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Women with postpartum weight retention have delayed wake times and decreased sleep efficiency during the perinatal period: a brief report

K.M. Sharkey, MD, PhD [a,b,c,*], G.M. Boni, BA [b,c], J.A. Quattrucci, BA [b,c], S. Blatch, MA [a,c], S.N. Carr, RN [b,c]

[a] Brown University, Providence, RI, United States
[b] Rhode Island Hospital, Providence, RI, United States
[c] Sleep for Science Research Laboratory, Providence, RI, United States

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ABSTRACT

Objective: This study assessed sleep and circadian rhythms across the perinatal period in new mothers with and without postpartum weight retention (PPWR).
Methods: Weight was measured at 2 and 16 weeks postpartum in 21 women with previous major depression or bipolar disorder (mean age, 29.5 ± 4.7 years) who self-reported pre-pregnancy weight during third trimester. Wrist actigraphy was acquired at 33 weeks gestation and postpartum weeks 2, 6, and 16. Circadian phase was measured at 33 weeks gestation and 6 weeks postpartum. The Horne-Östberg Morningness-Eveningness Questionnaire and Pittsburgh Sleep Quality Inventory were completed during third trimester. Women were classified as PPWR+ if weight at 16 weeks postpartum exceeded pre-pregnancy weight by ≥5 kg.
Results: Compared with prepregnancy, average weight gain (±SD) was 6.3 ± 8.8 kg at 2 weeks postpartum and 5.2 ± 8.5 kg at 16 weeks postpartum. Analysis of variance showed that PPWR+ women (n = 8; 38%) had later sleep offset times and lower sleep efficiencies than did PPWR− women at all time points and were more likely to report snoring during pregnancy.
Conclusions: Data from this small sample showed that women with PPWR had more disturbed sleep and later wake times and were more likely to report symptoms of sleep-disordered breathing. Future work in larger samples should examine whether interventions to improve sleep during pregnancy decrease PPWR.

Introduction

Significant weight gain in the perinatal period is associated with increased risk of overweight/obesity among women of childbearing age,[1,2] higher incidence of chronic diseases later in life,[3] and disadvantages to offspring.[4] Sleep disturbances that are ubiquitous in the perinatal period, including shortened, fragmented sleep, and altered sleep timing,[5,6] as well as changes in work and meal schedules, may contribute to perinatal weight gain. Indeed, sleep restriction and later meal times are associated with weight gain and/or higher caloric intake in nonperinatal adults.[7,8] A handful of epidemiologic studies have linked shorter self-reported postpartum sleep duration with greater postpartum weight retention (PPWR[9–12]). For instance, using the Project Viva cohort,[13] Gunderson and colleagues[9] showed that short self-reported sleep duration at 6 months postpartum (defined as ≤5 hours per night) significantly increased the risk of PPWR at 1 year postpartum. We are aware of no study that has examined associations between PPWR and sleep or circadian rhythms during pregnancy or that has measured sleep objectively.

The aim of this study was to examine whether sleep timing and duration or circadian phase across the perinatal period (including pregnancy and the postpartum period) were associated with PPWR. We hypothesized that shorter sleep duration, later sleep timing, and later dim light melatonin onset (DLMO) would be related to PPWR at 16 weeks postpartum.

Methods

Participants

This study is a secondary analysis of a larger study[14,15] in which perinatal women aged 18 to 40 years with a history of major depression (MDD) or bipolar disorder (BPD, but not in a mood episode at

* Corresponding author at: Brown University/Rhode Island Hospital, Division of Pulmonary, Critical Care, and Sleep Medicine, Sleep for Science Research Laboratory, 300 Duncan Drive, Providence, RI, 02906. Tel.: +1 401 421 9440; fax: +1 401 453 3578.
E-mail address: Katherine_Sharkey@brown.edu (K.M. Sharkey).

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enrollment) were recruited with flyers and brochures distributed in obstetric offices, newspaper advertisements, and direct mailings. History of MDD or BPD and absence of a mood episode at enrollment were confirmed by a Structured Clinical Interview for DSM-IV Disorders, Research Version, Patient Edition.[16] Participants completed the Horne-Östberg Morningness-Eveningness Questionnaire (MEQ[17]) and the Pittsburgh Sleep Quality Inventory (PSQI[18]) at enrollment. We excluded potential participants who had a primary Axis I diagnosis other than MDD or BPD, a diagnosed sleep disorder, a high-risk pregnancy, current night shift work, a disability that interfered with testing, current alcohol/drug dependence, or expectation that infants would have a nighttime caregiver other than the mother. We did not select participants on the basis of parity, feeding plans, or medication use other than hypnotics. The Rhode Island Hospital Institutional Review Board approved this study. Participants signed informed consent and received monetary compensation for their time and effort.

Sleep measures

Participants wore wrist actigraphs (Micro Motionlogger Watch; AMI, Ardsley, NY) continuously on the nondominant wrist for 1 week at 4 times across the perinatal period: 33 weeks gestation and postpartum weeks 2, 6, and 16. Actigraphy data were recorded in 1-minute bins using zero crossing mode and were analyzed using Action-W software (AMI), which has been validated with polysomnography.[19] We estimated the following sleep measures from actigraphy using supplemental information from participants' daily sleep diaries[20]: sleep onset time (first of 3 continuous epochs of sleep occurring after the bedtime reported on the sleep diary), sleep offset time (last epoch of 5 continuous epochs of sleep occurring before the wake time reported on the sleep diary), sleep period time (SPT; hours between sleep onset and sleep offset), total sleep time (TST; hours of estimated sleep occurring between sleep onset and sleep offset), and sleep efficiency (TST ÷ SPT * 100).

