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Quasi-Experimental study of effects of lighting on rest, activity and melatonin in postpartum women

Estudo Quasi-Experimental dos efeitos da iluminação no repouso, atividade e melatonina em puérperas

Estudio cuasiexperimental de los efectos de la iluminación em reposo, actividad y melatonina em mujeres posparto

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ABSTRACT

Objectives: to compare the parameters of the activity/rest cycle of early postpartum breastfeeding women under a controlled and uncontrolled long wavelength ray light regimen. **Methods:** quasi-experimental study with breastfeeding women and their babies during postnatal rooming-in, São Paulo, Brazil. Participants were allocated to either an experimental (intervention) or a comparison group. The intervention involved exposure of the woman in a controlled room with artificial long wavelength ray light at night. Each woman's level of 6-sulfatoxymelatonin at 24 hours and activity/rest times was analyzed. **Results:** the mean activity/rest times of women in the experimental and comparison groups were similar. The mean percentages of total load of 6-sulfatoxymelatonin during the day and night were similar (p=0.09). At 24 hours, the experimental group presented a significantly lower mean percentage of total load compared to the comparison group (p=0.04). **Conclusions:** women who stayed in the room with long-wavelength artificial light showed no difference in activity/rest and 6-sulfatoxymelatonin levels in the early postpartum period.
Descriptors: Circadian Rhythm; Lighting; Melatonin; Nursing; Postpartum Women.

RESUMO

Objetivos: comparar os parâmetros do ciclo de atividade/descanso de puérperas lactantes no início do pós-parto sob regime de iluminação com raios de comprimento de onda longo controlado e descontrolado. **Métodos:** estudo quase-experimental com lactantes e seus bebês em alojamento conjunto, São Paulo, Brasil. Os participantes foram alocados para grupos experimental (intervenção) ou de comparação. A intervenção consistia na exposição em uma sala controlada com iluminação artificial de raios de comprimento de onda longo à noite. Foram analisados os horários de atividade/repouso (horas) e nível de 6-sulfatoximelatonina em 24 horas. **Resultados:** a atividade média e os tempos de repouso das mulheres nos grupos experimental e comparação foram semelhantes. Os percentuais médios de volume total de 6-sulfatoximelatonina durante o dia e a noite foram semelhantes (p=0,09). Em 24 horas, o grupo experimental apresentou percentual médio significantemente menor de volume total em relação ao grupo comparação (p=0,04). **Conclusões:** as mulheres que permaneceram no quarto com luz artificial de comprimento de onda longa não apresentaram diferenças nos níveis de atividade/repouso e 6-sulfatoximelatonina no início do período pós-parto.
Descritores: Ritmo Circadiano; Iluminação; Melatonina; Enfermagem; Período Pós-Parto.

RESUMEN

Objetivos: comparar parámetros del ciclo actividad/descanso en madres lactantes en posparto temprano bajo régimen lumínico de rayos de longitud de onda larga controlado y no controlado. **Métodos:** estudio cuasiexperimental con madres lactantes y sus bebés, São Paulo, Brasil. Las participantes fueron asignadas a grupos experimental (intervención) y comparación, consistente en exposición en habitación controlada con luz artificial de rayos de longitud de onda larga durante la noche. Se analizaron tiempos de actividad/descanso (horas) y nivel de 6-sulfatoximelatonina a las 24 horas. **Resultados:** actividad media y tiempos de descanso fueron similares en grupos comparación e intervención. Porcentajes promedio de volumen total de 6-sulfatoximelatonina durante día y noche resultaron similares (p=0,09). A las 24 horas, el grupo intervención presentó porcentaje promedio de volumen total significantemente menor comparado con grupo comparación (p=0,04). **Conclusiones:** las mujeres expuestas a luz artificial de longitud de onda larga no mostraron diferencias en niveles actividad/descanso y 6-sulfatoximelatonina durante el posparto temprano.
Descriptores: Ritmo Circadiano; Iluminación; Melatonina; Enfermería; Periodo Posparto.

