

## Sleep Pattern of Japanese Infants and Their Mother's Parenting Stress

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### Abstract

**Aim:** The aim of this study was to investigate the relationship between sleep of healthy infants and their mother's parenting stress in Japan.

**Methods:** Cross-sectional study. Data obtained from 48 healthy mothers and their infants aged from 6-month old to 24-month old were studied. The mothers completed questionnaires including the Parenting Stress Index Short Form (PSI Short Form), and infant's sleep measures were assessed by an actigraph (Micro-mini RC, Ambulatory Monitoring Inc., Ardsley, NY).

**Results:** All infants, except one, shared a room with their mothers for sleeping. Of these infants, 22 infants shared a bed with their mothers. Sleep measures including sleep quality showed developmental change along with their age. However, the score of maternal parenting stress did not change. Maternal parenting stress is significantly differed by the mother's perception of infant's sleep.

**Conclusion:** Room-share is common lifestyle among Japanese mothers raising infants and sleep development of infants was confirmed. Thus, the health care providers could give information that bed-share and room-share does not affect infant's sleep development during early stage of infancy in Japan. Maternal subjective perception of infant's sleep is associated with parenting stress rather than sleep assessments by objective methods.

**Keywords:** Maternal parenting stress; Bed-share; Infant's sleep; Actigraph

**Abbreviations:** WASO: Wake after Sleep Onset; PSIP: Parenting Stress Index of parent's domain; PSIC: Parenting Stress Index of children's domain

### Introduction

Sleep pattern develops over time during childhood. Development of sleep patterns is a complex process; it depends on maturity of the Central Nervous System (CNS), and is influenced by environmental factors [1]. One of the characteristics of sleep during early infancy is sleep fragmentation. After the sleep-wake cycle is established by the age of four months, the length of nocturnal sleep duration expands. It is reported that the longest sleep duration is 6 hours on average at the age of 6-month, and 8-9 hours on average at the age of 12-month [2]. However, sleep problems, such as night crying and restlessness, are likely to occur after establishment of sleep-wake cycle [3,4]. It was reported that 10-30 percent of children were assessed to have behaviorally induced insufficient sleep [5]. They have difficulty falling asleep, and wake up frequently at night. Recently, it was reported that sleep problems of infants and preschoolers are related to a lack of self-soothing (falling asleep independently). Also, parental involvement and lack of self-soothing are highly associated with sleep problems [6].

Sleep practices are important environmental factors for sleep development and are strongly influenced by cultures. Bed-share or co-sleeping is one of the sleep practices and it is defined as infants and mothers/parents sleeping together in the adult's bed [7]. This sleep practice is widely accepted in Asian countries including Japan [7,8]. It is reported that Japanese culture valued interdependence more than independence. However, it has been pointed out that children who sleep with parents have more sleep problems than those who sleep separately [6].

Poor maternal sleep condition is thought to have a strong association to infant's sleep [9-11]. Sleep deprivation is associated with problematic sleepiness, fatigue, depressed mood, anxiety and poor daytime functioning [12]. Indeed, lack of sleep worsens the maternal depressive symptoms and fatigue [13-16]. Since bed-share is accepted

in Japanese culture, sleep development of infant and parenting involvement are interacting strongly in Japanese families. It was assumed that bed-share worsens infant's sleep problems, such as night-waking, and these sleep patterns of infants may decrease nocturnal sleep as well as high maternal parenting stress. However, relationship found between infant's sleep and parenting stress are very limited in Japan. The objective of this study was to investigate the relationship between sleep of healthy infants and their mother's parenting stress in Japan.

