SUPPLEMENT

**Supplementary Tables — Melatonin mixed-model analyses**

**Supplementary Table S1. Main Baseline Characteristics by Gestational Week (GW) group**

| Variable | <33 GW Median (IQR) | 33–37 GW Median (IQR) | *p*-value |
|---|---|---|---|
| Length (cm) | 42 (39–43) | 46 (45–48) | < 0.001 |
| Head circumference (cm) | 29 (28–31) | 32 (32–33) | < 0.001 |
| Weight (g) | 1600 (1300–1900) | 2335 (2030–2650) | < 0.001 |
| Maternal age (years) | 34.1 (29.8–40.1) | 34.5 (29.8–38.9) | 0.632 |

**Supplementary Table S2. Adjusted Night/Day ratios at selected PMAs (log-scale model).**

| PMA (weeks) | Night/Day ratio | 95% CI ↓ | 95% CI ↑ | p-value |
|---|---|---|---|---|
| **30.00** | 1.42 | 0.76 | 2.64 | 0.267 |
| **34.00** | 1.11 | 0.77 | 1.59 | 0.567 |
| **36.00** | 0.98 | 0.63 | 1.54 | 0.939 |
| **38.00** | 0.87 | 0.46 | 1.65 | 0.668 |

**Supplementary Table S3. Adjusted WfGA ratios at selected PMAs (log-scale model).**

| Contrast | PMA (weeks) | Ratio | 95% CI ↓ | 95% CI ↑ | p-value |
|---|---|---|---|---|---|
| **LGA/AGA** | 30 | 0.49 | 0.12 | 2.11 | 0.342 |
| **LGA/AGA** | 34 | 0.91 | 0.48 | 1.75 | 0.783 |
| **LGA/AGA** | 36 | 1.24 | 0.63 | 2.45 | 0.537 |
| **LGA/AGA** | 38 | 1.68 | 0.59 | 4.80 | 0.330 |
| **SGA/AGA** | 30 | 1.08 | 0.34 | 3.42 | 0.897 |
| **SGA/AGA** | 34 | 1.26 | 0.70 | 2.27 | 0.436 |
| **SGA/AGA** | 36 | 1.37 | 0.76 | 2.45 | 0.294 |
| **SGA/AGA** | 38 | 1.48 | 0.66 | 3.33 | 0.346 |

**Supplementary Table S4. Gestational age at birth (GA) and serum melatonin at a given PMA (raw-scale primary analysis)**

Primary model: linear mixed-effects on the raw scale with an infant-level random intercept; fixed effects included PMA (continuous), GA at birth (continuous), sex, multiple pregnancy, maternal age, maternal education (Q1.8b) and maternal country (Q1.1). PMA was centred at 35 weeks and GA at 33 weeks for interpretability. Estimation by ML (REML=False); optimiser L-BFGS, with Nelder–Mead fallback if required. Effects are reported as mean differences in pg/mL.

| Model / Contrast | Difference (pg/mL) | 95% CI (pg/mL) | p-value | Notes |
|---|---|---|---|---|
| **Mixed model (no interaction): GA per +1 week (at PMA 35)** | 1.1 | -1.0 to 3.2 | 0.324 | Adjusted; random intercept |
| **Mixed model (with PMA×GA): GA per +1 week (at PMA 35)** | 1.1 | -1.0 to 3.2 | 0.303 | PMA×GA p = 0.25 |
| **Predicted contrast at PMA 35: GA 34 vs 32 (2 weeks)** | 2.2 | -2.0 to 6.4 | | Derived from interaction model |

**Supplementary Table S5. Within-PMA adjusted models (raw scale; cluster-robust SEs by infant)**

| PMA bin | n (obs) | n (infants) | Per +1 wk GA (pg/mL) | 95% CI (pg/mL) | p-value | GA 34 vs 32 (pg/mL, 95% CI) |
|---|---|---|---|---|---|---|
| **34** | 44 | 41 | 4.5 | -5.5 to 14.6 | 0.374 | 9.1 (-11.0 to 29.1) |
| **35** | 80 | 70 | 4.2 | 1.7 to 6.6 | <0.001 | 8.3 (3.5 to 13.2) |
| **36** | 49 | 44 | 0.7 | -2.0 to 3.5 | 0.607 | 1.5 (-4.1 to 7.0) |

**Supplementary Table S6. Within-PMA adjusted models (raw scale; cluster-robust SEs by infant)**

Primary model: linear mixed-effects on the natural-logarithmic scale with infant-level random intercepts; fixed effects included PMA (continuous), GA at birth (continuous), sex, multiple pregnancy, maternal age, maternal education (Q1.8b) and maternal country (Q1.1). PMA was centred at 35 weeks and GA at 33 weeks for interpretability. Effects are presented as ratios after back-transformation. Estimation by ML (REML=False); optimiser L-BFGS, with Nelder–Mead fallback if required.

| Model / Contrast | Ratio | 95% CI | p-value | Notes |
|---|---|---|---|---|
| **Mixed model (no interaction): GA per +1 week (at PMA 35)** | 1.05 | 0.96 to 1.14 | 0.279 | Adjusted; random intercept |
| **Mixed model (with PMA×GA): GA per +1 week (at PMA 35)** | 1.05 | 0.96 to 1.14 | 0.272 | PMA×GA p = 0.56 |
| **Predicted contrast at PMA 35: GA 34 vs 32 (2 weeks)** | 1.10 | 0.93 to 1.30 | | Derived from interaction model |

**Supplementary Table S7. Within-PMA adjusted models (log scale; cluster-robust SEs by infant)**

| PMA bin | n (obs) | n (infants) | GA per +1 wk (ratio) | 95% CI | p-value | GA 34 vs 32 (ratio, 95% CI) |
|---|---|---|---|---|---|---|
| **34** | 44 | 41 | 1.17 | 0.83 to 1.65 | 0.358 | 1.38 (0.70 to 2.73) |
| **35** | 80 | 70 | 1.20 | 1.09 to 1.32 | <0.001 | 1.44 (1.18 to 1.76) |
| **36** | 49 | 44 | 0.97 | 0.83 to 1.15 | 0.741 | 0.95 (0.68 to 1.31) |

Abbreviations: GA, gestational age at birth; PMA, post-menstrual age. Ratios >1 indicate higher melatonin with higher GA at birth. Within-PMA models adjusted for the same covariates as the mixed model; inference uses cluster-robust standard errors by infant.