INTRODUCTION

The sleep-wake cycle is mainly controlled by the endogenous biological clock that determines circadian fluctuations in a series of physiological systems[1]. It is responsible for the regulation of the human organism, influencing brain activity, respiratory rate, cardiovascular activity, digestive and endocrine systems, with the release of growth hormones, thyroid stimulant, cortisol, aldosterone, adrenocorticotrophic hormone and corticosterone[1]. The so-called internal biological rhythm is influenced by endogenous factors such as age and chronotypes[2-3]; and by exogenous factors such as light and dark exposure, nutrition schedule and increase or decrease of ambient temperature[4].

An adult woman sleeps on average seven to nine hours a night[5]. The postpartum period, however, is characterized by a number of changes in the woman's body[6]. Changes in the woman's circadian cycle in the postpartum period are characterized by a process called *masking*, in which the body is influenced by allowing for greater flexibility in order to adjust its sleep cycle to that of the newborn[6-7]. This occurs in response to women seeking to mimic their newborn infant's ultradian sleep cycle in order to meet the frequent care demands required by the infant[6,8]. There are frequent changes in the postpartum sleep phases, in response to the needs of the infant, regardless of associated environmental conditions[9]. This altered sleep pattern continues for approximately two or three months, at which point the infant begins to respond to light and dark stimulus[10].

Therefore, ambient lighting is an important factor to be considered in relation to maternal well-being at this time, since the intensity and time of exposure of the individual to lighting influence the circadian cycle[11]. The central biological clock is the pacemaker that drives the biological rhythms and synchronizes them to the external environment[12]. Pineal melatonin synthesis occurring exclusively at night, provided it is dark, is crucial for adequate synchronization of the biological rhythms and internal temporal order maintenance[13]. Melatonin is derived from the essential amino acid tryptophan[14] which is metabolized by the liver and excreted as 6-sulfatoxymelatonin (aMT6s)[15]. Melatonin levels can be readily measured in the urine.

It is known that melatonin synthesis is negatively influenced by the type of light the individual is exposed to at night, as well as the intensity, wavelength, spectrum and exposure time[13]. An individual is able to perceive ambient lighting in the visible spectrum at wavelengths ranging from 380 nanometers (nm) to 730 nm[16]. The longer the wavelength produced by artificial light, the lower the influence on the pineal gland's synthesis of melatonin[11,17]. In addition to light exposure, melatonin hormone production will also vary between individuals, characterizing them as either small and large producers[18].

It is therefore noteworthy that women can also suffer interference of sleep time in the postpartum period when using artificial lighting at night to attend care of their child[19]. Inadequate night - time artificial light exposure has been found to lead to greater postpartum sleep fragmentation[20] and, consequently, greater daytime sleepiness[19]. In addition, the hospital routine in the early postpartum days may interfere with activity/rest cycle due to the constant use of light, not only by women, but also by their attending health professionals[21]. The newborn is solely dependent on its mother melatonin, which is delivered by breast milk during night hours, in order to maintain adequate biological rhythm synchronization. Artificial light exposure at night that disturbs the mother's melatonin synthesis may also in fact be detrimental to the child's health[22].

Few studies have analyzed the effects of exposure to common artificial lighting at night, especially among women in the reproductive phase[23-24]. One study identified a positive linear relationship between circulating melatonin concentration and the number of uterine contractions, demonstrating the impact of night lighting on labor[24]. As in the studies conducted during the postpartum period, multigravid women had lower melatonin levels and less sleep time when compared to nulliparous women[24]. A study of exposure to artificial lighting in a workplace environment have also showed a higher risk of developing cancer, in particular breast cancer, among night shift nurses[25]. Other observed effects include increased presence of anxiety-related symptoms[26], risk for depression among truck drivers[27]; and increased fatigue, reduced vigor and cognition in airplane pilots and flight controllers[28]. In light of these mixed findings it would be helpful to understand more about the effect of exposure to artificial lighting commonly used in maternity hospitals at night, with a view to improving care for the mother-baby breastfeeding dyad in the postpartum period.

OBJECTIVES

To compare the parameters of the activity/rest cycle of early postpartum breastfeeding women under controlled and uncontrolled long wavelength ray light regimen.