### Methods

#### Participants

This study was conducted with 48 mothers and their infants aged 6-24 months (28 infants between the age of 6-11-month, 9 infants between the age of 12-17 months, and 11 infants between the age of 18-23 months). Twenty eight infants were girls and 20 infants were boys (mean age: 13.7 ± 7.3 months; birth order: 35 infants were the first child). Mean gestational week at birth was 38.9 ± 1.7. All participants were healthy infants, without any neurological and developmental problems. The mean age of mothers was 33.5 ± 3.7. All of them were living in a nuclear family and 32 mothers (46%) were employed, while 11 (22%) mothers were on maternity leave. Thirty-five mothers (72%) were nursing at night.

Twenty-two infants (45%) shared bed with their mothers (bed-share), while 25 (52%) infants shared room with their mothers but slept

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in their own bed (room- share). One infant did not sleep with their parents and was excluded from further analysis.

### Data collection

A questionnaire was given to assess maternal parenting stress and maternal sleep. The Japanese version of the Parenting Stress Index Short Form (PSI Short Form) assessed maternal perception of the degree of stress relating to child-rearing [17]. The PSI Short Form was translated based on the original version developed by Abidin, and validity and reliability of the 19 items in the Japanese version were confirmed [17]. They are rated on a 5-point Likert-type scale, and a higher score means a higher level of parenting stress. These 19-items on the PSI Short Form consist of two domains: the children's domain and the parents' domain. The children's domain (PSIc) includes 9 items, representing the child's characteristics such as adaptability, acceptability, distractibility-hyperactivity, mood, and attachment, with a maximum possible score of 45. The parent's domain (PSIp) includes 10 items, such as depression, role restriction, a sense of competence, social isolation, and spousal/partner support, with a maximum score of 50. The questionnaire also asked several items about maternal sleep, such as nocturnal sleep duration, bed time and wake time.

### The infant's sleep

The infant's sleep was collected by actigraph (Micro-mini RC, Ambulatory Monitoring Inc., Ardsley, NY). This is a wrist-watch like device, which detects physical activity [18]. This device is well suited for long-term observation of sleep conditions. It is also considered to be a reliable data collection method of sleep in young children [19]. Mothers of infants were asked to keep the actigraph on their infant's ankles for a week. Mothers were also asked to complete the sleep diary documenting the sleep patterns of infants. The diary included information about their infants' sleep schedule and sleep quality as well as unusual external motions, such as moving in a car or a stroller. The activity data derived from the actigraph were analyzed using the actigraphic scoring analysis software program. "Sadeh for Infants" was chosen as the algorithm for all subjects in this study [18]. Sleep

measures included sleep onset time, sleep offset time, nocturnal sleep duration, the number of night waking (waking episodes longer than five minutes during nocturnal sleeping), and WASO (Wake After Sleep Onset: wake minutes during nocturnal sleeping).

According to the previous studies, if the actigraphic sleep measures met the following criteria, it is evaluated as a sleep problem; 1) two or more night-waking times per night on average, and 2) a sleep percentage below 90% [20].

### Data analysis

The sleep measures retrieved from acceleration sensor and parenting stress were divided into three age-groups and compared by one-way ANOVA. Also, two-group comparisons of infant's sleep measures and scores of parenting stress were assessed by the Mann and Whitney U test. The level of statistical significance is 5%. All statistical procedures were carried out using SPSS Ver. 18.0 for Windows (SPSS, Chicago, IL, USA).

### Procedure

This study was introduced to mothers by distributing fliers at parenting classes, which were held in Kobe city. Interviews were arranged with mothers, who were willing to cooperate with this study. Written informed consent was obtained from each mother. All study procedures adhered to the Helsinki Declarations for Human Investigation, and were approved by the institutional ethics committee.

