 5,734 (31.2) | 1,609 (29.3) | 266 (31.1) |
| 4－5.99 | 546 (30.2) | 3,491 (31.8) | 6,031 (32.8) | 1,836 (33.4) | 262 (30.6) |
| 6－7.99 | 250 (13.8) | 1,729 (15.8) | 2,946 (16.0) | 968 (17.6) | 149 (17.4) |
| 8－9.99 | 116 (6.4) | 741 (6.8) | 1,181 (6.4) | 373 (6.8) | 55 (6.4) |
| 10－11.99 | 38 (2.1) | 258 (2.4) | 464 (2.5) | 124 (2.3) | 19 (2.2) |
| 12－14.99 | 14 (0.8) | 89 (0.8) | 191 (1.0) | 48 (0.9) | 7 (0.8) |
| 15－19.99 | 8 (0.4) | 63 (0.6) | 94 (0.5) | 28 (0.5) | 2 (0.2) |
| ≥20 | 4 (0.2) | 25 (0.2) | 37 (0.2) | 14 (0.3) | 3 (0.4) |
| Missing | 130 (7.2) | 651 (5.9) | 1,040 (5.7) | 316 (5.7) | 58 (6.8) |
| **Regions where regional centers exist, N (%)** |  |  |  |  |  |
| Hokkaido | 73 (4.0) | 579 (5.3) | 970 (5.3) | 317 (5.8) | 43 (5.0) |
| Tohoku | 487 (26.9) | 2,839 (25.9) | 4,649 (25.3) | 1,418 (25.8) | 215 (25.1) |
| Kanto | 214 (11.8) | 1,311 (11.9) | 2,135 (11.6) | 678 (12.3) | 92 (10.8) |
| Chubu | 375 (20.7) | 2,371 (21.6) | 3,923 (21.4) | 1,108 (20.2) | 182 (21.3) |
| Kinki | 306 (16.9) | 1,706 (15.6) | 2,905 (15.8) | 865 (15.7) | 148 (17.3) |
| Chugoku | 38 (2.1) | 217 (2.0) | 403 (2.2) | 109 (2.0) | 16 (1.9) |
| Shikoku | 72 (4.0) | 445 (4.1) | 780 (4.2) | 217 (3.9) | 35 (4.1) |
| Kyusyu-Okinawa | 243 (13.4) | 1,503 (13.7) | 2,608 (14.2) | 785 (14.3) | 124 (14.5) |
| **Infant sex, N (%)** |  |  |  |  |  |
| Male | 882 (48.8) | 5,629 (51.3) | 9,311 (50.7) | 2,815 (51.2) | 463 (54.2) |
| Female | 926 (51.2) | 5,342 (48.7) | 9,062 (49.3) | 2,682 (48.8) | 392 (45.8) |
| **Infant birth weight, g** | 2,883 (404) | 2,937 (396) | 3,049 (386) | 3,177 (407) | 3,281 (398) |
| **Category of infant birth weight in percentiles, N (%)** |  |  |  |  |  |
| SGA | 268 (14.8) | 1,179 (10.7) | 1,117 (6.1) | 190 (3.5) | 16 (1.9) |
| AGA | 1,440 (79.6) | 9,089 (82.8) | 15,460 (84.1) | 4,306 (78.3) | 602 (70.4) |
| LGA | 100 (5.5) | 703 (6.4) | 1,796 (9.8) | 1,001 (18.2) | 237 (27.7) |
| **Category of infant birth weight in grams, N (%)** |  |  |  |  |  |
| Low birth weight (<2,500 g) | 268 (14.8) | 1,175 (10.7) | 1,126 (6.1) | 227 (4.1) | 21 (2.5) |
| Normal birth weight (≥2,500 g and <4,000 g) | 1,533 (84.8) | 9,754 (88.9) | 17,116 (93.2) | 5,169 (94.0) | 809 (94.6) |
| Macrosomia (≥4,000 g) | 7 (0.4) | 42 (0.4) | 131 (0.7) | 101 (1.8) | 25 (2.9) |

Continuous variables are expressed as mean (standard deviation). Categorical variables are expressed as numbers (percentages).

Abbreviations: AGA, appropriate for gestational age; APS, antiphospholipid syndrome; ART, assisted reproductive technology; BMI, body mass index; GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; LGA, large for gestational age; SGA, small for gestational age; SLE, systemic lupus erythematosus