METHODS

Ethical aspects

The study was approved by Ethics Committee from Federal of Sao Paulo University and authorized by the hospital. Written information about the study was offered to women and signed the informed consent was obtained.

Design, place of study and period

This is a quasi-experimental, feasibility study of the effect of illumination type during night-time hours and the collection of data around the rest and activity of puerperal women in the postnatal wards of a university hospital in the city of São Paulo, Brazil, from January 2018 to February 2019. The Consort 2010 tool was used to guide the study reporting, which provides evidence-based recommendations for the development of clinical trials, standardizing of reports and facilitation of transparency studies[29].

Women were allocated to two physically similar postnatal wards in either the experimental or comparison group. Allocations were carried out by a registered nurse on staff according to the availability of bed accommodation. The entire nursing team at the unit received information regarding the study before it started. The only difference between the two rooms was the type of lights that each group was exposed to. The study was blinded only to the professionals who performed the laboratory and statistical analysis, and the groups (named A and B) were revealed only after the analysis was completed. There was no capacity for blinding of the postnatal women or the researcher due to the conditions of the study environment.

Sample

The study sample included postpartum women (at least 12 hours post-birth), aged at least 18 years, with a singleton pregnancy at full-term, a low-risk pregnancy and baby that had been breastfeeding exclusively since birth. Women excluded from the study included those with low literacy levels, a history of psychiatric, thyroid or sleep disorders, obstetric complications in childbirth or postpartum, known use of illicit drugs during pregnancy. Women taking medicine (exogenous melatonin, beta-blocker medications, diuretics, corticosteroids and/or central nervous system depressant medication) in the previous 72 hours were also excluded, as were those who had not worked at night for the last 3 years as per Figure 1 (Participant CONSORT flow diagram).

Intervention

The intervention consisted of exposure to artificial lighting: Light Emission Diode - Align PM® LED lamp, model A19, General Electric®, USA with long wavelength light emission: (120 volts, 7 watts, 60 hertz, 350 lumens, 2000K, average life of 25,000 hours) during night-time hours on the postnatal ward. Each woman's room (all of which included an ensuite bathroom as a second environment) was equipped with two LED bedside lamps in the bedroom, and one LED lamp in the bathroom. The lamps were available for use according to the woman's need from 1900 hours to 06:59 hours each evening.

In order to prevent the passage of conventional artificial lighting from the windows or the ward corridor to the experimental unit room, the window and door entry blinds were similarly closed during these times Due to the impossibility of restricting the use of mobile phones, women were asked to use the application that changes the lighting of the mobile phone to the long wavelength light (Blue Light Filter application) to avoid exposure to ordinary light at night. Women were also asked to refrain from watching television after 1900 hours. The LED lamps used for the intervention were tested and evaluated after 100 hours of seasoning (maximum 120 hours of use) by the Institute for Technological Research, Brazil, which found wavelengths mainly above 550 nanometers (nm), with a peak close to 620nm.

Comparison group

A room with a similar physical floor plan and conventional artificial lighting (white light) arrangement was selected for the comparison group. The staff of the unit received training about the study routines and regarding the management of conventional and intervention artificial lighting in the controlled room.

Study protocol

The activity time was verified in minutes when the woman was awake, obtained by actigraphy (a wristwatch device). The uptime was calculated in *Daytime* (7:00am to 6:59pm), *Nighttime* (07:00pm 6:59am) and *24-Hour (*7:00am to 6:59am the next day).

Rest time was verified in minutes when the woman was sleeping or resting, obtained by actigraphy. The uptime was calculated in *Daytime* (7:00am to 6:59pm), *Nighttime* (07:00pm 6:59am) and *24-Hour (*7:00am to 6:59am the next day).

The level of 6-sulfatoxymelatonin **(**aMT6s) was measured by the average *percentage of total load (TL)* excreted in the woman's urine. MT6s TL was calculated as *Daytime* (7:00am to 6:59pm) and *Night* (7:00pm 6:59am) and *24-hour TL (*7:00am to 6:59am the next day) average.