### Results

#### Infant's sleep measures and maternal parenting stress and sleep duration

Comparing the actigraphic sleep measures between the three age-groups, the sleep measures of infants aged less than 12-month old were significantly poorer than those of infants aged over 18-month (Table 1). There were 11 infants who met the conditions of sleep problems (10 infants between the age of 6-11-month, and 1 infant between the age of 18-23 months). The sleep measures assessed by actigraph did

	1. 6-11 months (N=27)	2. 12-17 months (N=9)	3. 18-23 months (N=11)	Statistical Value	p Value	
Infant: Sleep onset time, PM	21:27 ± 1:00	21:29 ± 0:59	21:32 ± 0:25	0.02	n.s.	
Sleep offset time, AM	7:22 ± 0:50	7:16 ± 0:45	7:16 ± 0:24	0.10	n.s.	
Nocturnal sleep duration (min)	543.8 ± 47.6	555.8 ± 41.3	568.1 ± 37.7	1.23	n.s.	
WASO (min)	40.6 ± 24.3	29.0 ± 16.4	18.1 ± 16.4	4.54	0.02	1>3
Number of night - waking(count)	2.5 ± 1.5	1.9 ± 0.9	1.18 ± 1.30	3.79	0.03	1>3
Longest sleep episode (min)	179.4 ± 63.6	236.9 ± 73.7	285.7 ± 94.7	7.97	0.01	1<3
Sleep efficiency (%)	92.5 ± 3.97	95.2 ± 2.69	96.3 ± 3.8	4.39	0.02	1<3
Means activity score (count / min)	23.4 ± 10.1	19.0 ± 6.39	13.8 ± 6.3	4.51	0.02	1>3
Daytime sleep duration (min)	170.9 ± 117.6	101.3 ± 19.0	94.7 ± 34.6	2.47	n.s.	
Number of daytime sleep ( min)	2.19 ± 0.75	1.41 ± 0.51	0.94 ± 0.18	15.59	0.01	1>2 ,3
Total sleep duration (min)	689.1 ± 86.7	639.5 ± 26.2	657.0 ± 36.8	1.80	n.s.	
Mother Nocturnal sleep duration(min)	414.8 ± 83.7	393.3 ± 67.8	372.0 ± 37.9	1.38	n.s.	
PSIp	25.0 ± 4.4	23.6 ± 2.2	25.2 ± 3.1	0.81	n.s.	
PSIc	16.8 ± 4.4	15.2 ± 2.7	17.8 ± 4.4	0.96	n.s.	

Data are shown as mean ± SD or percentage of incidences.

WASO: Wake After Sleep Onset (Waking minutes during nocturnal sleeping)

PSIp: Parenting Stress Index Of Parent's Domain

PSIc: Parenting Stress Index Of Children's Domain

Data are compared between three age-groups from one-way analysis of variance and post hoc with Bonferroni correction

n.s: Non Significant

**Table 1:** Actigraphic infant's sleep measures and maternal parenting stress.

not show significant difference by sleep arrangements (bed-share and room-share).

The scores on the PSIp and PSiC were  $24.8 \pm 3.7$  and  $16.5 \pm 4.2$  respectively. The mean nocturnal sleep duration was  $400.9 \pm 72.4$  min. The score of PSI (PSIp and PSiC) and maternal nocturnal sleep duration did not show significant difference between the three age-groups (Table 1).

### Relationship between sleep measures of infants and their mother's parenting stress

The number of mothers who concerned about sleep problems on their infants was 21 (12 infants between the age of 6-11-month, 2 infants between the age of 12-17 months, and 7 infants between the age of 18-23 months). Comparing maternal parenting stress and nocturnal sleep duration by maternal concern for infant's sleep, the results showed that mothers who were concerned about infant's sleep showed significantly higher score of PSiC than those who were not concerned (Table 2). However, there was no significant difference by the infant's sleep problems assessed by actigraph (Table 2). Also, the score of PSI and maternal sleep duration did not show significant difference by sleep arrangements (bed-share and room-share).