**Supplementary Table 2. Parental and neonatal characteristics according to paternal birth weight**

| **Variables** | **Paternal birth weight** |
| --- | --- |
| **<2,500 g(N=1,352)** | **2,500－2,999 g(N=7,188)** | **3,000－3,499 g(N=20,234)** | **3,500－3,999 g(N=7,025)** | **≥4,000 g(N=1,705)** |
| **Maternal birth weight, N (%)** |  |  |  |  |  |
| <2,500 g | 100 (7.4) | 360 (5.0) | 944 (4.7) | 320 (4.6) | 84 (4.9) |
| 2,500－2,999 g | 415 (30.7) | 2,380 (33.1) | 5,938 (29.3) | 1,796 (25.6) | 442 (25.9) |
| 3,000－3,499 g | 633 (46.8) | 3,267 (45.5) | 10,461 (51.7) | 3,168 (45.1) | 844 (49.5) |
| 3,500－3,999 g | 168 (12.4) | 1,037 (14.4) | 2,504 (12.4) | 1,496 (21.3) | 292 (17.1) |
| ≥4,000 g | 36 (2.7) | 144 (2.0) | 387 (1.9) | 245 (3.5) | 43 (2.5) |
| **Maternal age at MT1, years** | 30.7 (5.1) | 30.6 (4.9) | 30.9 (4.8) | 30.9 (4.8) | 31.2 (4.6) |
| **Category of maternal age at MT1, N (%)** |  |  |  |  |  |
| <25 years | 148 (10.9) | 787 (10.9) | 1,838 (9.1) | 639 (9.1) | 133 (7.8) |
| 25－29.9 years | 422 (31.2) | 2,292 (31.9) | 6,052 (29.9) | 2,124 (30.2) | 476 (27.9) |
| 30－34.9 years | 457 (33.8) | 2,421 (33.7) | 7,378 (36.5) | 2,570 (36.6) | 666 (39.1) |
| 35－39.9 years | 264 (19.5) | 1,422 (19.8) | 4,219 (20.9) | 1,392 (19.8) | 361 (21.2) |
| ≥40 years | 54 (4.0) | 241 (3.4) | 680 (3.4) | 271 (3.9) | 59 (3.5) |
| Missing | 7 (0.5) | 25 (0.3) | 67 (0.3) | 29 (0.4) | 10 (0.6) |
| **Pre-pregnancy height, cm** | 157.7 (5.4) | 157.9 (5.4) | 158.1 (5.3) | 158.6 (5.4) | 158.4 (5.4) |
| **Pre-pregnancy body weight, kg** | 53.8 (9.5) | 52.9 (8.7) | 53.0 (8.7) | 53.4 (8.7) | 53.6 (9.3) |
| **Pre-pregnancy BMI, kg/m2** | 21.6 (3.5) | 21.2 (3.3) | 21.2 (3.2) | 21.2 (3.2) | 21.3 (3.4) |
| **Category of pre-pregnancy BMI, N (%)** |  |  |  |  |  |
| Underweight (<18.5 kg/m2) | 206 (15.2) | 1,149 (16.0) | 3,276 (16.2) | 1,019 (14.5) | 271 (15.9) |
| Normal range (18.5－24.9 kg/m2) | 960 (71.0) | 5,264 (73.2) | 14,882 (73.5) | 5,305 (75.5) | 1,237 (72.6) |
| Overweight (25.0－29.9 kg/m2) | 137 (10.1) | 609 (8.5) | 1,615 (8.0) | 541 (7.7) | 152 (8.9) |
| Obese (≥30.0 kg/m2) | 49 (3.6) | 166 (2.3) | 459 (2.3) | 159 (2.3) | 44 (2.6) |
| Missing | 0 (0.0) | 0 (0.0) | 2 (0.0) | 1 (0.0) | 1 (0.1) |
| **Gestational weight gain, kg** | 9.9 (4.1) | 10.1 (3.9) | 10.2 (4.0) | 10.4 (3.9) | 10.3 (4.0) |
| **Parity, N (%)** |  |  |  |  |  |
| Primipara | 646 (47.8) | 3,620 (50.4) | 9,222 (45.6) | 3,413 (48.6) | 752 (44.1) |
| Multipara | 706 (52.2) | 3,568 (49.6) | 11,012 (54.4) | 3,612 (51.4) | 953 (55.9) |
| **Conception method, N (%)** |  |  |  |  |  |
| Spontaneous pregnancy | 1,243 (91.9) | 6,672 (92.8) | 18,732 (92.6) | 6,454 (91.9) | 1,575 (92.4) |
| Non-ART | 68 (5.0) | 276 (3.8) | 791 (3.9) | 285 (4.1) | 67 (3.9) |
| ART | 39 (2.9) | 214 (3.0) | 640 (3.2) | 261 (3.7) | 57 (3.3) |
| Missing | 2 (0.1) | 26 (0.4) | 71 (0.4) | 25 (0.4) | 6 (0.4) |
| **History of hypertension, N (%)** |  |  |  |  |  |
| Yes | 8 (0.6) | 28 (0.4) | 78 (0.4) | 34 (0.5) | 10 (0.6) |
| No | 1,337 (98.9) | 7,135 (99.3) | 20,089 (99.3) | 6,962 (99.1) | 1,685 (98.8) |
| Missing | 7 (0.5) | 25 (0.3) | 67 (0.3) | 29 (0.4) | 10 (0.6) |
| **History of type 1 or 2 diabetes, N (%)** |  |  |  |  |  |
| Yes | 3 (0.2) | 8 (0.1) | 46 (0.2) | 14 (0.2) | 8 (0.5) |
| No | 1,342 (99.3) | 7,156 (99.6) | 20,123 (99.5) | 6,983 (99.4) | 1,688 (99.0) |
| Missing | 7 (0.5) | 24 (0.3) | 65 (0.3) | 28 (0.4) | 9 (0.5) |