Trained researchers visited the accommodation unit daily to identify women eligible for the study who were already allocated to the intervention group room or the comparison group room, depending on room availability. Those who met the established criteria were invited to participate in the study After reading the study information and signing the consent form, the researcher interviewed each woman to identify the following variables: sociodemographic data (age and presence of a partner), clinical history (presence of disease both pre-existing and associated with this pregnancy), obstetric data (parity, mode of birth and analgesia/anesthesia administered during the labor and birth) and newborn data (sex, gestational age, birth weight and type of infant feeding). Additional medical data were obtained from medical records.

Women in each group received guidance on the study procedures: use of available light in the environment at night, maintenance of window and door shutters during the night, use of Blue Light Filter light on their cell phone or non-use of cell phones/television at night (experimental group). Information was given about care of the actimeter during the 24 hours of the study including permission to use during the woman's personal hygiene activities and the newborn bath and the nature of 24-hour urine collection required for the study (except for the first sample).

Once the woman had consented to participation in the study researchers applied an actimeter on the dominant arm of the postpartum woman at 0700 hours. Two flasks were provided for each woman (amber with wide opening, yellow plastic caps and capacity of 2 liters each) identified with her name and the time period (daytime - 07:00am to 06:59pm and nightly - 07:00pm to 06:59am) for urine collection, packaged in a recycled ice cooler These flasks were changed every 12 hours to keep the urine temperature cool. At the end of the 24 hours of the study, the researcher removed the actimeter installed on the participant; asked each woman about her telephone/television use or exposure to light when leaving the room at night (yes or no) and then collected the urine bottles and the field diary.

The urine flasks were then transported to the laboratory of the Federal University of São Paulo (UNIFESP) in a recyclable ice pack. At the site, the researcher measured the participant's urinary volume (per period and total), collected two urine samples, placed in duplicate Eppendorf tubes (two 1.5mL samples) previously identified and subjected to freezing in a freezer at -80°C (Sanyo Biomedical Scientific® brand, Osaka, Japan).

Analysis of results and statistics

The social, demographic, obstetric, newborn variables and light exposure records underwent descriptive and inferential analysis including the means, respective confidence intervals, percentages and standard deviation. The association of the groups with the characterization variables was evaluated by using Fisher's exact test. To compare the means and medians of rest time, activity time, urinary volume, and mean percentage of excreted TL of aMT6s of

each group we used the t-test for independent samples, or the Mann-Whitney test. The assumption of the normality of variable distributions was assessed by the Shapiro-Wilks test and the homogeneity of variances by the Levene test.

To obtain the activity and rest times by the actimeter, the data recorded in the device were analyzed using the Proportional Integral Mode (PIM) method. This method filters the increase or decrease of movement to measure user activity, and 1-minute times are integrated within each hour, generating 24 times of 3,600 seconds, which equals 24 hours. Time refers to the activity and rest records at constant intervals[30]. Urinary volume was checked using a milliliter (ml) graduated glass beaker. Urine samples were subjected to centrifugation and analysis of 6-sulfatoxymelatonin by the ELISA method for aMT6s (6-Hydroxymelatonin Sulfate, 6-Sulfatoxymelatonin, IBL, International, Hamburg, Germany).

For all tests, the significance level of 5% and Confidence Interval (CI) 95% was utilized. Microsoft Excel® software (version 2010) was used for the construction of the database, and the R program (version 3.4.4) for statistical analysis.