## Discussion

### Infant's sleep

All, except one infant, slept with their mothers in this study. Under this nocturnal environment, the infant's sleep measures were assessed objectively. Because the sleep measures retrieved from actigraph were highly correlated with polysomnography and observation method [18,19], it was confirmed that waking time and waking duration during night was decreased and the longest sleep duration was increased. Thus, the sleep measures of infants assessed by actigraph showed significant developmental change in this study. The ratio of infants with sleep problems assessed by actigraph was 23% in this study. This ratio is consistent with the results reported previously [5]. Also, the sleep measures estimated from activity data in this study were not inferior compared to the previous study which was conducted in western countries where bed-share is not recommended [21]. Thus, it is concluded that sleep development of healthy Japanese infants who slept with their mothers was confirmed by objective data collection methods.

The sleep measures did not show significant difference between bed-share infants and room-share infants. These results could be explained by the unique Japanese cultural background. Parents with small children prefer to sleep on a Japanese traditional type of mattress, which is called "futon" in Japan [5]. In case of using futons,

even though infants and their parents sleep on their own futon, parents usually spread the infant's futon on the floor in close proximity to the parent's futon. In this situation, when the infants start crying at night, it is easy to bed share and comfort the infants. In turn, even though they sleep on different futons, it becomes difficult to distinguish whether they share only room or share the bed.

### Maternal parenting stress

The mean maternal nocturnal sleep duration was about 6.6 hours in this study. Maternal sleep deteriorates because of infant's fragmented sleep-wake patterns after the birth, and it recovers when the infants have a regular sleep-wake cycle by the age of four months [22,23]. Since the mean age of infants was 13.3 months old in this study, it is considered that the nocturnal sleep duration of mothers in this study recovered to normal nocturnal sleep duration. The mean nocturnal sleep duration of mothers with infants of a younger age was longer than the other two age-groups in this study. Also, sleep duration did not differ by infant's sleep problem. Thus, it is concluded that maternal sleeping duration was not affected by infant's sleep, even though all participants slept with their infants in the same room.

The previous study reported that subjective assessments of sleep may be more accurate predictors of postpartum depression symptoms than objective sleep assessments among postpartum women [16]. The group of mothers who had concerns about their infant's sleep showed higher score of PSiC than those mothers who did not concern about infant's sleep in this study. It is assumed that maternal subjective perception toward infant's sleep is more associated with parenting stress than objective infant's sleep assessments. Further study is needed to investigate the relationship between maternal parenting stress and the maternal perception of infant's sleep.

As the subjects of this study were collected in one certain area, it could not be concluded that the result of this study is representative of maternal parenting stress and infant sleep measures. Future study is needed to focus on maternal parenting stress and sleep measures among pairs of mother and child with both subjective and objective data collection methods with large number of subjects.

## Conclusion

The results of this study showed that most Japanese mothers shared room with their infants for sleeping and sleep development of infants was confirmed under this nocturnal environment. Thus, the health care providers could give information that bed-share and room-share does not affect infant's sleep development during early stage of infancy in Japan. Also, it is assumed that maternal subjective perception of infant's sleep is more associated with parenting stress than objective infant's sleep assessments. For supporting mothers in community level, health care providers should assess the mother's perception of infant's sleep.

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	Sleep problems of infants assessed by actigraph			Maternal concerning about sleep of infants		
	With sleep problems (N=11)	Without sleep problems (N=36)		With concerning (N=20)	Without concerning (N=22)	
psip	$25.2 \pm 3.9$	$24.4 \pm 3.6$	n.s.	$25.4 \pm 3.6$	$24.7 \pm 4.1$	n.s.
psic	$16.0 \pm 5.2$	$16.9 \pm 4.0$	n.s.	$18.0 \pm 4.3$	$15.5 \pm 3.7$	P=0.04
Maternal nocturnal sleep duration						
	$400.0 \pm 73.5$	$405.0 \pm 71.7$	n.s.	$399.0 \pm 77.3$	$403.6 \pm 72.1$	n.s.

Data are shown as mean  $\pm$  SD or percentage of incidences.

PSIp: Parenting Stress Index of Parent's Domain

PSiC: Parenting Stress Index of Children's Domain

n.s.: Non Significant

**Table 2:** Maternal parenting stress by infant's sleep.

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