| **History of kidney disorder, N (%)** |  |  |  |  |  |
| Yes | 6 (0.4) | 37 (0.5) | 76 (0.4) | 31 (0.4) | 9 (0.5) |
| No | 1,339 (99.0) | 7,126 (99.1) | 20,091 (99.3) | 6,965 (99.1) | 1,686 (98.9) |
| Missing | 7 (0.5) | 25 (0.3) | 67 (0.3) | 29 (0.4) | 10 (0.6) |
| **History of hyperthyroidism, N (%)** |  |  |  |  |  |
| Yes | 19 (1.4) | 72 (1.0) | 211 (1.0) | 77 (1.1) | 20 (1.2) |
| No | 1,326 (98.1) | 7,091 (98.7) | 19,956 (98.6) | 6,919 (98.5) | 1,675 (98.2) |
| Missing | 7 (0.5) | 25 (0.3) | 67 (0.3) | 29 (0.4) | 10 (0.6) |
| **History of hypothyroidism, N (%)** |  |  |  |  |  |
| Yes | 14 (1.0) | 67 (0.9) | 191 (0.9) | 83 (1.2) | 19 (1.1) |
| No | 1,331 (98.4) | 7,096 (98.7) | 19,976 (98.7) | 6,913 (98.4) | 1,676 (98.3) |
| Missing | 7 (0.5) | 25 (0.3) | 67 (0.3) | 29 (0.4) | 10 (0.6) |
| **History of SLE and/or APS, N (%)** |  |  |  |  |  |
| Yes | 6 (0.4) | 16 (0.2) | 44 (0.2) | 18 (0.3) | 8 (0.5) |
| No | 1,346 (99.6) | 7,172 (99.8) | 20,190 (99.8) | 7,007 (99.7) | 1,697 (99.5) |
| **History of mental diseases, N (%)** |  |  |  |  |  |
| Yes | 140 (10.4) | 602 (8.4) | 1,576 (7.8) | 566 (8.1) | 140 (8.2) |
| No | 1,205 (89.1) | 6,561 (91.3) | 18,591 (91.9) | 6,430 (91.5) | 1,555 (91.2) |
| Missing | 7 (0.5) | 25 (0.3) | 67 (0.3) | 29 (0.4) | 10 (0.6) |
| **Maternal smoking history N (%)** |  |  |  |  |  |
| Never | 817 (60.4) | 4,325 (60.2) | 11,947 (59.0) | 4,221 (60.1) | 947 (55.5) |
| Previously did, but quit before realizing current pregnancy | 272 (20.1) | 1,444 (20.1) | 4,294 (21.2) | 1,476 (21.0) | 398 (23.3) |
| Previously did, but quit after realizing current pregnancy | 116 (8.6) | 745 (10.4) | 2,146 (10.6) | 668 (9.5) | 183 (10.7) |
| Smoking in only the MT1 questionnaire | 7 (0.5) | 31 (0.4) | 101 (0.5) | 37 (0.5) | 9 (0.5) |
| Smoking in only the MT2 questionnaire | 11 (0.8) | 33 (0.5) | 95 (0.5) | 22 (0.3) | 7 (0.4) |
| Smoking in both MT1 and MT2 questionnaire | 44 (3.3) | 198 (2.8) | 540 (2.7) | 185 (2.6) | 55 (3.2) |
| Missing | 85 (6.3) | 412 (5.7) | 1,111 (5.5) | 416 (5.9) | 106 (6.2) |
| **Maternal alcohol consumption, N (%)** |  |  |  |  |  |
| Never | 406 (30.0) | 2,072 (28.8) | 5,957 (29.4) | 2,066 (29.4) | 478 (28.0) |
| Quit drinking before awareness of conception | 191 (14.1) | 980 (13.6) | 2,638 (13.0) | 906 (12.9) | 227 (13.3) |
| Quit drinking after awareness of conception | 474 (35.1) | 2,640 (36.7) | 7,395 (36.5) | 2,625 (37.4) | 639 (37.5) |
| Drinking in only the MT1 questionnaire | 92 (6.8) | 531 (7.4) | 1,519 (7.5) | 494 (7.0) | 117 (6.9) |
| Drinking in only the MT2 questionnaire | 11 (0.8) | 69 (1.0) | 242 (1.2) | 68 (1.0) | 20 (1.2) |
| Drinking in both MT1 and MT2 questionnaire | 16 (1.2) | 107 (1.5) | 284 (1.4) | 103 (1.5) | 29 (1.7) |
| Missing | 162 (12.0) | 789 (11.0) | 2,199 (10.9) | 763 (10.9) | 195 (11.4) |
| **Maternal highest level of education, N (%)** |  |  |  |  |  |
| Junior high school | 64 (4.7) | 221 (3.1) | 628 (3.1) | 198 (2.8) | 51 (3.0) |
| High school | 422 (31.2) | 2,198 (30.6) | 5,786 (28.6) | 1,962 (27.9) | 466 (27.3) |
| Technical junior college | 19 (1.4) | 107 (1.5) | 310 (1.5) | 116 (1.7) | 38 (2.2) |
| Technical/vocational college | 311 (23.0) | 1,672 (23.3) | 4,845 (23.9) | 1,656 (23.6) | 406 (23.8) |
| Associate degree | 226 (16.7) | 1,297 (18.0) | 3,748 (18.5) | 1,271 (18.1) | 336 (19.7) |