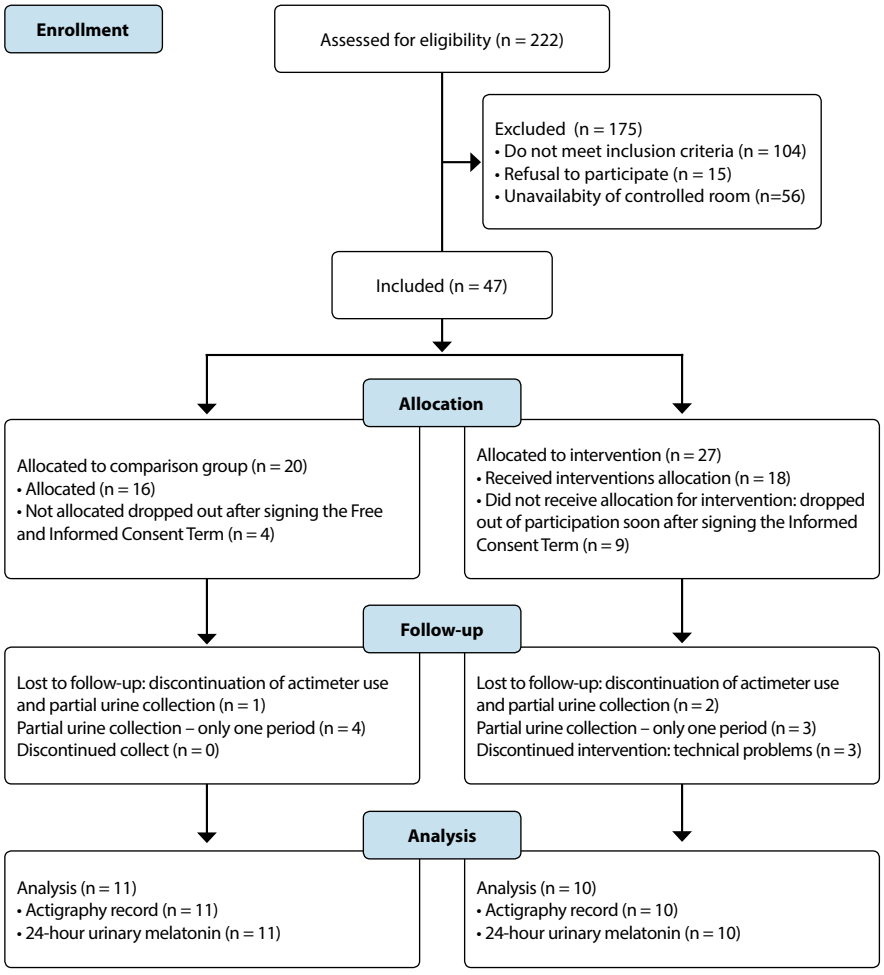

Figure 1 - Participants CONSORT flow diagram, São Paulo, São Paulo, Brazil, 2018-2019

RESULTS

A convenience sample composed of 21 postpartum women participated in the study, with 10 women and their infants in group A and 11 in group B (Figure 1). Blinding revealed group, A as the experimental group (EG) and B as the comparison group (CG).

Table 1 - Characterization of puerperal women and newborns, according to experimental and comparison groups, São Paulo, São Paulo, Brazil, 2018-2019

Variable	Experimental (n=10)	Comparison (n=11)	*p* value
Postpartum Data			
Age, *M (SD)* *	26.6 (3.5)	32.0 (5.6)	0.01
With partner, n (%) **	4 (40)	9 (81.8)	0.12
DM and/or hypertension, n (%)**	2 (20)	2 (18.1)	1
Primiparous, n (%) **	3 (30)	4 (36.3)	1
Vaginal birth, n (%) **	8 (80)	4 (36.3)	0.11
Analgesia/Anesthesia, n (%) **	7 (70)	8 (72.7)	1
Exposure to artificial light **			
Television screen, n (%)	10 (100)	7 (63.6)	0.11
Phone screen, n (%)	10 (100)	10 (90.9)	1
Ward corridor, n (%)	2 (20)	4 (36.3)	0.72
Newborn Data			
Sex female, n (%) **	3 (30)	6 (54.5)	0.48
Gestational age, *M (SD)***	38.7 (1.4)	39.0 (1.0)	0.59
Birth weight (g), *M (SD)* *	3285 (520.8)	3099 (721.7)	0.51
Exclusive Breastfeeding, n (%)**	10 (100)	8 (72.7)	0.24

*Note: M - average; SD - Standard Deviation; DM - Diabetes Mellitus; G - grams; *T Test, applied for age and birth weight variables; ** Fisher's exact test for the other variables.*

Table 2 - Activity and rest times of mothers in the experimental and comparison groups, São Paulo, São Paulo, Brazil, 2018-2019