Circadian rhythms measurement

We measured DLMO phase at 33 weeks gestation and 6 weeks postpartum. Participants collected saliva at home using a kit that included labeled Salivettes (Sarstedt, Nümbrecht, Germany), a saliva collection log, a scale to weigh samples, and dark welder's glasses (Uvex, Smithfield, RI) to be worn continuously during saliva collection to avoid light-induced melatonin suppression. Saliva was collected every 30 minutes from ~2.5 hours before to ~3 hours after predicted DLMO phase, determined from sleep diary data.[21] Participants were telephoned or texted at each sample time to prompt saliva collection and to confirm they were wearing the welder's glasses. Participants logged the time and weight of each sample and refrigerated the Salivettes overnight; samples were collected the next day, centrifuged, and frozen at −20°F.

Saliva samples were assayed for melatonin using radioimmunoassay (Alpco, Salem, NH). We computed DLMO phase by linear interpolation between the times of saliva samples before and after the melatonin levels reached the threshold for melatonin onset, defined as 4 pg/mL.[22]

Weight measures

Self-reported prepregnancy weight was obtained during the 33-week assessment with the question “What was your approximate weight one year ago?” At 2 and 16 weeks postpartum, a researcher measured participants' weights to the nearest 0.1 lb using a digital scale. We divided the sample into PPWR groups (PPWR+ and PPWR−), with PPWR+ defined as ≥5 kg weight retention from prepregnancy to 16 weeks postpartum.[3,4]

Analyses

We performed statistical analyses with SPSS Statistics, Version 19 (IBM, Chicago, IL). Because the weights in our sample were normally distributed, we used repeated-measures analysis of variance and independent-samples *t* tests to compare sleep and circadian measures between groups across the perinatal period. We used χ^2 to compare reported snoring between groups. Data are summarized with mean ± SD; tests with $\alpha < .05$ were considered statistically significant.

Results

Participants

Data were available from 21 women (mean age, 29.5 ± 4.7 years): 17 with a history of MDD and 4 with a history of BPD. Median number of lifetime mood episodes was 1 (range, 1-4). Four participants were nulliparous, and the median number of children among those who were experienced mothers was 1 (range, 1-3 children). Twelve participants (57.1%) were working for pay at least part time during third trimester and 80.9% were involved with or living with their baby's father. Average MEQ score was 48.7 ± 7.9, including 2 moderate morning types, 13 neither types, and 6 moderate evening types.[17]

Weight

Across the whole sample, weights were 73.5 ± 19.4 kg at prepregnancy, 79.9 ± 18.9 kg at 2 weeks postpartum, and 78.7 ± 20.4 kg at 16 weeks postpartum, corresponding to body mass indices of 27.4 ± 8.0, 29.6 ± 7.1, and 29.1 ± 7.9 kg/m^2, respectively. The mean weight gain from prepregnancy to 2 weeks postpartum was 6.3 ± 8.8 kg. On average, the sample experienced a 1.1 ± 3.3-kg weight loss from 2 to 16 weeks postpartum. At 16 weeks postpartum, 38% of the women (n = 8) weighed ≥5 kg over their reported prepregnancy weight and were classified as PPWR+. In the PPWR+ group, average postpartum weights were 90.2 ± 16.5 kg at week 2 and 90.0 ± 17.3 kg at week 16, compared with 73.5 ± 17.9 kg at week 2 and 71.8 ± 19.6 kg at week 16 in the PPWR− group. Average reported prepregnancy weights did not differ between groups (PPWR+: 76.3 ± 15.5 kg and PPWR−: 71.8 ± 21.9 kg; $t = -0.50$, $df = 19$, $P = .63$).

Sleep and circadian rhythms

Table 1 shows sleep and circadian measures for the full sample and the PPWR+ and PPWR− groups. Women with PPWR had later sleep offset times and lower sleep efficiencies than did those without PPWR. Trends for later sleep onset times and later DLMOs were seen in the PPWR+ group, but these effects did not reach statistical significance. SPT, TST, and MEQ score did not differ between PPWR groups.

As expected, sleep offset, SPT, and sleep efficiency changed across the perinatal period in both groups. There were no time × PPWR group interactions.

Self-reported sleep quality measured with the PSQI at 33 weeks gestation showed significant sleep disturbance in our pregnant sample, with a mean PSQI score of 6.6 ± 3.3. PSQI score did not differ significantly between PPWR groups (PPWR+: 7.4 ± 3.1 and PPWR−: 6.2 ± 3.5; $t = -0.81$, $df = 19$, $P = .49$).

Snoring

Because of associations between weight and sleep-disordered breathing, we examined whether PPWR+ women were more likely to report snoring on PSQI item 5e administered at gestational week 33. Seventeen women (13 PPWR− and 4 PPWR+) reported no trouble sleeping due to coughing or loud snoring in the last month; 1