| Bachelor's degree | 278 (20.6) | 1,509 (21.0) | 4,428 (21.9) | 1,634 (23.3) | 362 (21.2) |
| Graduate degree (Master's/Doctor's) | 14 (1.0) | 113 (1.6) | 304 (1.5) | 126 (1.8) | 31 (1.8) |
| Missing | 18 (1.3) | 71 (1.0) | 185 (0.9) | 62 (0.9) | 15 (0.9) |
| **HDP, N (%)** |  |  |  |  |  |
| Yes | 54 (4.0) | 220 (3.1) | 646 (3.2) | 256 (3.6) | 66 (3.9) |
| No | 1,291 (95.5) | 6,943 (96.6) | 19,522 (96.5) | 6,741 (96.0) | 1,630 (95.6) |
| Missing | 7 (0.5) | 25 (0.3) | 66 (0.3) | 28 (0.4) | 9 (0.5) |
| **GDM, N (%)** |  |  |  |  |  |
| Yes | 42 (3.1) | 174 (2.4) | 482 (2.4) | 173 (2.5) | 55 (3.2) |
| No | 1,310 (96.9) | 7,014 (97.6) | 19,752 (97.6) | 6,852 (97.5) | 1,650 (96.8) |
| **Preterm delivery at less than 37 weeks of gestation, N (%)** | 73 (5.4) | 284 (4.0) | 808 (4.0) | 286 (4.1) | 81 (4.8) |
| **Delivery week, weeks** | 39.2 (1.5) | 39.3 (1.4) | 39.3 (1.4) | 39.3 (1.5) | 39.3 (1.6) |
| **Paternal age at FT1, years** | 33.0 (6.2) | 32.6 (5.9) | 32.9 (5.6) | 32.8 (5.6) | 33.0 (5.4) |
| **Category of paternal age at FT1, N (%)** |  |  |  |  |  |
| <25 years | 89 (6.6) | 529 (7.4) | 1,128 (5.6) | 404 (5.8) | 75 (4.4) |
| 25－29.9 years | 321 (23.7) | 1,764 (24.5) | 4,643 (22.9) | 1,635 (23.3) | 367 (21.5) |
| 30－34.9 years | 422 (31.2) | 2,258 (31.4) | 6,790 (33.6) | 2,336 (33.3) | 621 (36.4) |
| 35－39.9 years | 304 (22.5) | 1,706 (23.7) | 5,028 (24.8) | 1,716 (24.4) | 413 (24.2) |
| ≥40 years | 196 (14.5) | 832 (11.6) | 2,349 (11.6) | 838 (11.9) | 196 (11.5) |
| Missing | 20 (1.5) | 99 (1.4) | 296 (1.5) | 96 (1.4) | 33 (1.9) |
| **Paternal height, cm** | 169.2 (5.9) | 170.4 (5.6) | 171.9 (5.5) | 173.5 (5.6) | 175.0 (5.6) |
| **Paternal body weight, kg** | 66.7 (11.0) | 67.5 (10.6) | 69.0 (10.6) | 71.7 (11.3) | 74.2 (11.9) |
| **Paternal BMI, kg/m2** | 23.3 (3.4) | 23.2 (3.3) | 23.3 (3.3) | 23.8 (3.4) | 24.2 (3.6) |
| **Category of paternal BMI, N (%)** |  |  |  |  |  |
| Underweight (<18.5 kg/m2) | 55 (4.1) | 296 (4.1) | 719 (3.6) | 167 (2.4) | 34 (2.0) |
| Normal range (18.5－24.9 kg/m2) | 923 (68.3) | 4,955 (68.9) | 13,981 (69.1) | 4,625 (65.8) | 1,065 (62.5) |
| Overweight (25.0－29.9 kg/m2) | 291 (21.5) | 1,493 (20.8) | 4,350 (21.5) | 1,741 (24.8) | 443 (26.0) |
| Obese (≥30.0 kg/m2) | 51 (3.8) | 284 (4.0) | 768 (3.8) | 354 (5.0) | 126 (7.4) |
| Missing | 32 (2.4) | 160 (2.2) | 416 (2.1) | 138 (2.0) | 37 (2.2) |
| **Paternal smoking history, N (%)** |  |  |  |  |  |
| Never | 385 (28.5) | 2,102 (29.2) | 5,908 (29.2) | 2,088 (29.7) | 435 (25.5) |
| Previously did, but quit before realizing their partner's pregnancy | 280 (20.7) | 1,635 (22.7) | 4,763 (23.5) | 1,676 (23.9) | 420 (24.6) |
| Previously did, but quit after realizing their partner's pregnancy | 64 (4.7) | 343 (4.8) | 950 (4.7) | 332 (4.7) | 75 (4.4) |
| Currently smoking | 569 (42.1) | 2,908 (40.5) | 8,047 (39.8) | 2,743 (39.0) | 715 (41.9) |
| Missing | 54 (4.0) | 200 (2.8) | 566 (2.8) | 186 (2.6) | 60 (3.5) |
| **Paternal alcohol consumption, N (%)** |  |  |  |  |  |
| Never | 321 (23.7) | 1,498 (20.8) | 4,185 (20.7) | 1,455 (20.7) | 310 (18.2) |
| Quit drinking | 65 (4.8) | 266 (3.7) | 632 (3.1) | 239 (3.4) | 53 (3.1) |
| Continue drinking | 944 (69.8) | 5,315 (73.9) | 15,107 (74.7) | 5,229 (74.4) | 1,304 (76.5) |
| Missing | 22 (1.6) | 109 (1.5) | 310 (1.5) | 102 (1.5) | 38 (2.2) |
| **Paternal highest level of education, N (%)** |  |  |  |  |  |
| Junior high school | 84 (6.2) | 322 (4.5) | 964 (4.8) | 301 (4.3) | 95 (5.6) |