Variable	Experimental (n=10)	Comparison (n=11)	Dif. (CI 95%)	*p* value*
Activity time (minutes)				
Daytime, *M (SD)*	552.3 (71.3)	586.5 (88.7)	(-108.2 - 39.7)	0.34
Night, *M (SD)*	311.7 (101.4)	305.5 (104.3)	(-87.9 - 100.3)	0.89
24 hours, *M (SD)*	859.7 (145.2)	886.5 (94.2)	(-137.5 - 83.9)	0.61
Rest time (minutes)				
Daytime, *M (SD)*	167.8 (71.2)	129.9 (90.3)	(-36.9 – 112.7)	0.30
Night, *M (SD)*	408.2 (101.4)	414.4 (104.3)	(-100.3 – 87.9)	0.89
24 horas, *M (SD)*	580.4 (145.2)	550 (94.6)	(-80.3 – 141.3)	0.57

*Note:dif. = Mean difference between upper and lower limit of CI; CI - Confidence Interval; * T Test applied to all variables; M - average; SD - standard deviation.*

Data from mothers and their children are presented in Table 1. The groups were homogeneous except for age (p=0.01), with women in the experimental group younger by 5.4 years.

The mean activity and rest times of women in the experimental and comparison groups were similar in all periods: day (p=0.34 and p=0.30), night (p=0.89 and p=0.89) and 24 hours (p=0.61 and p=0.57), respectively (Table 2).

Regarding urinary volume, women in the CG had a significantly higher median at night (p=0.05), compared to EG. The mean percentages of TL of aMT6s during the day and night periods

were similar in the investigated groups (p=0.09). At 24 hours, the EG presented a significantly lower mean percentage of TL compared to the CG (p=0.04) (Table 3).

Table 3 - The amount of urinary volume and percentage of total load of 6-sulfatoxymelatonin of the puerperal women between the experimental and comparison groups by periods, São Paulo, São Paulo, Brazil, 2018-2019

Variable	Experimental (n=10)	Comparison (n=11)	Dif. (CI 95%)	*p* value
Urinary volume (mL) *				
Daytime, *Median (SD)*	485.0 (483.6)	693.1 (598.0)	(230.0 – 715.0)	0.34
Night time, *Median(SD)*	520.5 (442.1)	748.6 (339.0)	(400.0 – 840.0)	0.05
24 hours, *Median (SD)*	1002.5 (901.0)	1441.8 (837.4)	(640.0 – 1760.0)	0.06
TL aMT6s **				
Daytime, *M (SD)*	47.6 (28.4)	47.4 (21.1)	(-22.5 – 22.9)	0.98
Night, *M (SD)*	52.4 (28.4)	52.5 (21.1)	(-22.9 – 22.5)	0.98
24 horas, *M (SD)*	6.2 (5.2)	16.3 (14.2)	(-20.0 – 0.05)	0.04

*Note: dif. - Mean difference between upper and lower limit of CI; CI - Confidence Interval; *Mann-Whitney Test - urine volume applied to the variables; ** T Test - applied for TL variables; M - average; SD - standard deviation; TL - total load; aMT6s - 6-sulfatoxymelatonin.*

DISCUSSION

This is the first study conducted in Brazil to evaluate maternal postpartum rest in a hospital setting. Long wavelength artificial lighting (Align PM®) did not interfere with the activity and rest times of the mothers admitted to the joint accommodation during the 24-hour evaluation. Women's total resting times were similar between the two groups.

Two similar studies have previously been conducted between 24 and 48 hours postpartum in hospital settings in Japan and Ireland[9,31]. These studies revealed average maternal night-time rest times totaling 5.2 hours (n=16)[31] and 5.4 hours (n=132)[9]. These results were lower than the rest times obtained in this study (6.8 hours). Additional studies conducted in home settings between the first and eighth weeks postpartum in USA and New Zeeland, found that maternal sleep time ranged from 5.4 to 5.8 hours[32-33]. Four studies that analyzed women's sleep patterns at approximately 2 and 6 months postpartum in their homes (Canada and USA) found greater than 6 hours of sleep[24,34-35]. Mean nocturnal sleep time of postpartum women is still poorly understood, with differing findings in the literature.