| High school | 505 (37.4) | 2,639 (36.7) | 7,122 (35.2) | 2,397 (34.1) | 576 (33.8) |
| Technical junior college | 23 (1.7) | 140 (1.9) | 441 (2.2) | 126 (1.8) | 44 (2.6) |
| Technical/vocational college | 287 (21.2) | 1,433 (19.9) | 3,893 (19.2) | 1,353 (19.3) | 306 (17.9) |
| Associate degree | 28 (2.1) | 161 (2.2) | 458 (2.3) | 137 (2.0) | 32 (1.9) |
| Bachelor's degree | 350 (25.9) | 2,090 (29.1) | 6,094 (30.1) | 2,251 (32.0) | 555 (32.6) |
| Graduate degree (Master's/Doctor's) | 57 (4.2) | 321 (4.5) | 1,042 (5.1) | 389 (5.5) | 75 (4.4) |
| Missing | 18 (1.3) | 82 (1.1) | 220 (1.1) | 71 (1.0) | 22 (1.3) |
| **Marital status, N (%)** |  |  |  |  |  |
| Married | 1,310 (96.9) | 6,947 (96.6) | 19,691 (97.3) | 6,825 (97.2) | 1,669 (97.9) |
| Unmarried | 30 (2.2) | 192 (2.7) | 427 (2.1) | 156 (2.2) | 23 (1.3) |
| Missing | 12 (0.9) | 49 (0.7) | 116 (0.6) | 44 (0.6) | 13 (0.8) |
| **Annual household income (million, Japanese Yen), N (%)** |  |  |  |  |  |
| <2 | 63 (4.7) | 292 (4.1) | 711 (3.5) | 247 (3.5) | 55 (3.2) |
| 2－3.99 | 462 (34.2) | 2,267 (31.5) | 6,379 (31.5) | 2,120 (30.2) | 509 (29.9) |
| 4－5.99 | 428 (31.7) | 2,371 (33.0) | 6,562 (32.4) | 2,260 (32.2) | 545 (32.0) |
| 6－7.99 | 191 (14.1) | 1,116 (15.5) | 3,222 (15.9) | 1,230 (17.5) | 283 (16.6) |
| 8－9.99 | 61 (4.5) | 446 (6.2) | 1,351 (6.7) | 499 (7.1) | 109 (6.4) |
| 10－11.99 | 26 (1.9) | 163 (2.3) | 494 (2.4) | 175 (2.5) | 45 (2.6) |
| 12－14.99 | 12 (0.9) | 60 (0.8) | 194 (1.0) | 65 (0.9) | 18 (1.1) |
| 15－19.99 | 4 (0.3) | 28 (0.4) | 107 (0.5) | 43 (0.6) | 13 (0.8) |
| ≥20 | 1 (0.1) | 11 (0.2) | 49 (0.2) | 18 (0.3) | 4 (0.2) |
| Missing | 104 (7.7) | 434 (6.0) | 1,165 (5.8) | 368 (5.2) | 124 (7.3) |
| **Regions where regional centers exist, N (%)** |  |  |  |  |  |
| Hokkaido | 77 (5.7) | 374 (5.2) | 1,075 (5.3) | 359 (5.1) | 97 (5.7) |
| Tohoku | 343 (25.4) | 1,908 (26.5) | 5,095 (25.2) | 1,820 (25.9) | 442 (25.9) |
| Kanto | 123 (9.1) | 829 (11.5) | 2,366 (11.7) | 897 (12.8) | 215 (12.6) |
| Chubu | 293 (21.7) | 1,510 (21.0) | 4,349 (21.5) | 1,462 (20.8) | 345 (20.2) |
| Kinki | 220 (16.3) | 1,127 (15.7) | 3,208 (15.9) | 1,116 (15.9) | 259 (15.2) |
| Chugoku | 28 (2.1) | 139 (1.9) | 433 (2.1) | 146 (2.1) | 37 (2.2) |
| Shikoku | 62 (4.6) | 310 (4.3) | 829 (4.1) | 272 (3.9) | 76 (4.5) |
| Kyusyu-Okinawa | 206 (15.2) | 991 (13.8) | 2,879 (14.2) | 953 (13.6) | 234 (13.7) |
| **Infant sex, N (%)** |  |  |  |  |  |
| Male | 680 (50.3) | 3,607 (50.2) | 10,400 (51.4) | 3,530 (50.2) | 883 (51.8) |
| Female | 672 (49.7) | 3,581 (49.8) | 9,834 (48.6) | 3,495 (49.8) | 822 (48.2) |
| **Infant birth weight, g** | 2,935 (423) | 2,960 (389) | 3,024 (393) | 3,118 (418) | 3,157 (426) |
| **Category of infant birth weight in percentiles, N (%)** |  |  |  |  |  |
| SGA | 152 (11.2) | 731 (10.2) | 1,508 (7.5) | 325 (4.6) | 54 (3.2) |
| AGA | 1,109 (82.0) | 5,954 (82.8) | 16,924 (83.6) | 5,568 (79.3) | 1,342 (78.7) |
| LGA | 91 (6.7) | 503 (7.0) | 1,802 (8.9) | 1,132 (16.1) | 309 (18.1) |
| **Category of infant birth weight in grams, N (%)** |  |  |  |  |  |
| Low birth weight (<2,500 g) | 175 (12.9) | 686 (9.5) | 1,496 (7.4) | 381 (5.4) | 79 (4.6) |
| Normal birth weight (≥2,500 g and <4,000 g) | 1,170 (86.5) | 6,469 (90.0) | 18,589 (91.9) | 6,557 (93.3) | 1,596 (93.6) |
| Macrosomia (≥4,000 g) | 7 (0.5) | 33 (0.5) | 149 (0.7) | 87 (1.2) | 30 (1.8) |

Continuous variables are expressed as mean (standard deviation). Categorical variables are expressed as numbers (percentages).

Abbreviations: AGA, appropriate for gestational age; APS, antiphospholipid syndrome; ART, assisted reproductive technology; BMI, body mass index; GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; LGA, large for gestational age; SGA, small for gestational age; SLE, systemic lupus erythematosus

**Supplementary Table 3. Differences in parental and neonatal characteristics between study participants who were analyzed in this study and those who were excluded.**

| **Variables** | **Study participants who were analyzed in this study(N=37,504)** | **Study participants who were excluded due to several reasonsa(N=58,303)** | **P-value** |
| --- | --- | --- | --- |
| **Maternal age at MT1, years** | 30.9 (4.8) | 30.7 (5.2) | <0.001 |
| **Pre-pregnancy height, cm** | 158.2 (5.3) | 158.1 (5.4) | 0.042 |
| **Pre-pregnancy body weight, kg** | 53.1 (8.7) | 53.1 (8.9) | 0.52 |
| **Pre-pregnancy BMI, kg/m2** | 21.2 (3.2) | 21.2 (3.3) | 0.95 |
| **Gestational weight gain, kg** | 10.2 (4.0) | 10.3 (4.3) | 0.004 |
| **Parity, N (%)** |  |  | <0.001 |
| Primipara | 17,653 (47.1) | 22,048 (37.8) |  |
| Multipara | 19,851 (52.9) | 33,269 (57.1) |  |
| Missing | 0 (0.0) | 2,986 (5.1) |  |
| **Conception method, N (%)** |  |  | <0.001 |
| Spontaneous pregnancy | 34,676 (92.5) | 53,678 (92.1) |  |
| Non-ART | 1,487 (4.0) | 2,027 (3.5) |  |
| ART | 1,211 (3.2) | 1,707 (2.9) |  |
| Missing | 130 (0.3) | 891 (1.5) |  |
| **History of hypertension, N (%)** |  |  | <0.001 |
| Yes | 158 (0.4) | 273 (0.5) |  |
| No | 37,208 (99.2) | 55,026 (94.4) |  |
| Missing | 138 (0.4) | 3,004 (5.2) |  |
| **History of type 1 or 2 diabetes, N (%)** |  |  | <0.001 |
| Yes | 79 (0.2) | 120 (0.2) |  |
| No | 37,292 (99.4) | 55,217 (94.7) |  |
| Missing | 133 (0.4) | 2,966 (5.1) |  |
| **History of kidney disorder, N (%)** |  |  | <0.001 |
| Yes | 159 (0.4) | 231 (0.4) |  |
| No | 37,207 (99.2) | 55,068 (94.5) |  |
| Missing | 138 (0.4) | 3,004 (5.2) |  |
| **History of hyperthyroidism, N (%)** |  |  | <0.001 |
| Yes | 399 (1.1) | 585 (1.0) |  |
| No | 36,967 (98.6) | 54,714 (93.8) |  |
| Missing | 138 (0.4) | 3,004 (5.2) |  |
| **History of hypothyroidism, N (%)** |  |  | <0.001 |
| Yes | 374 (1.0) | 536 (0.9) |  |
| No | 36,992 (98.6) | 54,763 (93.9) |  |
| Missing | 138 (0.4) | 3,004 (5.2) |  |
| **History of SLE and/or APS, N (%)** |  |  | <0.001 |
| Yes | 92 (0.2) | 133 (0.2) |  |
| No | 37,412 (99.8) | 57,643 (98.9) |  |
| Missing | 0 (0.0) | 527 (0.9) |  |
| **History of mental diseases, N (%)** |  |  | <0.001 |
| Yes | 3,024 (8.1) | 4,225 (7.2) |  |
| No | 34,342 (91.6) | 51,074 (87.6) |  |
| Missing | 138 (0.4) | 3,004 (5.2) |  |
| **Maternal smoking history, N (%)** |  |  | <0.001 |
| Never | 22,257 (59.3) | 29,123 (50.0) |  |
| Previously did, but quit before realizing current pregnancy | 7,884 (21.0) | 11,152 (19.1) |  |
| Previously did, but quit after realizing current pregnancy | 3,858 (10.3) | 6,676 (11.5) |  |
| Smoking in only the MT1 questionnaire | 185 (0.5) | 415 (0.7) |  |
| Smoking in only the MT2 questionnaire | 168 (0.4) | 334 (0.6) |  |
| Smoking in both MT1 and MT2 questionnaire | 1,022 (2.7) | 2,333 (4.0) |  |
| Missing | 2,130 (5.7) | 8,270 (14.2) |  |
| **Maternal alcohol consumption, N (%)** |  |  | <0.001 |
| Never | 10,979 (29.3) | 15,546 (26.7) |  |
| Quit drinking before awareness of conception | 4,942 (13.2) | 7,200 (12.3) |  |
| Quit drinking after awareness of conception | 13,773 (36.7) | 19,636 (33.7) |  |
| Drinking in only the MT1 questionnaire | 2,753 (7.3) | 3,724 (6.4) |  |
| Drinking in only the MT2 questionnaire | 410 (1.1) | 603 (1.0) |  |