Several studies have examined night-waking patterns. A survey of 30 mothers in Australia that investigated night-waking times during the first three weeks postpartum identified an average time of 1.9 hours overnight[36], while another American study revealed average wakefulness of 2.2 hours in the fourth week, and 2.1 hours in the eighth week[32]. These findings were lower than the observed in the present study (EG=5.1 hours; CG=5.0 hours) which may be related to the different environments in which each of these studies were performed. Compared to the home, hospital environments have greater circulation of people, frequent interruptions by ancillary staff, lack of privacy, more ambient noise, shared rooms and the continuous presence of staff members[37]. In the immediate postpartum period, more frequent episodes of newborn care are required overnight, with breastfeeding being the main activity undertaken by mothers[31].

Faced with increased interruptions to sleep overnight, many women compensate by scheduling daytime naps[38]. Examination over a 24-hour period allows for better analysis of this compensating behavior. A survey conducted in Australia with 33 postpartum women at 6, 12 and 18 weeks postpartum quantified changes in sleep duration, nocturnal disturbances and daytime sleepiness[39]. Average sleep for women in this study was 7.2 hours in 24 hours, which is lower than the observed in the present study (EG=9.6 hours; CG=9.1 hours). These variations are more consistent with those recommended by the National Sleep Foundation (NSF) from USA, where healthy adult women aged 18 to 64 years are advised to sleep 7 to 9 hours/day[5].

Although our study found no interference of light on melatonin synthesis in women in the immediate postpartum period, more general research indicates that frequent night light exposure can cause harm[11,40]. The length of time, the hour in the night and type of light exposure have been found to alter the circadian cycle, directly influencing melatonin production[24].

Studies examining the effect of night waking and lighting on melatonin levels demonstrate mixed results. A study of nulliparous women tested one night of sleep fragmentation exposing 11 women to three nocturnal awakenings with simulated newborn crying for 30 minutes. The study result showed no effect on the level of aMT6s when exposed to artificial night lighting (1 lux) during wake periods[41]. The difference found in the level of 6-sulfatoxymelatonin in this study may be related to the fact that there are individual variations in the production of this hormone, which adds complexity to comparison of reference values and different analysis methods[18,24]. A study found that nulliparous women had higher melatonin levels than multigravid women, but exposure to night light was not the focus of analysis.[24] In the present study, there was no difference in the mean percentage of TL of aMT6s per period. Only the mean excreted level at 24 hours was statistically different, probably due to the lower urine volume presented by the mothers in the EG in all periods.

Study limitations

Using the mobile app as an attempt to reduce exposure to screen light at night was not effective and the use of television was not avoided by the mothers, which may have affected the study outcomes. Despite extensive research in the databases, few studies have been identified addressing the effect of artificial light on sleep, especially in the postpartum period, which justifies the use of older references. Conducting studies that limit participants' habits can be a barrier to achieving the proposed objectives. One study has shown that using full-brightness electronic devices for more than one hour suppresses melatonin production[42] and consequently alters an individual's sleep quality[16,43-44].

It is possible that the 24-hour assessment time may have overestimated the total resting time of the women studied. Longer periods of actimeter use could provide greater accuracy

of the average sleep time of the population[45]. The postpartum period has many barriers to the study participation and the need for actimeter and urine collection during the period may have dissuaded participation. In addition, researchers' non-differentiation of participants' chronotypes may be one of the reasons for identifying the difference in the percentage of 24-hour 6-sulfatoxymelatonin TL in the CG.

Contributions to Nursing and Public Health

Although this study does not demonstrate an effect of long-wavelength artificial light on maternal postpartum night-time sleeping, there is a need for further postpartum investigations that consider the additional impact of night-time artificial lighting factors on maternal rest, 6-sulfatoxymelatonin level, the quality of infant sleep and on breastfeeding behaviors at night. In addition, studies exploring the establishment of restricted nighttime artificial light use in postpartum settings could contribute to new approaches to how health professionals offer guidance to women and families during this vulnerable time.

CONCLUSIONS

This study showed that the average nighttime rest of women hospitalized in rooming-in was considered satisfactory. Women who stayed in the room with long-wavelength artificial light at night showed no difference in activity/rest and 6-sulfatoxymelatonin levels when compared to the comparison group in the immediate postpartum period.

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