| Drinking in both MT1 and MT2 questionnaire | 539 (1.4) | 865 (1.5) |  |
| Missing | 4,108 (11.0) | 10,729 (18.4) |  |
| **Maternal highest level of education, N (%)** |  |  | <0.001 |
| Junior high school | 1,162 (3.1) | 3,021 (5.2) |  |
| High school | 10,834 (28.9) | 17,430 (29.9) |  |
| Technical junior college | 590 (1.6) | 907 (1.6) |  |
| Technical/vocational college | 8,890 (23.7) | 11,881 (20.4) |  |
| Associate degree | 6,878 (18.3) | 9,145 (15.7) |  |
| Bachelor's degree | 8,211 (21.9) | 10,244 (17.6) |  |
| Graduate degree (Master's/Doctor's) | 588 (1.6) | 730 (1.3) |  |
| Missing | 351 (0.9) | 4,945 (8.5) |  |
| **HDP, N (%)** |  |  | <0.001 |
| Yes | 1,242 (3.3) | 1,884 (3.2) |  |
| No | 36,127 (96.3) | 52,401 (89.9) |  |
| Missing | 135 (0.4) | 4,018 (6.9) |  |
| **GDM, N (%)** |  |  | <0.001 |
| Yes | 926 (2.5) | 1,590 (2.7) |  |
| No | 36,578 (97.5) | 54,395 (93.3) |  |
| Missing | 0 (0.0) | 2,318 (4.0) |  |
| **Preterm delivery at less than 37 weeks of gestation, N (%)** |  |  | <0.001 |
| Yes | 1,532 (4.1) | 3,213 (5.5) |  |
| No | 35,972 (95.9) | 52,705 (90.4) |  |
| Missing | 0 (0.0) | 2,385 (4.1) |  |
| **Delivery week, weeks** | 39.3 (1.5) | 38.6 (4.0) | <0.001 |
| **Paternal age at FT1, years** | 32.8 (5.7) | 32.3 (6.4) | <0.001 |
| **Paternal height, cm** | 171.9 (5.7) | 171.4 (5.7) | <0.001 |
| **Paternal body weight, kg** | 69.3 (10.9) | 69.1 (11.3) | 0.036 |
| **Paternal BMI, kg/m2** | 23.4 (3.3) | 23.5 (3.5) | 0.22 |
| **Paternal smoking history, N (%)** |  |  | <0.001 |
| Never | 10,918 (29.1) | 2,447 (4.2) |  |
| Previously did, but quit before realizing their partner's pregnancy | 8,774 (23.4) | 2,032 (3.5) |  |
| Previously did, but quit after realizing their partner's pregnancy | 1,764 (4.7) | 501 (0.9) |  |
| Currently smoking | 14,982 (39.9) | 4,582 (7.9) |  |
| Missing | 1,066 (2.8) | 48,741 (83.6) |  |
| **Paternal alcohol consumption, N (%)** |  |  | <0.001 |
| Never | 7,769 (20.7) | 2,116 (3.6) |  |
| Quit drinking | 1,255 (3.3) | 489 (0.8) |  |
| Continue drinking | 27,899 (74.4) | 7,096 (12.2) |  |
| Missing | 581 (1.5) | 48,602 (83.4) |  |
| **Paternal highest level of education, N (%)** |  |  | <0.001 |
| Junior high school | 1,766 (4.7) | 4,643 (8.0) |  |
| High school | 13,239 (35.3) | 19,715 (33.8) |  |
| Technical junior college | 774 (2.1) | 1,165 (2.0) |  |
| Technical/vocational college | 7,272 (19.4) | 9,322 (16.0) |  |
| Associate degree | 816 (2.2) | 1,038 (1.8) |  |
| Bachelor's degree | 11,340 (30.2) | 14,856 (25.5) |  |
| Graduate degree (Master's/Doctor's) | 1,884 (5.0) | 2,188 (3.8) |  |
| Missing | 413 (1.1) | 5,376 (9.2) |  |
| **Marital status, N (%)** |  |  | <0.001 |
| Married | 36,442 (97.2) | 52,327 (89.8) |  |
| Unmarried | 828 (2.2) | 2,645 (4.5) |  |
| Missing | 234 (0.6) | 3,331 (5.7) |  |
| **Annual household income (million, Japanese Yen), N (%)** |  |  | <0.001 |
| <2 | 1,368 (3.6) | 3,101 (5.3) |  |
| 2－3.99 | 11,737 (31.3) | 17,370 (29.8) |  |
| 4－5.99 | 12,166 (32.4) | 15,877 (27.2) |  |
| 6－7.99 | 6,042 (16.1) | 7,530 (12.9) |  |
| 8－9.99 | 2,466 (6.6) | 3,172 (5.4) |  |
| 10－11.99 | 903 (2.4) | 1,172 (2.0) |  |
| 12－14.99 | 349 (0.9) | 474 (0.8) |  |
| 15－19.99 | 195 (0.5) | 268 (0.5) |  |
| ≥20 | 83 (0.2) | 195 (0.3) |  |
| Missing | 2,195 (5.9) | 9,144 (15.7) |  |
| **Regions where regional centers exist, N (%)** |  |  | <0.001 |
| Hokkaido | 1,982 (5.3) | 5,931 (10.2) |  |
| Tohoku | 9,608 (25.6) | 11,311 (19.4) |  |
| Kanto | 4,430 (11.8) | 7,593 (13.0) |  |
| Chubu | 7,959 (21.2) | 9,360 (16.1) |  |
| Kinki | 5,930 (15.8) | 10,017 (17.2) |  |
| Chugoku | 783 (2.1) | 2,035 (3.5) |  |
| Shikoku | 1,549 (4.1) | 4,975 (8.5) |  |
| Kyusyu-Okinawa | 5,263 (14.0) | 7,081 (12.1) |  |
| **Infant birth weight, g** | 3,032 (404) | 2,972 (528) | <0.001 |

Continuous variables are expressed as mean (standard deviation). Categorical variables are expressed as numbers (percentages).

aPaternal consent to participate in the JECS was disagree, maternal consent was withdrawal or censoring, paternal consent was withdrawal or censoring, or missing data.

Abbreviations: APS, antiphospholipid syndrome; ART, assisted reproductive technology; BMI, body mass index; GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; SLE, systemic lupus erythematosus

**Supplementary Figure 1. Association of parental birth weights with male infant birth weight (SGA or LGA)**



a Both maternal and paternal birth weight were included in a multinomial logistic regression model.

b Adjusted for regions where regional centres exist, marital status, annual income, maternal variables, and paternal variables in addition to model 1. Maternal variables included age, height, pre-pregnancy BMI, gestational weight gain, conception method, parity (primipara or not), history of the following diseases (hyperthyroidism, hypothyroidism, SLE and/or APS, mental illness, and kidney disorder), smoking status, alcohol consumption, and highest level of education. Paternal variables included age, height, BMI, smoking status, alcohol consumption, and highest level of education.

c Adjusted for history of type 1 or 2 diabetes, GDM, and HDP in addition to model 2.

Abbreviations: AGA, appropriate for gestational age; APS, antiphospholipid syndrome; BMI, body mass index; CI, confidence interval; GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; LGA, large for gestational age; NA, not applicable, OR, odds ratio; SGA, small for gestational age; SLE, systemic lupus erythematosus.

**Supplementary Figure 2. Association of maternal and paternal birth weights with male infant birth weight (Low birth weight infant or macrosomia)**

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a Both maternal and paternal birth weight were included in a multinomial logistic regression model.

b Adjusted for regions where regional centres exist, marital status, annual income, maternal variables, and paternal variables in addition to model 1. Maternal variables included age, height, pre-pregnancy BMI, gestational weight gain, conception method, parity (primipara or not), history of the following diseases (hyperthyroidism, hypothyroidism, SLE and/or APS, mental illness, and kidney disorder), smoking status, alcohol consumption, and highest level of education. Paternal variables included age, height, BMI, smoking status, alcohol consumption, and highest level of education.

c Adjusted for history of type 1 or 2 diabetes, GDM, and HDP in addition to model 2.

Abbreviations: APS, antiphospholipid syndrome; BMI, body mass index; CI, confidence interval; not applicable, GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; OR, odds ratio; SLE, systemic lupus erythematosus.

**Supplementary Figure 3. Association of parental birth weights with female infant birth weight (SGA or LGA)**


a Both maternal and paternal birth weight were included in a multinomial logistic regression model.

b Adjusted for regions where regional centres exist, marital status, annual income, maternal variables, and paternal variables in addition to model 1. Maternal variables included age, height, pre-pregnancy BMI, gestational weight gain, conception method, parity (primipara or not), history of the following diseases (hyperthyroidism, hypothyroidism, SLE and/or APS, mental illness, and kidney disorder), smoking status, alcohol consumption, and highest level of education. Paternal variables included age, height, BMI, smoking status, alcohol consumption, and highest level of education.

c Adjusted for history of type 1 or 2 diabetes, GDM, and HDP in addition to model 2.

Abbreviations: AGA, appropriate for gestational age; APS, antiphospholipid syndrome; BMI, body mass index; CI, confidence interval; GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; LGA, large for gestational age; NA, not applicable, OR, odds ratio; SGA, small for gestational age; SLE, systemic lupus erythematosus.

**Supplementary Figure 4. Association of maternal and paternal birth weights with female infant birth weight (Low birth weight infant or macrosomia)**



a Both maternal and paternal birth weight were included in a multinomial logistic regression model.

b Adjusted for regions where regional centres exist, marital status, annual income, maternal variables, and paternal variables in addition to model 1. Maternal variables included age, height, pre-pregnancy BMI, gestational weight gain, conception method, parity (primipara or not), history of the following diseases (hyperthyroidism, hypothyroidism, SLE and/or APS, mental illness, and kidney disorder), smoking status, alcohol consumption, and highest level of education. Paternal variables included age, height, BMI, smoking status, alcohol consumption, and highest level of education.

c Adjusted for history of type 1 or 2 diabetes, GDM, and HDP in addition to model 2.

Abbreviations: APS, antiphospholipid syndrome; BMI, body mass index; CI, confidence interval; not applicable, GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; OR, odds ratio; SLE, systemic lupus erythematosus.